SUSTAINABILITY STATEMENT

Boorley Gardens – Combined Miller Homes Phases

REPORT STATUS: 4.0

Document Control Sheet

Client	Miller Homes Southern
Development	Boorley Gardens – Combined Energy Strategy for All Miller Homes Phases and Plots
Report Title	Sustainability Statement
Reason for Issue	For Approval

Quality Management:

Report No	Job no 1782-07-RP-001-4	
Issue	4	
Prepared	12.08.2025	
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Revision History – Issue 4

This Issue 4 incorporates the points raised by the LPA in correspondence dated 17 November 2025. The table below summarises the comments received and the corresponding changes made.

LPA Comment	Section Updated	Change Made
Report must clearly state which conditions are addressed for each phase, and which discharge application each relates to.	Section 1 (Exec Summary) and new Section 2 matrix	Executive Summary reworded to reference Section 2. Section 2 reworked to make clear this is a single combined report covering all phases and conditions 29-32 together, with compliance assessed on a site-wide average basis.
ESD6 wording in the Exec Summary required correction – 15% reduction is the required figure, not a Code Ene 7 credit count.	Section 1 (Exec Summary)	ESD6 bullet rewritten to state the 15% minimum CO_2 reduction requirement (in line with the SPD).
Phase 1E (plots 199–210, 220–260) must be reflected as a phase in its own right.	Section 5 (Conclusion) and Section 2 matrix	Phase 1E (plots 199–210 and 220–260) added to the phase list in Section 2 and the Conclusion.
Plot ranges must be consistent across the report.	Throughout	Plot ranges checked and aligned with the approved layouts for each phase.
Section 3.2 (ESD 1 Assessment) – clarify whether figures shown are design stage or as-built.	Section 3.2	Note added beneath the ESD 1 table confirming this is a combined design-stage and as-built submission, with figures reflecting the as-built position for completed plots and the design-stage position for plots not yet built.
Section 4 (Water Efficiency) – clarify treatment of white goods in the water calculator.	Section 4	Sentence added to confirm that no allowance has been taken for white goods in the design-stage water calculator, in line with the standard methodology.

About Sadler Energy and Environmental Services Ltd.

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry from the concept and planning stage through to the completion of the project.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for energy efficiency, quality and practical on-site applications.

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1. Executive Summary

This sustainability statement has been commissioned by Miller Homes Southern Ltd in respect of a site-wide development proposal for Boorley Gardens, Hedge End. The full proposal included the construction of 323 dwellings to respond to local planning authority, Borough of Eastleigh Council's policy and guidance, all of which is promoting low carbon development. The following Essential Requirements apply:

- ESD1: General Sustainable Development, the Council requires all residential development to achieve Level 4 of the Code from January 2012.
- ESD2: Rainwater Harvesting/ Grey Water Recycling (not applicable to houses)
- ESD3: External Water Consumption (residential only)
- ESD4: Reducing Surface Water Runoff
- ESD5: Passive Solar Heat Gain
- ESD6: Carbon Dioxide Reduction (small scale zero/low carbon technologies), a minimum 15% reduction in CO_2 emissions through local low/zero carbon energy, in line with the Council's Environmentally Sustainable Development SPD (15% required from 2012)
- ESD7: Green Roofs (not applicable to houses)
- ESD8: Trees

The purpose of this report is to demonstrate, through site-wide calculations, that the Boorley Gardens development as a whole achieves compliance with the requirements of Planning Permission Ref: O/15/75953 (as amended by X/19/84943), specifically conditions 29, 30, 31 and 32. Compliance is assessed on a site-wide average basis across all 323 dwellings and all Miller Homes phases. The headline performance is set out in Section 5 (Conclusion); the supporting breakdown by phase and plot is provided in Appendix A, and the related discharge of condition application history is summarised in Section 2 below.

Across the development as a whole, the design and as-built calculations confirm a site-wide average reduction of 40.46% in carbon emissions over the 2013 Building Regulations target, with photovoltaic installations delivering a site-wide renewable energy contribution of 29.80% — comfortably exceeding the 15% minimum required under ESD 6 and the Code for Sustainable Homes Level 4 target set by Condition 28. The full per-plot tabulation is provided in Appendix A for completeness.

2. Information and Background

This Energy Strategy has been produced to identify the design stage evidence in accordance with Eastleigh Borough Council in accordance with ESD 1, 3, 6 and 8.

2.1 Phase and Condition Discharge Matrix

The Boorley Gardens development is being delivered by Miller Homes Southern across multiple phases (Phase 1E plots 199–210 and 220–260; Phase 2C; Phase 1H; Phase 1I; Phase 3A; Phase 3B). This Issue 4 is a single combined report covering all phases and addressing conditions 29, 30, 31 and 32 together for the development, in line with the methodology agreed with the LPA. Compliance is demonstrated on a site-wide average basis (see Section 5), with full per-plot calculations provided in Appendix A.

In summary:

	Comments	**Evidence**
ESD 1	Developer has committed to achieving a Code Level 4 in the Code for Sustainable Homes	**Design SAP** Calculations (Appendix B & Design & As Built Summary Appendix A).
ESD 2	Submit details of the rainwater harvesting and/or grey water recycling systems supplying all WC flushing and other appropriate uses for that development	ESD 2 is not applicable due to the nature of the development. As confirmed at the planning stage.
ESD 3	Code compliant Water Butts are allocated to all dwellings. One and two bedroom homes will be provided with water butts of minimum 150 litre capacity. Three bedroom and above homes will be provided with water butts of a minimum 200 litre capacity.	Site plan showing the location of the water butts provided (Appendix D)

ESD 4	Miller Homes will address the mandatory requirement for CfSH as stipulated for SUR 1 any run-off from the site will be channelled through Sustainable Urban Drainage Techniques.	A Flood Risk and Drainage Statement was reviewed and approved as part of Reserved Matters 2 for 143 units, and updated work done earlier for RM1. A separate application for discharge of condition 11 will be made and that with the work done at RM will satisfy the requirements of ESD 4.
ESD 5	Solar gain – The development should make full use of potential passive solar heat gain through orientation, building design and landscape design (while avoiding excessive summer heat gain and glare) within a framework of good urban design unless there are particular site or building use factors which make it unfeasible	This is addressed in the Design and Access Statement and the update which was approved at grant of Reserved Matters for these plots.
ESD 6	10 or more houses to achieve: • Up to the end of 2011 at least one Code Ene 7 credit (10% carbon dioxide emissions reductions via local low/zero carbon energy) • From January 2012 two Code Ene 7 credits (15% carbon dioxide emissions reductions via local low/zero carbon energy)	PV Schedule and PV site layout is included within Appendix E.
ESD 7	Green roofs	ESD 7 is not applicable due to the nature of the development. As confirmed in at the planning stage.
ESD 8	The tree requirements have been addressed by the Landscape Designer: • all new streets created for residential development to provide at least 1 street tree 1 per 30 linear metres of street • All new off-street car parks accessible to the public to provide at least 1 tree per 6 vehicle spaces • All new private back gardens to retain existing trees or (if no existing trees to retain) receive at least 1 newly planted tree	Landscape proposals have been submitted, assessed, and approved during the Reserved Matters process.

2.1 Planning Condition

The Eastleigh Borough Council Environmental Sustainable Development Supplementary Planning Document was adopted in March 2009 and sets measures to respond to the declared climate emergency. The specific planning conditions for the development are detailed below:

"CONDITION 28 REQUIRES:
In respect of energy efficiency, a standard of a 19% improvement of dwelling emission rate over the target emission rate as set in the 2013 Building Regulations being equivalent to and not exceeding the requirement as set by Code Level 4 (as defined by ENE1) in the, now revoked, Code for Sustainable Homes (or equivalent requirements that are set out in national legislation or policy).

In respect of water consumption, a maximum predicted internal mains water consumption of 105 litres/person/day, i.e. the equivalent requirement as set by Code Level 4 (as defined by WAT1) in the, now revoked, Code for Sustainable Homes (or equivalent requirements that are set out in national legislation or policy). This is a performance condition which sets limits and does not require a submission. The ways in which this are achieved are set out in the response to condition 29."

CONDITION 29 REQUIRES:
''Prior to the construction of any building above slab level in each individual phase of the development (or, in accordance with a timetable to be agreed in writing with the LPA), a BREEAM New Construction Interim Stage Certificate at ''excellent'' standard (for non-residential development); or (for residential development) design stage SAP data and a design stage water calculator confirming energy efficiency and the predicted internal mains water consumption shall be submitted to and approved in writing by the LPA. The development shall not be carried out otherwise than in accordance with the approved details.''

CONDITION 30 REQUIRES:
Prior to the construction of any dwelling above slab level in each individual phase of the development (or, in accordance with a timetable to be agreed in writing by the LPA) a report shall be submitted to and approved in writing by the LPA which sets out how essential requirements set out within ESD 2-8 of Eastleigh Borough Council's Environmentally Sustainable Development SPD will be met within that phase. The development shall not be carried out otherwise than in accordance with the approved details.

OUTLINE PLANNING CONDITION 31 REQUIRES:
"Prior to the first occupation of each type of building within each phase a (for residential development) an as built stage SAP data, and an as built stage water calculator confirming energy efficiency and the predicted internal mains water consumption; which shall meet the requirements set out in condition 24 above; shall be submitted to and approved in writing by the LPA. The development shall not be carried out otherwise than in accordance with the approved details."

OUTLINE PLANNING CONDITION 32 REQUIRES:
"Prior to the first occupation of each type of building within each phase of development a report highlighting how the essential requirements set out within ESD2-8 of the Eastleigh Borough Council's adopted Environmentally Sustainable Development SPD, set out by condition 26 above, have been achieved in that phase of the development shall be submitted to and approved in writing by the LPA. The development shall not be carried out otherwise than in accordance with the approved details."

3. Energy Efficiency

A fabric first approach has been adopted to minimise energy demand as much as practical. Energy efficiency features that were proposed include: Built form, Insulation standards, Glazing, Heating systems, Ventilation, Lighting, and Controls.

Three main sources of heat loss:

- Thermal Envelope
- Thermal Bridging
- Uncontrolled Air Leakage

3.1 Thermal Envelope

The table below summarises the proposed performance of the thermal envelope. It is proposed that all areas significantly improve upon the minimum building fabric standards stated within BR Part L 2013.

Thermal Element	BR U-value (Part L 2013) W/m²K	Proposed target values (Block A) W/m²K	% Improvement over BR 2013 (Block A)
Ground Floor	**0.25**	**0.19**	**31%**
External wall	**0.30**	**0.27**	**11%**
Cold roof	**0.20**	**0.11**	**45%**
Flat Roof	**0.20**	**0.16**	**25%**
Warm Roof	**0.20**	**0.16**	**25%**
External Doors	**2.00**	**1.5**	**33%**
Windows & Glazed Doors	**2.00**	**1.3**	**53%**

Table 1 – Design Fabric Standard

The fabric specification shows an improvement on BR 2013 standards and are conducive to energy efficiency within built form and insulation standards.

3.2 ESD 1 Assessment

The development has been designed to meet the requirements of Part L1A of the 2013 Building Regulations, forming the foundation of its sustainable construction approach.

Compliance with Part L is assessed through the Standard Assessment Procedure (SAP), using the 'Target Emission Rate' (TER), expressed in kilograms of CO_2 per square meter of total useful floor area per annum, as the benchmark. The designed performance of each dwelling—referred to as the Dwelling Emission Rate (DER)—must be lower than this benchmark.

In addition, the local council requires all residential developments of 10 or more dwellings to achieve Code Level 4, equivalent to a 19% improvement over current building regulations. The tables below summarise the "as-designed" and 'as-built' percentage reduction in TER achieved across the Miller Homes Phases as modelled using SAP 2012. The design SAP calculations, including a plot-by-plot summary of performance, are provided in Appendix A.

	No. of Plots	Average DER	Average TER	Percentage Improvement	Site Total Actual Dwelling Emission Rate $KgCO_2$ per Annum	Site Total Target Emission Rate $KgCO_2$ per Annum
Site Wide Phase 2C	90	13.96	18.29	**23.68%**	112,652.1	147,345.10
1E Plots 199-301 (Phase not finished)	103	10.70	17.74	**39.68%**	110,729.32	180,123.41
Phase 1H – 33no (Plots 103-135)	33	6.92	17.37	**60.16%**	24,647.26	63,237.17
Phase 1i – 57no (Plots 136-192)	57	7.24	17.36	**58.29%**	42,455.06	103,419.12

Phase 3A (3D) (RM3) (Plots 445-462 & 668)	19	7.25	17.44	**58.43%**	14,651.29	36,170.85
3B - Plots 659-667 & 669-680	21	13.87	18.47	**24.91%**	23,133.06	30,327.03
SITE SUMMARY	**323**	**10.61**	**17.82**	**40.46%**	**328,268.09**	**560,622.68**

Table 2 - Part L compliant CO_2 Emissions

The development exceeds the target of a 19% improvement over building regulations, as shown in Graph 1 below. A full summary of the design stage SAP calculations is included in Appendix B, with plot-specific details demonstrating compliance for all plots in Appendix A.

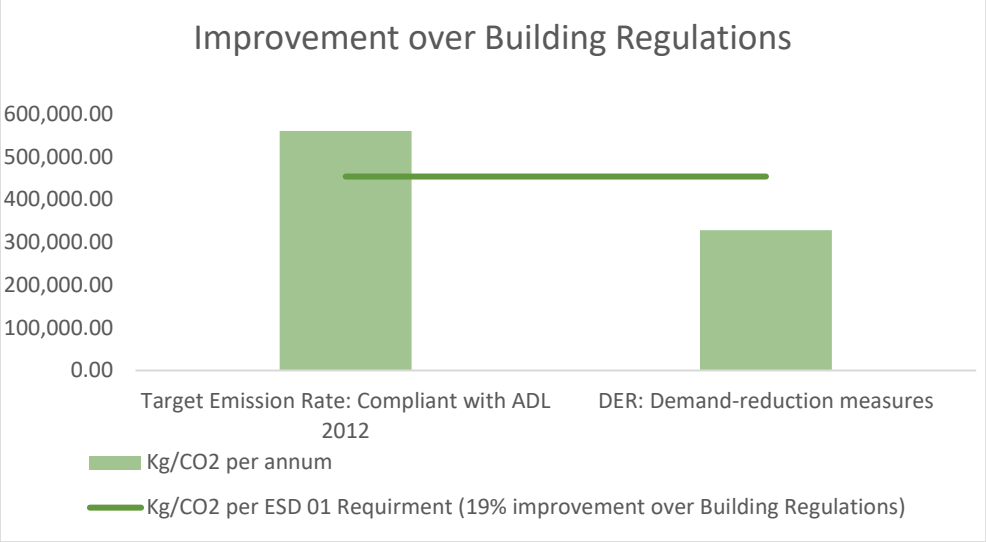

Graph 1 - Site improvement over building regulations V. ESD requirements

As demonstrated the site has been calculated to provide a significant improvement over building regulations and the minimum ESD requirements, with a total of 40.46% improvement achieved.

Note: As agreed with the LPA, this report is a combined design-stage and as-built submission covering all phases. The figures in the ESD 1 table above therefore reflect the as-built position for plots already completed and the design-stage position for plots not yet built; the same combined approach applies to the water calculations in Section 4 and the appendices. Conditions 29, 30, 31 and 32 are addressed together within this single report, in line with the combined-submission methodology set out in Section 2.

3.3 ESD 6 Carbon Dioxide Reduction (Small Scale zero/low carbon technologies Site Assessment

Under the Code for Sustainable Homes, one credit is awarded for achieving a 10% reduction in carbon dioxide emissions through the use of local low or zero carbon (LZC) energy sources. Two credits can be earned by achieving a 15% reduction. The site-wide reduction in carbon emissions was achieved through the installation of photovoltaic panels by an MCS-registered contractor, resulting in a 29.80% CO_2 reduction, as calculated using the Code for Sustainable Homes methodology.

Phase	CO_2 Emissions from Space and water heating ($kgCO_2/yr$)	CO_2 Emissions from fans and pumps ($kgCO2/yr$)	CO_2 Emissions from lighting ($kgCO_2/yr$)	CO_2 Emissions from Appliances and Cooking ($kgCO_2/yr$)	TOTAL Emissions ($kgCO_2/yr$)	CO_2 Emissions from Savings PV ($kgCO_2/yr$)	% Reduction Due to Renewable Technology
Site Wide Phase 2C	139,684.95	3,503.67	17,880.01	105,276.22	266,344.85	-29,737.81	**11.03%**
1E Plots 199-301	144546.88	4009.28	21798.62	2863.65	173286.64	-59617.76	**34.40%**

(Phase not finished)							
Phase 1H – 33no (Plots 103-135)	47790.23	1284.53	7541.24	835.52	57451.51	-31969.22	**55.65%**
Phase 1i – 57no (Plots 136-192)	77273.77	2218.73	12692.23	1357.15	93295.26	-49725.6	**53.30%**
Phase 3A (3D) (RM3) (Plots 445-462 & 668)	27262.52	739.58	4387.39	449.41	32838.89	-17738.17	**54.02%**
3B - Plots 659-667 & 669-680	23826.11	817.43	3843.54	679.73	29166.80	-5591.47	**19.17%**
SITE SUMMARY	**460,384.46**	**12,573.22**	**68,143.03**	**111,461.68**	**652,383.95**	**194,380.03**	**29.80%**

Table 3 - Site Wide ENE07 Calculations

4. Water Efficiency

In accordance with Eastleigh Borough Council Environmentally Sustainable Development Supplementary Planning it is proposed that all dwellings achieve a minimum water efficiency standard of 105 litres/person/day as set out in Building Regulations Part G. The following maximum water consumption criteria, as stated in table 2.2 of approved document Part G has been followed, see Table 4 below.

Water Fitting	Maximum Consumption	Specification
WC	4/2.6 litres dual flush	Ideal Standard Close coupled cistern 4/2.6 litre dual flush
Shower	8 l/min	Vado Celsius with FR/shower/8-PLA
Bath	181 litres	Ideal Standard Tempo Arc
Basin Taps	3 l/min	Vado Life basin mounted taps FR/tap/3-PLA
Sink Taps	6 l/min	Vado Kori taps FR/tap/6 - PLA
Dishwasher	1.25 l/place setting	No dishwasher or base unit; plumbing & electric point to space only
Washing Machine	8.17 l/kilogram dry load	Not provided; plumbing & electric point to space only

Table 4 - (Part G2 Table 2.2) Maximum fittings consumption

The code for sustainable homes calculator tool has been completed within Appendix B and has confirmed a flow rate of 99.5 l/p/d using the design specifications and manufacturers' information which is included within Appendix F.

Miller Homes offers customers the option to include washing machine and/or dishwashers as part of the optional extras package. However, not all purchasers choose to take up these options. To reflect this, the water efficiency calculations within this report cover all scenarios. A summary can be found in Table 5 and full calculations for each house type and scenario can be seen in Appendix C. As the calculations demonstrate, even under worst case assumptions (without white goods included), all unit types achieve compliance with water efficiency targets set by Eastleigh Borough Council. The inclusion of efficient appliances further improves performance. Miller Homes has therefore taken all reasonable measures to ensure policy compliance, regardless of purchaser choices. The Water Calculations in Appendix C, and the figures in Tables 4 and 5, reflect both Design Stage and As-Built information. The water calculator submitted with this report follows the standard methodology of excluding optional white goods (washing machines and dishwashers) from the baseline calculation, in line with Part G default assumptions (washing machines and dishwashers) from the baseline calculation, in line with Part G default assumptions; this applies to both the design-stage figures (for plots not yet built) and the as-built figures (for plots already completed) presented in this combined report.

House Type	No white goods included. Part G default figures used. (L/p/p/p/d)	Washing machine included (Model - Zanussi ZWF842C3PW) (L/p/p/p/d)	Dishwasher included (Model – Zanussi ZDLN1521) (L/p/p/p/d)	Both washing machine and dishwasher included (L/p/p/p/d)
Type 1 – 2, 3 or 4 bed house (1 bathroom/ 1 ensuite / WC room/ Utility/ Kitchen)	104.5	101.3	102.9	99.7

Type 2 – 2, 3, or 4 bed house (1 bathroom/ 1 ensuite/ WC room/ kitchen)	104.5	101.3	102.9	99.7
Type 3 – 2&3 Bed House (1 bathroom/ WC room/ Kitchen)	104.5	101.3	102.9	99.7
Type 4 – 1 & 2 Bed apartments (1 bathroom/ Kitchen)	104.5	101.3	102.9	99.7

Table 5 – Total water consumption (Part G) depending on house Type and options of white good installed

5. Conclusion

This Energy and Sustainability Statement has been prepared by SEES Ltd on behalf of Miller Homes, covering a total of 323 dwellings across all Miller Homes phases of the Boorley Gardens development. The specific phases included are:

- Site Wide Phase 2C – Plots 355–444 (phase ongoing)
- Phase 1H – 33 dwellings (Plots 103–135)
- Phase 1I – 57 dwellings (Plots 136–192)
- Phase 3A (3D) (RM3) – Plots 445–462 & 668
- Phase 3B – Plots 659–667 & 669–680.
- Phase 1E – Plots 199–210 and 220–260

Taken as a whole, the development achieves the compliance thresholds set by policies ESD 1, 3, 6 and 8 of the Eastleigh Borough Council's Environmentally Sustainable Development Supplementary Planning Document. Compliance is assessed on a site-wide average basis across the 323 dwellings, in line with the combined design-stage and as-built methodology agreed with the LPA.

The development incorporates enhanced fabric specifications that go beyond SAP 2021 standards, including:

- Fabric-first design to reduce space heating demand.
- High-specification thermal envelope to minimise heat loss.
- Thermal bridging minimisation through Constructive Details and bespoke calculations.
- Enhanced airtightness to improve overall energy efficiency.

The calculations confirm a site-wide average reduction of 40.46% in carbon emissions over the 2013 Building Regulations target, well in excess of the 19% Code Level 4 requirement under Condition 28. Photovoltaic installations, fitted by an MCS-certified contractor, deliver a site-wide renewable energy contribution of 29.80%, comfortably exceeding the 15% minimum required under ESD 6. Individual plot variations around these averages are tabulated in Appendix A; the development as a whole meets and exceeds every quantitative threshold set by the planning conditions and the SPD.

This development demonstrates a strong commitment to sustainability and carbon reduction, aligning with both local and national environmental policies and setting a benchmark for low-carbon residential projects.

APPENDIX A – Site-wide Summary TER v. DER

Phase 2C

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 355	14.99	19.23	22.05	1460.326	1873.387	
Plot 356	12.45	16.82	25.98	1400.003	1891.409	
Plot 357	12.13	16.54	26.66	1364.019	1859.923	
Plot 358	12.45	16.82	25.98	1400.003	1891.409	
Plot 359	12.13	16.54	26.66	1364.019	1859.923	
Plot 360	12.45	16.82	25.98	1400.003	1891.409	
Plot 361	12.13	16.54	26.66	1364.019	1859.923	
Plot 362	12.45	16.82	25.98	1400.003	1891.409	
Plot 363	12.13	16.54	26.66	1364.019	1859.923	
Plot 364	14.44	18.79	23.15	1142.204	1486.289	
Plot 365	14.44	18.7	22.78	1142.204	1479.17	
Plot 366	14.16	18.55	23.67	1379.467	1807.141	
Plot 367	14.99	19.01	21.15	1203.997	1526.883	
Plot 368	14.99	19.01	21.15	1203.997	1526.883	
Plot 369	14.99	19.01	21.15	1203.997	1526.883	
Plot 370	14.99	19.01	21.15	1203.997	1526.883	
Plot 371	15.08	18.73	19.49	1192.828	1481.543	
Plot 372	15.08	18.73	19.49	1192.828	1481.543	
Plot 373	13.27	17.56	24.43	1558.429	2062.246	
Plot 374	13.27	17.56	24.43	1558.429	2062.246	
Plot 375	15	18.87	20.51	1461.3	1838.315	
Plot 376	14.44	18.7	22.78	1142.204	1479.17	
Plot 377	14.54	18.79	22.62	1150.114	1486.289	
Plot 378	14.44	18.7	22.78	1142.204	1479.17	
Plot 379	14.54	18.79	22.62	1150.114	1486.289	
Plot 380	15.31	19.65	22.09	956.7219	1227.929	
Plot 381	13.71	18.78	27.00	1042.508	1428.031	
Plot 382	12.67	17.41	27.23	1181.604	1623.657	Y
Plot 383	12.67	17.41	27.23	1181.604	1623.657	Y
Plot 384	13.71	18.78	27.00	1042.508	1428.031	
Plot 385	15.31	19.65	22.09	956.7219	1227.929	
Plot 386	14.14	18.26	22.56	1135.725	1466.643	Y
Plot 387	12.09	16.79	27.99	971.0688	1348.573	Y
Plot 388	14.14	18.26	22.56	1135.725	1466.643	Y
Plot 389	12.67	17.41	27.23	1181.604	1623.657	Y
Plot 390	12.67	17.41	27.23	1181.604	1623.657	
Plot 391	14.14	18.26	22.56	1135.725	1466.643	Y
Plot 392	12.09	16.79	27.99	971.0688	1348.573	
Plot 393	14.14	18.26	22.56	1135.725	1466.643	
Plot 394	13.36	18.4	27.39	1088.706	1499.416	Y
Plot 395	14.18	18.99	25.33	1138.938	1525.277	

Plot 396	14.44	18.7	22.78	1142.204	1479.17	
Plot 397	14.54	18.79	22.62	1150.114	1486.289	
Plot 398	14.71	19.23	23.50	1433.048	1873.387	
Plot 399	15	18.87	20.51	1461.3	1838.315	
Plot 400	13.27	17.56	24.43	1558.429	2062.246	
Plot 401	13.27	17.56	24.43	1558.429	2062.246	
Plot 402	14.57	18.73	22.21	1394.64	1792.836	
Plot 403	13.08	17.17	23.82	1677.641	2202.224	
Plot 404	14.57	18.73	22.21	1394.64	1792.836	
Plot 405	15.08	18.73	19.49	1192.828	1481.543	
Plot 406	15.08	18.73	19.49	1192.828	1481.543	
Plot 407	12.9	17	24.12	1654.554	2180.42	
Plot 408	13.06	16.27	19.73	1946.462	2424.881	
Plot 409	15.02	18.59	19.20	1437.714	1779.435	
Plot 410	15.02	18.59	19.20	1437.714	1779.435	
Plot 411	15.46	20.4	24.22	931.6196	1229.304	
Plot 412	14.87	20.84	28.65	762.831	1069.092	
Plot 413	14.14	18.26	22.56	1135.725	1466.643	
Plot 414	14.14	18.26	22.56	1135.725	1466.643	
Plot 415	14.87	20.84	28.65	762.831	1069.092	
Plot 416	15.46	20.4	24.22	931.6196	1229.304	
Plot 417	14.8	20.09	26.33	948.828	1287.97	
Plot 418	14.24	19.58	27.27	822.7872	1131.332	
Plot 419	14.52	18.51	21.56	1166.246	1486.723	
Plot 420	12.67	17.41	27.23	1181.604	1623.657	
Plot 421	12.67	17.41	27.23	1181.604	1623.657	
Plot 422	14.14	18.26	22.56	1135.725	1466.643	
Plot 423	14.14	18.26	22.56	1135.725	1466.643	
Plot 424	14.14	18.26	22.56	1135.725	1466.643	
Plot 425	14.14	18.26	22.56	1135.725	1466.643	
Plot 426	15.46	20.4	24.22	931.6196	1229.304	
Plot 427	14.87	20.84	28.65	762.831	1069.092	
Plot 428	14.72	18.42	20.09	1164.352	1457.022	
Plot 429	14.72	18.42	20.09	1164.352	1457.022	
Plot 430	14.87	20.84	28.65	762.831	1069.092	
Plot 431	15.46	20.4	24.22	931.6196	1229.304	
Plot 432	14.18	18.99	25.33	1138.938	1525.277	
Plot 433	13.7	18.57	26.23	1100.384	1491.542	
Plot 434	13.92	17.95	22.45	1298.179	1674.017	
Plot 435	13.64	17.71	22.98	1272.066	1651.635	
Plot 436	13.43	16.8	20.06	1733.813	2168.88	
Plot 437	13.07	16.95	22.89	1687.337	2188.245	
Plot 438	13.42	16.6	19.16	2000.117	2474.064	
Plot 439	12.71	16.73	24.03	1655.605	2179.25	
Plot 440	13.36	16.85	20.71	1740.274	2194.881	
Plot 441	13.09	17.17	23.76	1678.923	2202.224	

Plot 442	13.74	17.92	23.33	1384.717	1805.978	
Plot 443	13.74	17.92	23.33	1384.717	1805.978	
Plot 444	13.36	16.85	20.71	1740.274	2194.881	
Phase Total	**13.96**	**18.29**	**23.68**	**112652.1**	**147345.1**	

Phase 1H

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 103	6.97	16.72	58.31	682.5	1637.22	
Plot 104	7.34	17.8	58.76	684.53	1660.03	
Plot 105	8.38	18.32	54.26	673.08	1471.46	
Plot 106	8.82	18.74	52.93	708.42	1505.2	
Plot 107	8.38	18.32	54.26	673.08	1471.46	
Plot 108	8.82	18.74	52.93	708.42	1505.2	
Plot 109	6.78	17.63	61.54	789.8	2053.72	
Plot 110	7.15	17.16	58.33	666.81	1600.34	
Plot 111	5.79	16.99	65.92	566.96	1663.66	
Plot 112	8.82	18.74	52.93	708.42	1505.2	
Plot 113	8.38	18.32	54.26	673.08	1471.46	
Plot 114	7.96	18.89	57.86	639.35	1517.24	
Plot 115	7.64	18.59	58.90	613.64	1493.15	
Plot 116	6.61	17.56	62.36	754.47	2004.3	
Plot 117	5.91	16.62	64.44	786.38	2211.46	
Plot 118	5.91	16.62	64.44	786.38	2211.46	
Plot 119	8.35	19.07	56.21	783.06	1788.38	
Plot 120	5.45	15.56	64.97	862.73	2463.15	
Plot 121	6.2	16.22	61.78	863.78	2259.77	
Plot 122	5.97	16.68	64.21	794.37	2219.44	
Plot 123	6.2	16.22	61.78	863.78	2259.77	
Plot 124	7.12	17.71	59.80	837.67	2083.58	
Plot 125	5.07	16.29	68.88	649.37	2086.42	
Plot 126	5.66	15.77	64.11	895.98	2496.39	
Plot 127	5.66	15.77	64.11	895.98	2496.39	
Plot 128	5.66	15.77	64.11	895.98	2496.39	
Plot 129	5.91	16.62	64.44	786.38	2211.46	
Plot 130	6.58	17.2	61.74	774.14	2023.58	
Plot 131	5.14	16.36	68.58	658.33	2095.39	
Plot 132	6.4	17.02	62.40	752.96	2002.4	
Plot 133	7.39	17.8	58.48	733.83	1767.54	
Plot 134	8.28	19.01	56.44	776.5	1782.76	
Plot 135	7.54	18.36	58.93	707.1	1721.8	
Phase Total	**6.92**	**17.37**	**60.18**	**24647.26**	**63237.17**	

Phase 1i

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 136	5.3	16.58	68.03	678.82	2123.57	
Plot 137	8.28	15.98	48.19	1012.15	1953.4	
Plot 138	8.28	15.98	48.19	1012.15	1953.4	
Plot 139	8.28	15.98	48.19	1012.15	1953.4	
Plot 140	8.28	15.98	48.19	1012.15	1953.4	
Plot 141	5.91	16.36	63.88	823.38	2279.28	
Plot 142	6.47	17.51	63.05	761.2	2060.05	
Plot 143	5.87	16.79	65.04	582.89	1667.25	
Plot 144	6.02	16.93	64.44	597.79	1681.15	
Plot 145	8.85	18.01	50.86	710.83	1446.56	
Plot 146	8.85	18.01	50.86	710.83	1446.56	
Plot 147	8.85	18.01	50.86	710.83	1446.56	
Plot 148	5.79	16.99	65.92	566.96	1663.66	
Plot 149	8.82	18.74	52.93	708.42	1505.2	
Plot 150	8.38	18.32	54.26	673.08	1471.46	
Plot 151	7.27	17.9	59.39	798.97	1967.21	
Plot 152	8.82	18.74	52.93	708.42	1505.2	
Plot 153	8.38	18.32	54.26	673.08	1471.46	
Plot 154	6.19	17.4	64.43	606.12	1703.81	
Plot 155	9.63	18.76	48.67	773.48	1506.8	
Plot 156	9.63	18.76	48.67	773.48	1506.8	
Plot 157	9.63	18.76	48.67	773.48	1506.8	
Plot 158	7.96	18.89	57.86	639.35	1517.25	
Plot 159	7.64	18.59	58.90	613.64	1493.15	
Plot 160	6.47	16.9	61.72	642.47	1678.17	
Plot 161	6.37	16.8	62.08	632.54	1668.24	
Plot 162	5.14	16.36	68.58	658.33	2095.39	
Plot 163	6.43	16.44	60.89	895.83	2290.42	
Plot 164	5.36	15.9	66.29	815.15	2418.07	
Plot 165	5.36	15.9	66.29	815.15	2418.07	
Plot 166	5.91	16.36	63.88	823.38	2279.28	
Plot 167	6.47	17.51	63.05	761.2	2060.05	
Plot 168	6.99	17.88	60.91	694.11	1775.48	
Plot 169	5.2	16.49	68.47	666.02	2112.04	
Plot 170	6.81	16.6	58.98	906.14	2208.8	
Plot 171	5.66	16.12	64.89	788.55	2245.84	
Plot 172	5.2	16.49	68.47	666.02	2112.04	
Plot 173	7.03	17.92	60.77	698.08	1779.46	
Plot 174	8.06	17.69	54.44	907.72	1992.25	
Plot 175	8.03	17.66	54.53	904.34	1988.87	
Plot 176	9.23	18.06	48.89	741.35	1450.58	
Plot 177	7.4	18.35	59.67	594.37	1473.87	
Plot 178	5.2	16.49	68.47	666.02	2112.04	
Plot 179	6.81	16.6	58.98	906.14	2208.8	

Plot 180	6.81	16.6	58.98	906.14	2208.8	
Plot 181	6.83	17.68	61.37	678.22	1755.62	
Plot 182	7.14	17.98	60.29	840.02	2115.35	
Plot 183	8.49	18.03	52.91	715.2	1518.85	
Plot 184	8.33	17.87	53.39	701.72	1505.37	
Plot 185	7.54	18.82	59.94	707.1	1764.94	
Plot 186	8.04	17.63	54.40	905.46	1985.49	
Plot 187	6.97	16.72	58.31	682.5	1637.22	
Plot 188	7.22	17.14	57.88	579.91	1376.68	
Plot 189	7.3	17.7	58.76	680.8	1650.7	
Plot 190	7.05	17.46	59.62	657.48	1628.32	
Plot 191	7.22	17.14	57.88	579.91	1376.68	
Plot 192	7.19	17.81	59.63	704.04	1743.96	
Phase Totals	**7.24**	**17.36**	**58.29**	**42455.06**	**103419.12**	

Phase 1E

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 199	12.89	16.46	21.69	1589.85	2030.17	Y
Plot 200	12.92	16.46	21.51	1593.55	2030.17	Y
Plot 201	13.31	16.46	19.14	1641.66	2030.17	Y
Plot 202	13.37	16.46	18.77	1649.06	2030.18	Y
Plot 203	13.47	18.41	26.83	1309.28	1789.45	Y
Plot 204	13.18	17.2	23.37	1258.82	1642.77	Y
Plot 205	13.38	17.31	22.70	1277.92	1653.28	Y
Plot 206	13.91	18.59	25.17	1400.18	1871.27	Y
Plot 207	13.05	18.24	28.45	1032.26	1442.78	Y
Plot 208	12.27	18.01	31.87	985.53	1446.56	Y
Plot 209	10.58	15.92	33.54	985.63	1483.11	Y
Plot 210	12.74	16.95	24.84	1244.7	1656.02	Y
Plot 211	8	18.15	55.92	777.6	1764.18	
Plot 212	8.91	18.14	50.88	704.78	1434.87	
Plot 213	9.05	18.31	50.57	715.86	1448.32	
Plot 214	9.37	18.42	49.13	741.17	1457.02	
Plot 215	9.52	18.59	48.79	753.03	1470.47	
Plot 216	8.91	18.314	51.35	704.78	1434.87	
Plot 217	9.05	18.31	50.57	715.86	1448.32	
Plot 218	9.37	18.42	49.13	741.17	1457.02	
Plot 219	9.32	18.38	49.29	737.21	1453.86	
Plot 220	14.7	18.86	22.06	1428.84	1833.19	Y
Plot 221	13.36	18.36	27.23	1276.01	1753.56	Y
Plot 222	13.31	17.31	23.11	1271.24	1653.28	Y
Plot 223	13.27	17.2	22.85	1267.42	1642.77	Y
Plot 224	13.38	18.36	27.12	1277.92	1753.56	Y
Plot 225	13.35	18.36	27.29	1275.06	1753.56	Y
Plot 226	13.36	18.36	27.23	1276.01	1753.56	Y

Plot 227	12.28	16.78	26.82	1472.86	2012.59	Y
Plot 228	14.65	18.86	22.32	1423.98	1833.19	Y
Plot 229	13.08	16.93	22.74	1677.64	2171.44	Y
Plot 230	13.54	17.21	21.32	1623.99	2064.17	Y
Plot 231	12.78	16.46	22.36	1576.29	2030.18	Y
Plot 232	12.98	16.46	21.14	1600.95	2030.18	Y
Plot 233	11.4	16.42	30.57	1406.08	2025.24	Y
Plot 234	11.27	16.54	31.86	1390.04	2040.04	Y
Plot 235	12.95	17.58	26.34	1553.22	2108.55	Y
Plot 236	13.61	17.08	20.32	1632.38	2048.58	Y
Plot 237	14.05	18.02	22.03	1341.92	1721.09	Y
Plot 238	13.86	18.02	23.09	1323.77	1721.09	Y
Plot 239	14.71	18.71	21.38	1429.81	1818.61	Y
Plot 240	11.12	16.54	32.77	1371.54	2040.04	Y
Plot 241	10.94	16.42	33.37	1349.34	2025.24	Y
Plot 242	11.08	16.54	33.01	1366.61	2040.04	Y
Plot 243	11.15	16.42	32.10	1375.24	2025.24	Y
Plot 244	14.12	18.21	22.46	1372.46	1770.01	Y
Plot 245	14.24	19.45	26.79	1124.39	1535.77	Y
Plot 246	14.21	18.16	21.75	1357.2	1734.46	Y
Plot 247	12.5	17.49	28.53	1499.25	2097.75	Y
Plot 248	12.65	16.94	25.32	1622.49	2172.72	Y
Plot 249	12.58	17.49	28.07	1508.85	2097.75	Y
Plot 250	12.55	16.85	25.52	1609.66	2161.18	Y
Plot 251	12.83	16.85	23.86	1645.58	2161.18	Y
Plot 252	12.37	16.71	25.97	1596.97	2157.26	Y
Plot 253	12.79	16.6	22.95	1666.28	2162.65	Y
Plot 254	11.53	16.25	29.05	1502.13	2117.05	Y
Plot 255	13.34	17.71	24.68	1600	2124.14	Y
Plot 256	12.48	16.9	26.15	1600.68	2167.59	
Plot 257	14.35	18.16	20.98	1370.57	1734.46	
Plot 258	14.35	18.16	20.98	1370.57	1734.46	
Plot 259	14.04	17.49	19.73	1683.96	2097.75	
Plot 260	12.42	16.5	24.73	1603.42	2130.15	Y
Plot 261	5.31	16.76	68.32	685.52	2163.72	
Plot 262	9.52	18.64	48.93	753.03	1474.42	
Plot 263	9.51	18.59	48.84	752.24	1470.47	
Plot 264	8.87	18.14	51.10	701.62	1434.87	
Plot 265	8.94	18.31	51.17	707.15	1448.32	
Plot 266	7.72	18.59	58.47	620.07	1493.15	
Plot 267	7.88	18.89	58.28	632.92	1517.24	
Plot 268	11.77	20.76	43.30	754.69	1331.13	
Plot 269	11.93	20.31	41.26	690.15	1174.93	
Plot 270	12.47	20.98	40.56	639.71	1073.71	
Plot 271	9.01	20.01	54.97	542.94	1205.8	
Plot 272	7.44	17.44	57.34	728.38	1707.38	

Plot 273	8.16	17.47	53.29	761	1629.25	
Plot 274	8.25	18.38	55.11	652.58	1453.86	
Plot 275	8.19	18.26	55.15	647.83	1444.37	
Plot 276	6.74	17.19	60.79	791.68	2019.14	
Plot 277	5.09	16.52	69.19	657.12	2132.73	
Plot 278	5.09	16.52	69.19	657.12	2132.73	
Plot 279	5.09	16.52	69.19	657.12	2132.73	
Plot 280	6.09	17.49	65.18	730.43	2097.75	
Plot 281	7.44	17.44	57.34	728.38	1707.38	
Plot 282	8.16	17.47	53.29	761	1629.25	
Plot 283	6.43	17.63	63.53	599.66	1644.17	
Plot 284	6.29	16.68	62.29	615.79	1632.97	
Plot 285	9.05	18.31	50.57	715.86	1448.32	
Plot 286	8.91	18.14	50.88	704.78	1434.87	
Plot 287	9.52	18.59	48.79	753.03	1470.47	
Plot 288	9.37	18.42	49.13	741.17	1457.02	
Plot 289	7.84	18.09	56.66	620.14	1430.92	
Plot 290	7.74	17.97	56.93	612.23	1421.43	
Plot 291	6.91	18.22	62.07	671.65	1770.98	
Plot 292	10.26	18.7	45.13	780.58	1422.7	
Plot 293	9.91	19.41	48.94	705.49	1381.8	
Plot 294	7.57	17.68	57.18	705.98	1648.84	
Plot 295	7.79	17.92	56.53	726.5	1671.22	
Plot 296	7.41	17.47	57.58	690.32	1627.51	
Plot 297	7.62	17.71	56.97	709.88	1649.86	
Plot 298	7.57	17.68	57.18	705.98	1648.84	
Plot 299	7.79	17.92	56.53	726.5	1671.22	
Plot 300	7.41	17.47	57.58	690.32	1627.51	
Plot 301	7.71	17.8	56.69	718.26	1658.25	
Phase Totals	**10.70**	**17.74**	**39.71**	**110729.32**	**180123.41**	

Phase 3A

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 445	5.91	15.76	62.50	899.32	2398.2	
Plot 446	5.91	15.76	62.50	899.32	2398.2	
Plot 447	6.29	17.38	63.81	740.52	2046.15	
Plot 448	7.26	17.89	59.42	854.72	2106.19	
Plot 449	5.96	15.81	62.30	906.93	2405.81	
Plot 450	5.96	15.81	62.30	906.93	2405.81	
Plot 451	6.39	17.47	63.42	752.29	2056.74	
Plot 452	8.93	18.32	51.26	838.26	1719.7	
Plot 453	8.25	17.82	53.70	694.98	1501.16	
Plot 454	8.5	18.05	52.91	716.04	1520.53	
Plot 455	5.83	16.5	64.67	633.49	1792.89	
Plot 456	9.41	19.01	50.50	743.39	1501.79	

Plot 457	9.16	18.79	51.25	723.64	1484.41	
Plot 458	9.41	19.01	50.50	743.39	1501.79	
Plot 459	9.16	18.79	51.25	723.64	1484.41	
Plot 460	5.98	16.65	64.08	649.79	1809.2	
Plot 461	7.06	17.94	60.65	701.06	1781.44	
Plot 462	7.15	18.04	60.37	841.77	2123.85	
Plot 668	5.32	16.64	68.03	681.81	2132.58	
Phase Total	**7.254737**	**17.44421**	**58.41**	**14651.29**	**36170.85**	

Phase 3B

Plot	DER	TER	% improvements	Dwelling Emissions (Kg/CO_2 per annum)	Target Emissions (Kg/CO_2 per annum)	As Built (Yes / No)
Plot 659	14.54	18.6	21.83	1150.11	1471.45	Y
Plot 660	12.36	17.92	31.03	975.95	1414.96	Y
Plot 661	13.28	17.61	24.59	1300.11	1724.02	Y
Plot 662	13.33	17.61	24.30	1305.01	1724.02	Y
Plot 663	14.71	18.94	22.33	1444.67	1860.1	Y
Plot 664	12.66	16.22	21.95	1468.69	1881.68	Y
Plot 665	12.63	16.22	22.13	1465.21	1881.68	Y
Plot 666	12.55	16.22	22.63	1455.93	1881.68	Y
Plot 667	12.56	16.22	22.56	1457.09	1881.68	Y
Plot 669	13.05	19.05	31.50	1032.89	1457.52	Y
Plot 670	11.35	16.86	32.68	868.39	1289.96	Y
Plot 671	11.72	16.57	29.27	896.7	1267.77	Y
Plot 672	12.67	19.14	33.80	1035.17	1206.01	Y
Plot 673	16.02	19.23	16.69	1009.42	1211.68	Y
Plot 674	15.73	18.91	16.82	1203.5	1446.8	Y
Plot 675	17.4	21.34	18.46	915.41	1122.7	Y
Plot 676	13.77	20.39	32.47	724.44	1072.72	Y
Plot 677	17.07	20.56	16.97	898.05	1081.66	Y
Plot 678	13.49	19.82	31.94	709.71	1042.73	Y
Plot 679	16.56	20.26	18.26	1035.17	1266.45	Y
Plot 680	13.87	20.23	31.44	781.44	1139.76	Y
Phase Total	**13.87238**	**18.47238**	**24.90**	**23133.06**	**30327.03**	

APPENDIX B – Full SAP Calculations

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 103 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 103	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 103, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.72 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.55 m², No overhang
Windows facing South: 7.88 m², No overhang
Windows facing West: 7.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
   172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
   172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m = 1692.5948 (64)
Heat gains from water heating, kWh/month
    56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m     135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
     22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
    252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
     36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
  -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
     75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
    418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)


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6. Solar gains
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[Jan]                                Area      Solar flux          g              FF          Access          Gains
                                     m2         Table 6a    Specific data  Specific data      factor              W
                                                   W/m2    or Table 6b    or Table 6c    Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                4.5500      19.6403          0.7200         0.7000      0.7700      31.2121 (76)
South                               7.8800      46.7521          0.7200         0.7000      0.7700     128.6740 (78)
West                                7.4700      19.6403          0.7200         0.7000      0.7700      51.2427 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains  211.1287  372.0338  534.0752  690.8089  790.9469  790.2901  760.0009  686.1702  589.3621  418.6921  255.3339  178.9929 (83)
Total gains  629.4998  788.2090  935.1302 1067.3506 1142.3927 1117.6873 1071.8560 1004.3613  920.2126  774.2817  639.3680  584.5586 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau        46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha       4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
     0.9918    0.9795    0.9499    0.8748    0.7430    0.5614    0.4151    0.4577    0.6978    0.9197    0.9831    0.9939 (86)

MIT        19.5392   19.8056   20.1653   20.5754   20.8390   20.9648   20.9924   20.9886   20.9102   20.5325   19.9659   19.5139 (87)
Th 2       19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
     0.9898    0.9745    0.9378    0.8462    0.6904    0.4867    0.3277    0.3673    0.6241    0.8947    0.9782    0.9923 (89)
MIT 2      18.0351   18.4239   18.9409   19.5238   19.8605   20.0187   20.0407   20.0436   19.9604   19.4838   18.6762   18.0116 (90)
Living area fraction                                                                 fLA = Living area / (4) =    0.1928 (91)
MIT        18.3251   18.6903   19.1769   19.7266   20.0492   20.2011   20.2242   20.2258   20.1435   19.6860   18.9249   18.3013 (92)
Temperature adjustment                                                                                       0.0000
adjusted MIT  18.3251   18.6903   19.1769   19.7266   20.0492   20.2011   20.2242   20.2258   20.1435   19.6860   18.9249   18.3013 (93)


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8. Space heating requirement
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              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9849    0.9659    0.9255    0.8367    0.6921    0.4994    0.3444    0.3844    0.6331    0.8843    0.9707    0.9884 (94)
Useful gains 619.9681  761.3153  865.4988  893.0682  790.6997  558.2087  369.1408  386.0808  582.5410  684.6696  620.6106  577.7776 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
1547.2590 1513.1099 1383.3612 1149.0638  881.1319  574.3634  371.6379  390.0243  626.9598  958.8897 1262.0909 1521.9195 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
  689.9044  505.2059  385.2896  184.3169   67.2816    0.0000    0.0000    0.0000    0.0000  204.0197  461.8658  702.4415 (98)
Space heating                                                                                               3200.3256 (98)
Space heating per m2                                                                                (98) / (4) =   32.6831 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		93.3000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		3430.1453 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	689.9044	505.2059	385.2896	184.3169	67.2816	0.0000	0.0000	0.0000	0.0000	204.0197	461.8658	702.4415	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	739.4474	541.4855	412.9578	197.5529	72.1132	0.0000	0.0000	0.0000	0.0000	218.6707	495.0330	752.8848	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5546	89.4428	89.2263	88.7217	87.8747	86.7000	86.7000	86.7000	86.7000	88.7784	89.3671	89.5825	(217)
Fuel for water heating, kWh/month													
	193.1365	169.4969	176.2040	155.7239	151.7825	134.1289	125.6569	142.2510	143.3756	161.5362	173.5775	187.3883	(219)
Water heating fuel used												1914.2580	(219)
Annual totals kWh/year													
Space heating fuel - main system												3430.1453	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1068 * 1.00) =										-1384.2193		-1384.2193	(233)
Total delivered energy for all uses												4435.5591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3430.1453	0.2160	740.9114	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.2580	0.2160	413.4797	(264)
Space and water heating			1154.3911	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1384.2193	0.5190	-718.4098	(269)
Total CO2, kg/year			682.7010	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.9700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.9700	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		24.1577	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1577	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5500	19.6403	0.6300	0.7000	0.7700	27.3106	(76)
South	7.8800	46.7521	0.6300	0.7000	0.7700	112.5897	(78)
West	7.4700	19.6403	0.6300	0.7000	0.7700	44.8373	(80)

Solar gains	184.7376	325.5296	467.3158	604.4578	692.0785	691.5038	665.0008	600.3989	515.6919	366.3556	223.4172	156.6188	(83)
Total gains	616.2616	754.8613	881.5348	993.6304	1055.4885	1030.2002	988.1621	930.5607	859.1831	735.1189	620.6131	575.3409	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9975	0.9929	0.9791	0.9354	0.8313	0.6568	0.4903	0.5392	0.7881	0.9620	0.9942	0.9982	(86)
MIT	19.7569	19.9549	20.2417	20.5799	20.8353	20.9626	20.9929	20.9888	20.9069	20.5531	20.0829	19.7209	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9967	0.9905	0.9720	0.9132	0.7779	0.5660	0.3791	0.4246	0.7073	0.9443	0.9919	0.9976	(89)
MIT 2	18.2911	18.5807	18.9959	19.4759	19.8030	19.9431	19.9644	19.9641	19.8932	19.4506	18.7756	18.2443	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.5737	18.8456	19.2361	19.6888	20.0021	20.1397	20.1627	20.1617	20.0887	19.6632	19.0277	18.5290	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5737	18.8456	19.2361	19.6888	20.0021	20.1397	20.1627	20.1617	20.0887	19.6632	19.0277	18.5290	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9870	0.9656	0.9063	0.7804	0.5820	0.4006	0.4467	0.7182	0.9378	0.9889	0.9964	(94)
Useful gains	613.2105	745.0569	851.1798	900.5062	823.6947	599.5397	395.8764	415.6860	617.0538	689.3976	613.6974	573.2654	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1637.5755	1596.3688	1454.7102	1219.5746	936.6452	619.3025	398.2921	419.8181	671.8649	1022.5157	1351.0077	1629.6854	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	762.1276	572.0816	449.0266	229.7292	84.0352	0.0000	0.0000	0.0000	0.0000	247.8399	530.8634	785.9764	(98)
Space heating												3661.6799	(98)
Space heating per m2											(98) / (4) =	37.3946	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3920.4282	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	762.1276	572.0816	449.0266	229.7292	84.0352	0.0000	0.0000	0.0000	0.0000	247.8399	530.8634	785.9764	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	815.9824	612.5070	480.7566	245.9628	89.9735	0.0000	0.0000	0.0000	0.0000	265.3532	568.3762	841.5165	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9905	87.6834	87.0676	85.7438	83.3946	80.3000	80.3000	80.3000	80.3000	85.8206	87.4665	88.0901	(217)
Fuel for water heating, kWh/month													
	241.0553	213.2300	225.5676	203.5576	202.6315	185.3441	177.5738	197.9532	200.1393	212.7859	220.6871	235.0105	(219)
Water heating fuel used												2515.5358	(219)
Annual totals kWh/year													
Space heating fuel - main system												3920.4282	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												6911.3391	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3920.4282	0.2160	846.8125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.5358	0.2160	543.3557	(264)
Space and water heating			1390.1682	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1636.8879	(272)
Emissions per m2 for space and water heating			14.1970	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1970 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			16.7200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 103 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 103	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 103, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 103 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 103	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 103, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	6.97	$kgCO_2/yr/m^2$	
TER	16.72	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.97	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.30	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	36.85	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.39	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.39	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	22	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 104 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 104	**Prop Type Ref**	As
Property	Type 3 - Semi SG, Plot 104, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.34	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.75		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.89	**TFEE**	52.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.34 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.05 m², No overhang
Windows facing East: 4.02 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7300	1.2357	18.2025			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	16.8700	79.9800	0.2100	16.7958			(29a)
Main Roof	46.6300		46.6300	0.0700	3.2641			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5343			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6670 (36)
Total fabric heat loss (33) + (36) =	52.2013 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	101.0785	100.4988	99.9191	97.0205	96.4408	93.5422	93.5422	92.9625	94.7016	96.4408	97.6002	98.7596	(39)

Average = Sum(39)m / 12 = 96.8756 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0838	1.0776	1.0714	1.0403	1.0341	1.0030	1.0030	0.9968	1.0155	1.0341	1.0465	1.0590	(40)
HLP (average)												1.0388	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

Energy content (annual) Total = Sum(45)m = 1534.9896 (45)

Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8116   10.6590   11.7776   11.3586   11.7088   11.2984   11.6546   11.6898   11.3312   11.7491   11.4052   11.8011 (61)
Total heat required for water heating calculated for each month
              170.9572  149.8488  155.4089  136.5799  131.8616  114.9811  107.7319  121.9399  122.8980  141.7695  153.3327  165.9251 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              170.9572  149.8488  155.4089  136.5799  131.8616  114.9811  107.7319  121.9399  122.8980  141.7695  153.3327  165.9251 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1673.2347 (64)
Heat gains from water heating, kWh/month
               55.8688   48.9453   50.7018   44.4757   42.8780   37.2991   34.8594   39.5806   39.9288   46.1691   50.0422   54.1965 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.8411   20.2873   16.4987   12.4906    9.3369    7.8826    8.5174   11.0712   14.8598   18.8679   22.0216   23.4759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              244.9491  247.4909  241.0856  227.4496  210.2365  194.0587  183.2509  180.7090  187.1143  200.7504  217.9634  234.1413 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 (71)
Water heating gains (Table 5)
               75.0925   72.8353   68.1476   61.7719   57.6317   51.8043   46.8540   53.1997   55.4566   62.0552   69.5030   72.8448 (72)
Total internal gains
              408.8992  406.6300  391.7484  367.7285  343.2216  319.7620  304.6387  310.9965  323.4472  347.6900  375.5046  396.4785 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    3.0500            10.6334           0.7200           0.7000           0.7700           11.3275 (74)
East                                     4.0200            19.6403           0.7200           0.7000           0.7700           27.5764 (76)
West                                     7.6600            19.6403           0.7200           0.7000           0.7700           52.5460 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    91.4499  178.3839  294.9069  435.5415  540.9545  557.4923  529.1864  449.3437  344.4339  211.7495  113.8772   75.3320 (83)
Total gains   500.3491  585.0139  686.6554  803.2700  884.1761  877.2543  833.8251  760.3402  667.8812  559.4394  489.3818  471.8104 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.4391   48.7185   49.0012   50.4651   50.7685   52.3416   52.3416   52.6680   51.7008   50.7685   50.1654   49.5764
alpha          4.2293    4.2479    4.2667    4.3643    4.3846    4.4894    4.4894    4.5112    4.4467    4.3846    4.3444    4.3051
util living area
               0.9959    0.9915    0.9778    0.9307    0.8201    0.6380    0.4829    0.5433    0.8074    0.9643    0.9923    0.9968 (86)

MIT           19.4931   19.6834   20.0125   20.4545   20.7799   20.9497   20.9885   20.9812   20.8530   20.4061   19.8873   19.4855 (87)
Th 2          20.0141   20.0192   20.0243   20.0499   20.0550   20.0808   20.0808   20.0860   20.0705   20.0550   20.0447   20.0345 (88)
util rest of house
               0.9948    0.9893    0.9718    0.9119    0.7746    0.5614    0.3870    0.4438    0.7427    0.9511    0.9900    0.9960 (89)
MIT 2         17.9908   18.2715   18.7517   19.3955   19.8282   20.0427   20.0753   20.0761   19.9397   19.3424   18.5873   17.9935 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2586 (91)
MIT           18.3794   18.6366   19.0778   19.6694   20.0743   20.2773   20.3115   20.3102   20.1760   19.6175   18.9235   18.3794 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.3794   18.6366   19.0778   19.6694   20.0743   20.2773   20.3115   20.3102   20.1760   19.6175   18.9235   18.3794 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9922    0.9848    0.9641    0.9029    0.7757    0.5786    0.4116    0.4690    0.7509    0.9432    0.9860    0.9938 (94)
Useful gains 496.4316  576.1290  662.0095  725.2893  685.8134  507.5535  343.1790  356.5853  501.5329  527.6417  482.5272  468.9087 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1423.1205 1380.5157 1256.7588 1044.8491  807.6276  531.0646  347.1776  363.4998  575.4026  869.6532 1153.9739 1400.3528 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              689.4565  540.5479  442.4935  230.0831   90.6298    0.0000    0.0000    0.0000    0.0000  254.4566  483.4416  692.9944 (98)
Space heating                                                                                                          3424.1033 (98)
Space heating per m2                                                                                  (98) / (4) =     36.7157 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3669.9929	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	689.4565	540.5479	442.4935	230.0831	90.6298	0.0000	0.0000	0.0000	0.0000	254.4566	483.4416	692.9944	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	738.9673	579.3653	474.2696	246.6057	97.1380	0.0000	0.0000	0.0000	0.0000	272.7294	518.1582	742.7593	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5611	89.4935	89.3358	88.9246	88.1312	86.7000	86.7000	86.7000	86.7000	88.9781	89.4061	89.5814	(217)
Fuel for water heating, kWh/month													
	190.8833	167.4410	173.9604	153.5907	149.6197	132.6195	124.2582	140.6458	141.7509	159.3309	171.5014	185.2226	(219)
Water heating fuel used												1890.8244	(219)
Annual totals kWh/year													
Space heating fuel - main system												3669.9929	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												403.3811	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =										-1474.3553		-1474.3553	(233)
Total delivered energy for all uses												4564.8430	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3669.9929	0.2160	792.7185	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.8244	0.2160	408.4181	(264)
Space and water heating			1201.1365	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	403.3811	0.5190	209.3548	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			684.2259	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.3400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.3400	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		24.8667	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.8667	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			14.7300	1.3258	19.5284			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	16.8700	79.9800	0.1800	14.3964			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6166			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1771	(36)
Total fabric heat loss (33) + (36) =	58.7937	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.9046	103.6527	103.4058	102.2460	102.0290	101.0189	101.0189	100.8318	101.4080	102.0290	102.4680	102.9269	(39)
Average = Sum(39)m / 12 =												102.2450	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1141	1.1114	1.1088	1.0964	1.0940	1.0832	1.0832	1.0812	1.0874	1.0940	1.0987	1.1037	(40)
HLP (average)												1.0963	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8411	20.2873	16.4987	12.4906	9.3369	7.8826	8.5174	11.0712	14.8598	18.8679	22.0216	23.4759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.0535	419.7879	404.8304	380.1558	354.9902	330.8738	315.7573	322.7715	335.8840	360.7815	388.6677	409.6363	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0500	10.6334	0.6300	0.7000	0.7700	9.9116	(74)
East	4.0200	19.6403	0.6300	0.7000	0.7700	24.1293	(76)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	80.0187	156.0859	258.0436	381.0988	473.3352	487.8057	463.0381	393.1758	301.3797	185.2808	99.6425	65.9155	(83)
Total gains	502.0722	575.8738	662.8740	761.2546	828.3254	818.6795	778.7955	715.9473	637.2637	546.0623	488.3103	475.5518	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3301	62.4816	62.6308	63.3412	63.4760	64.1107	64.1107	64.2296	63.8647	63.4760	63.2040	62.9222	
alpha	5.1553	5.1654	5.1754	5.2227	5.2317	5.2740	5.2740	5.2820	5.2576	5.2317	5.2136	5.1948	
util living area													
	0.9988	0.9973	0.9918	0.9680	0.8907	0.7278	0.5576	0.6232	0.8767	0.9847	0.9975	0.9991	(86)
MIT	19.7494	19.8900	20.1457	20.4912	20.7853	20.9484	20.9896	20.9820	20.8564	20.4675	20.0473	19.7264	(87)
Th 2	19.9893	19.9915	19.9937	20.0038	20.0057	20.0146	20.0146	20.0162	20.0112	20.0057	20.0019	19.9978	(88)
util rest of house													
	0.9984	0.9964	0.9887	0.9554	0.8489	0.6394	0.4395	0.5021	0.8134	0.9767	0.9965	0.9988	(89)
MIT 2	18.3133	18.5202	18.8941	19.3961	19.7908	19.9795	20.0106	20.0085	19.8902	19.3705	18.7580	18.2857	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.6847	18.8745	19.2178	19.6793	20.0480	20.2301	20.2638	20.2603	20.1401	19.6542	19.0915	18.6583	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6847	18.8745	19.2178	19.6793	20.0480	20.2301	20.2638	20.2603	20.1401	19.6542	19.0915	18.6583	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9948	0.9855	0.9503	0.8510	0.6601	0.4703	0.5335	0.8231	0.9729	0.9951	0.9982	(94)
Useful gains	500.8670	572.9056	653.2485	723.3828	704.9029	540.4361	366.2397	381.9792	524.5304	531.2372	485.9076	474.6876	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1494.6359	1448.4960	1315.0925	1102.1450	851.7387	568.7423	370.1161	389.2421	612.5124	923.7920	1228.7427	1488.1467	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	739.3641	588.3967	492.4120	272.7087	109.2458	0.0000	0.0000	0.0000	0.0000	292.0607	534.8413	754.0136	(98)
Space heating												3783.0430	(98)
Space heating per m2											(98) / (4) =	40.5645	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4050.3672	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.3641	588.3967	492.4120	272.7087	109.2458	0.0000	0.0000	0.0000	0.0000	292.0607	534.8413	754.0136	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	791.6104	629.9751	527.2077	291.9794	116.9656	0.0000	0.0000	0.0000	0.0000	312.6989	572.6352	807.2950	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9520	87.7573	87.2929	86.2010	84.0136	80.3000	80.3000	80.3000	80.3000	86.2529	87.5012	88.0324	(217)
Fuel for water heating, kWh/month													
	238.8853	211.0561	222.6307	199.9635	198.6406	183.0424	175.3686	195.4949	197.6539	209.5348	218.5598	232.9631	(219)
Water heating fuel used												2483.7938	(219)
Annual totals kWh/year													
Space heating fuel - main system												4050.3672	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												403.3811	(232)
Total delivered energy for all uses												7012.5421	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4050.3672	0.2160	874.8793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2483.7938	0.2160	536.4995	(264)
Space and water heating			1411.3788	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	403.3811	0.5190	209.3548	(268)
Total CO2, kg/m2/year			1659.6585	(272)
Emissions per m2 for space and water heating			15.1338	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2449	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1338 * 1.00) + 2.2449 + 0.4174, rounded to 2 d.p.			17.8000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 104 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 104	**Prop Type Ref**	As
Property	Type 3 - Semi SG, Plot 104, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.34	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.75		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.89	**TFEE**	52.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.85	79.98

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.63	46.63

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	46.63

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.71	0.065	No
Independently assessed	E3 Sill	10.11	0.004	No
Independently assessed	E4 Jamb	28.65	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 104 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 104	**Prop Type Ref**	As
Property	Type 3 - Semi SG, Plot 104, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.34	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.75		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.89	**TFEE**	52.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.34	$kgCO_2/yr/m^2$	
TER	17.80	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.34	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.75	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.89	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.33	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.33	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.59	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.12	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.12	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 105 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 105	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 105, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 2.44 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                     3.4900           19.6403           0.7200           0.7000           0.7700           23.9407 (76)
South                                    2.4400           46.7521           0.7200           0.7000           0.7700           39.8432 (78)
West                                     7.8500           19.6403           0.7200           0.7000           0.7700           53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.6333  217.4268  333.7293  459.4422  545.8272  552.7488  528.5966  464.3804  378.2976  250.9485  144.2229   98.3990 (83)
Total gains   492.6239  590.2928  693.0245  796.8722  861.0607  846.6139  808.6011  750.3980  675.5696  570.2977  488.9192  462.1005 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9943    0.9872    0.9678    0.9095    0.7902    0.6071    0.4541    0.5040    0.7591    0.9472    0.9888    0.9956 (86)

MIT           19.5381   19.7557   20.0935   20.5171   20.8101   20.9579   20.9907   20.9857   20.8855   20.4748   19.9421   19.5249 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9927    0.9838    0.9590    0.8857    0.7393    0.5281    0.3584    0.4051    0.6862    0.9282    0.9853    0.9944 (89)
MIT 2         18.0182   18.3378   18.8278   19.4388   19.8202   20.0056   20.0318   20.0344   19.9295   19.3974   18.6289   18.0132 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9893    0.9780    0.9499    0.8774    0.7427    0.5459    0.3822    0.4296    0.6980    0.9199    0.9801    0.9917 (94)
Useful gains  487.3517  577.2789  658.2806  699.1442  639.4800  462.1516  309.0856  322.3433  471.5342  524.6284  479.1864  458.2461 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1294.0794 1258.7105 1147.2507  952.1204  732.6977  479.2780  311.8119  326.8063  521.7677  793.9105 1050.7841 1272.6141 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.2054  457.9220  363.7938  182.1429   69.3539    0.0000    0.0000    0.0000    0.0000  200.3459  411.5503  605.8898 (98)
Space heating                                                                                                         2891.2040 (98)
Space heating per m2                                                                                  (98) / (4) =     35.9961 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3098.8253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.2054	457.9220	363.7938	182.1429	69.3539	0.0000	0.0000	0.0000	0.0000	200.3459	411.5503	605.8898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	643.3070	490.8061	389.9183	195.2228	74.3343	0.0000	0.0000	0.0000	0.0000	214.7330	441.1043	649.3995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5054	89.4160	89.2264	88.7616	87.9446	86.7000	86.7000	86.7000	86.7000	88.8125	89.3266	89.5294	(217)
Fuel for water heating, kWh/month													
	182.3764	160.0293	166.3490	147.0163	143.2983	126.8093	118.8742	134.4666	135.4969	152.5117	163.9410	176.9790	(219)
Water heating fuel used												1808.1482	(219)
Annual totals kWh/year													
Space heating fuel - main system												3098.8253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4162.2229	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3098.8253	0.2160	669.3463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.1482	0.2160	390.5600	(264)
Space and water heating			1059.9063	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			673.3807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.8383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
South	2.4400	46.7521	0.6300	0.7000	0.7700	34.8628	(78)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	102.9291	190.2484	292.0132	402.0119	477.5988	483.6552	462.5220	406.3329	331.0104	219.5800	126.1950	86.0991	(83)
Total gains	491.0795	576.0064	663.5750	751.0849	803.8481	787.9105	752.9230	703.3721	639.9340	551.2044	483.7882	462.9638	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9978	0.9948	0.9852	0.9509	0.8595	0.6903	0.5220	0.5767	0.8293	0.9728	0.9954	0.9984	(86)
MIT	19.7446	19.9109	20.1832	20.5297	20.8068	20.9542	20.9909	20.9853	20.8824	20.5072	20.0603	19.7169	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9971	0.9930	0.9799	0.9330	0.8106	0.5990	0.4055	0.4571	0.7542	0.9594	0.9935	0.9978	(89)
MIT 2	18.2749	18.5190	18.9153	19.4135	19.7764	19.9432	19.9698	19.9690	19.8764	19.3925	18.7461	18.2411	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9904	0.9751	0.9272	0.8144	0.6201	0.4349	0.4872	0.7673	0.9544	0.9911	0.9968	(94)
Useful gains	488.9803	570.4956	647.0245	696.4335	654.6313	488.5754	327.4087	342.6570	491.0411	526.0650	479.4989	461.4677	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.0865	1307.4866	1188.8912	995.7770	767.2138	509.7518	330.2392	347.5855	551.3441	835.0772	1107.3942	1338.9447	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating												3170.2151	(98)
Space heating per m2											(98) / (4) =	39.4698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3394.2346	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	682.7484	530.2548	431.6369	230.7573	89.6803	0.0000	0.0000	0.0000	0.0000	246.1511	484.0306	698.9753	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7411	87.4935	86.9604	85.7396	83.5223	80.3000	80.3000	80.3000	80.3000	85.7828	87.2313	87.8329	(217)
Fuel for water heating, kWh/month													
	230.6787	203.1527	212.6630	191.3072	190.1361	174.1812	166.8789	186.0308	188.0853	200.4839	210.4588	224.9973	(219)
Water heating fuel used												2379.0539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3394.2346	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6205.1170	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3394.2346	0.2160	733.1547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.0539	0.2160	513.8756	(264)
Space and water heating			1247.0303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1471.1493	(272)
Emissions per m2 for space and water heating			15.5258	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5258 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 105 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 105	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 105, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 105 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 105	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 105, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.38	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.25	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.13	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 106 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 106	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 106, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing East: 3.49 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


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6. Solar gains
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[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                       m2          Table 6a     Specific data     Specific data     factor           W
                                                     W/m2       or Table 6b       or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                 2.4400          10.6334          0.7200          0.7000          0.7700          9.0620 (74)
East                                  3.4900          19.6403          0.7200          0.7000          0.7700         23.9407 (76)
West                                  7.8500          19.6403          0.7200          0.7000          0.7700         53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    86.8521  169.4919  280.0362  412.7660  511.6058  526.7029  500.1875  425.4780  326.8497  201.1819  108.1742   71.5253 (83)
Total gains   461.8427  542.3579  639.3314  750.1960  826.8394  820.5679  780.1920  711.4956  624.1216  520.5311  452.8706  435.2268 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha           4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9955    0.9906    0.9754    0.9239    0.8073    0.6226    0.4694    0.5287    0.7944    0.9607    0.9916    0.9965 (86)

MIT            19.4960   19.6919   20.0274   20.4723   20.7919   20.9535   20.9895   20.9828   20.8613   20.4179   19.8935   19.4877 (87)
Th 2           19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9943    0.9881    0.9685    0.9028    0.7581    0.5429    0.3711    0.4262    0.7247    0.9457    0.9889    0.9956 (89)
MIT 2          17.9569   18.2456   18.7343   19.3798   19.7998   20.0022   20.0312   20.0328   19.9061   19.3204   18.5588   17.9591 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT            18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9832    0.9603    0.8940    0.7603    0.5606    0.3956    0.4515    0.7343    0.9376    0.9846    0.9933 (94)
Useful gains  457.8800  533.2649  613.9782  670.6461  628.6207  459.9766  308.6189  321.2092  458.3082  488.0386  445.8838  432.2903 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1288.8976 1250.9424 1139.3897  947.2366  730.9637  478.9648  311.7449  326.6449  519.7337  787.6117 1045.0449 1268.1402 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              618.2771  482.2793  390.9061  199.1452   76.1432    0.0000    0.0000    0.0000    0.0000  222.8824  431.3960  621.8723 (98)
Space heating                                                                                                         3042.9015 (98)
Space heating per m2                                                                                  (98) / (4) =     37.8847 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3261.4164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2771	482.2793	390.9061	199.1452	76.1432	0.0000	0.0000	0.0000	0.0000	222.8824	431.3960	621.8723	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6764	516.9124	418.9776	213.4460	81.6111	0.0000	0.0000	0.0000	0.0000	238.8878	462.3752	666.5298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5236	89.4502	89.2798	88.8397	88.0217	86.7000	86.7000	86.7000	86.7000	88.9046	89.3597	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3393	159.9683	166.2496	146.8871	143.1728	126.8093	118.8742	134.4666	135.4969	152.3537	163.8803	176.9481	(219)
Water heating fuel used												1807.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.4164	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4324.1122	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3261.4164	0.2160	704.4660	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.4463	0.2160	390.4084	(264)
Space and water heating			1094.8744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			708.3488	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.2783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.2783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	75.9956	148.3054	245.0317	361.1702	447.6551	460.8650	437.6640	372.2932	285.9935	176.0342	94.6525	62.5847	(83)
Total gains	464.1460	534.0634	616.5935	710.2432	773.9044	765.1203	728.0650	669.3324	594.9171	507.6587	452.2457	439.4493	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9963	0.9891	0.9600	0.8735	0.7056	0.5382	0.6021	0.8588	0.9804	0.9966	0.9987	(86)
MIT	19.7135	19.8631	20.1320	20.4918	20.7893	20.9495	20.9896	20.9822	20.8592	20.4622	20.0243	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9977	0.9950	0.9851	0.9447	0.8271	0.6142	0.4189	0.4791	0.7894	0.9703	0.9952	0.9983	(89)
MIT 2	18.2296	18.4497	18.8421	19.3625	19.7568	19.9397	19.9693	19.9676	19.8541	19.3304	18.6937	18.2013	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9929	0.9810	0.9388	0.8298	0.6350	0.4490	0.5100	0.8001	0.9656	0.9933	0.9974	(94)
Useful gains	462.5800	530.2900	604.8527	666.8002	642.1961	485.8866	326.9040	341.3760	476.0031	490.1916	449.1967	438.3133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.1684	1301.5015	1182.5697	991.3737	765.4586	509.4043	330.1730	347.4198	549.2871	829.7509	1102.9297	1335.5398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating												3318.7460	(98)
Space heating per m2											(98) / (4) =	41.3190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3553.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.6572	554.8759	460.1943	250.2066	98.1877	0.0000	0.0000	0.0000	0.0000	270.4841	503.9484	714.7072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7915	87.5866	87.1042	85.9419	83.7243	80.3000	80.3000	80.3000	80.3000	86.0179	87.3183	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5462	202.9369	212.3119	190.8567	189.6773	174.1812	166.8789	186.0308	188.0853	199.9358	210.2491	224.8887	(219)
Water heating fuel used												2376.5789	(219)
Annual totals kWh/year													
Space heating fuel - main system												3553.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6361.6687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.2613	0.2160	767.5044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.5789	0.2160	513.3410	(264)
Space and water heating			1280.8455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1504.9645	(272)
Emissions per m2 for space and water heating			15.9468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9468 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 106 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 106	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 106, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 106 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 106	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 106, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.82	$kgCO_2/yr/m^2$	
TER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.82	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.93	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 107 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 107	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 107, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 2.44 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                     3.4900           19.6403           0.7200           0.7000           0.7700           23.9407 (76)
South                                    2.4400           46.7521           0.7200           0.7000           0.7700           39.8432 (78)
West                                     7.8500           19.6403           0.7200           0.7000           0.7700           53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.6333  217.4268  333.7293  459.4422  545.8272  552.7488  528.5966  464.3804  378.2976  250.9485  144.2229   98.3990 (83)
Total gains   492.6239  590.2928  693.0245  796.8722  861.0607  846.6139  808.6011  750.3980  675.5696  570.2977  488.9192  462.1005 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9943    0.9872    0.9678    0.9095    0.7902    0.6071    0.4541    0.5040    0.7591    0.9472    0.9888    0.9956 (86)

MIT           19.5381   19.7557   20.0935   20.5171   20.8101   20.9579   20.9907   20.9857   20.8855   20.4748   19.9421   19.5249 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9927    0.9838    0.9590    0.8857    0.7393    0.5281    0.3584    0.4051    0.6862    0.9282    0.9853    0.9944 (89)
MIT 2         18.0182   18.3378   18.8278   19.4388   19.8202   20.0056   20.0318   20.0344   19.9295   19.3974   18.6289   18.0132 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9893    0.9780    0.9499    0.8774    0.7427    0.5459    0.3822    0.4296    0.6980    0.9199    0.9801    0.9917 (94)
Useful gains  487.3517  577.2789  658.2806  699.1442  639.4800  462.1516  309.0856  322.3433  471.5342  524.6284  479.1864  458.2461 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1294.0794 1258.7105 1147.2507  952.1204  732.6977  479.2780  311.8119  326.8063  521.7677  793.9105 1050.7841 1272.6141 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.2054  457.9220  363.7938  182.1429   69.3539    0.0000    0.0000    0.0000    0.0000  200.3459  411.5503  605.8898 (98)
Space heating                                                                                                         2891.2040 (98)
Space heating per m2                                                                                  (98) / (4) =     35.9961 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3098.8253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.2054	457.9220	363.7938	182.1429	69.3539	0.0000	0.0000	0.0000	0.0000	200.3459	411.5503	605.8898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	643.3070	490.8061	389.9183	195.2228	74.3343	0.0000	0.0000	0.0000	0.0000	214.7330	441.1043	649.3995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5054	89.4160	89.2264	88.7616	87.9446	86.7000	86.7000	86.7000	86.7000	88.8125	89.3266	89.5294	(217)
Fuel for water heating, kWh/month													
	182.3764	160.0293	166.3490	147.0163	143.2983	126.8093	118.8742	134.4666	135.4969	152.5117	163.9410	176.9790	(219)
Water heating fuel used												1808.1482	(219)
Annual totals kWh/year													
Space heating fuel - main system												3098.8253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4162.2229	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3098.8253	0.2160	669.3463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.1482	0.2160	390.5600	(264)
Space and water heating			1059.9063	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			673.3807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.8383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
South	2.4400	46.7521	0.6300	0.7000	0.7700	34.8628	(78)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	102.9291	190.2484	292.0132	402.0119	477.5988	483.6552	462.5220	406.3329	331.0104	219.5800	126.1950	86.0991	(83)
Total gains	491.0795	576.0064	663.5750	751.0849	803.8481	787.9105	752.9230	703.3721	639.9340	551.2044	483.7882	462.9638	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9978	0.9948	0.9852	0.9509	0.8595	0.6903	0.5220	0.5767	0.8293	0.9728	0.9954	0.9984	(86)
MIT	19.7446	19.9109	20.1832	20.5297	20.8068	20.9542	20.9909	20.9853	20.8824	20.5072	20.0603	19.7169	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9971	0.9930	0.9799	0.9330	0.8106	0.5990	0.4055	0.4571	0.7542	0.9594	0.9935	0.9978	(89)
MIT 2	18.2749	18.5190	18.9153	19.4135	19.7764	19.9432	19.9698	19.9690	19.8764	19.3925	18.7461	18.2411	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9904	0.9751	0.9272	0.8144	0.6201	0.4349	0.4872	0.7673	0.9544	0.9911	0.9968	(94)
Useful gains	488.9803	570.4956	647.0245	696.4335	654.6313	488.5754	327.4087	342.6570	491.0411	526.0650	479.4989	461.4677	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.0865	1307.4866	1188.8912	995.7770	767.2138	509.7518	330.2392	347.5855	551.3441	835.0772	1107.3942	1338.9447	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating												3170.2151	(98)
Space heating per m2											(98) / (4) =	39.4698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3394.2346	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	682.7484	530.2548	431.6369	230.7573	89.6803	0.0000	0.0000	0.0000	0.0000	246.1511	484.0306	698.9753	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7411	87.4935	86.9604	85.7396	83.5223	80.3000	80.3000	80.3000	80.3000	85.7828	87.2313	87.8329	(217)
Fuel for water heating, kWh/month													
	230.6787	203.1527	212.6630	191.3072	190.1361	174.1812	166.8789	186.0308	188.0853	200.4839	210.4588	224.9973	(219)
Water heating fuel used												2379.0539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3394.2346	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6205.1170	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3394.2346	0.2160	733.1547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.0539	0.2160	513.8756	(264)
Space and water heating			1247.0303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1471.1493	(272)
Emissions per m2 for space and water heating			15.5258	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5258 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 107 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 107	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 107, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 107 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 107	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 107, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.38	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.25	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.13	kWh/m^2/yr	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 108 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 108	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 108, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing East: 3.49 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                       m2          Table 6a     Specific data     Specific data     factor           W
                                                     W/m2       or Table 6b       or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                 2.4400          10.6334          0.7200          0.7000          0.7700          9.0620 (74)
East                                  3.4900          19.6403          0.7200          0.7000          0.7700         23.9407 (76)
West                                  7.8500          19.6403          0.7200          0.7000          0.7700         53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    86.8521  169.4919  280.0362  412.7660  511.6058  526.7029  500.1875  425.4780  326.8497  201.1819  108.1742   71.5253 (83)
Total gains   461.8427  542.3579  639.3314  750.1960  826.8394  820.5679  780.1920  711.4956  624.1216  520.5311  452.8706  435.2268 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha           4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9955    0.9906    0.9754    0.9239    0.8073    0.6226    0.4694    0.5287    0.7944    0.9607    0.9916    0.9965 (86)

MIT            19.4960   19.6919   20.0274   20.4723   20.7919   20.9535   20.9895   20.9828   20.8613   20.4179   19.8935   19.4877 (87)
Th 2           19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9943    0.9881    0.9685    0.9028    0.7581    0.5429    0.3711    0.4262    0.7247    0.9457    0.9889    0.9956 (89)
MIT 2          17.9569   18.2456   18.7343   19.3798   19.7998   20.0022   20.0312   20.0328   19.9061   19.3204   18.5588   17.9591 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT            18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9832    0.9603    0.8940    0.7603    0.5606    0.3956    0.4515    0.7343    0.9376    0.9846    0.9933 (94)
Useful gains  457.8800  533.2649  613.9782  670.6461  628.6207  459.9766  308.6189  321.2092  458.3082  488.0386  445.8838  432.2903 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1288.8976 1250.9424 1139.3897  947.2366  730.9637  478.9648  311.7449  326.6449  519.7337  787.6117 1045.0449 1268.1402 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              618.2771  482.2793  390.9061  199.1452   76.1432    0.0000    0.0000    0.0000    0.0000  222.8824  431.3960  621.8723 (98)
Space heating                                                                                                         3042.9015 (98)
Space heating per m2                                                                                  (98) / (4) =     37.8847 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3261.4164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2771	482.2793	390.9061	199.1452	76.1432	0.0000	0.0000	0.0000	0.0000	222.8824	431.3960	621.8723	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6764	516.9124	418.9776	213.4460	81.6111	0.0000	0.0000	0.0000	0.0000	238.8878	462.3752	666.5298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5236	89.4502	89.2798	88.8397	88.0217	86.7000	86.7000	86.7000	86.7000	88.9046	89.3597	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3393	159.9683	166.2496	146.8871	143.1728	126.8093	118.8742	134.4666	135.4969	152.3537	163.8803	176.9481	(219)
Water heating fuel used												1807.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.4164	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4324.1122	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3261.4164	0.2160	704.4660	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.4463	0.2160	390.4084	(264)
Space and water heating			1094.8744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			708.3488	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.2783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.2783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	75.9956	148.3054	245.0317	361.1702	447.6551	460.8650	437.6640	372.2932	285.9935	176.0342	94.6525	62.5847	(83)
Total gains	464.1460	534.0634	616.5935	710.2432	773.9044	765.1203	728.0650	669.3324	594.9171	507.6587	452.2457	439.4493	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9963	0.9891	0.9600	0.8735	0.7056	0.5382	0.6021	0.8588	0.9804	0.9966	0.9987	(86)
MIT	19.7135	19.8631	20.1320	20.4918	20.7893	20.9495	20.9896	20.9822	20.8592	20.4622	20.0243	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9977	0.9950	0.9851	0.9447	0.8271	0.6142	0.4189	0.4791	0.7894	0.9703	0.9952	0.9983	(89)
MIT 2	18.2296	18.4497	18.8421	19.3625	19.7568	19.9397	19.9693	19.9676	19.8541	19.3304	18.6937	18.2013	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9929	0.9810	0.9388	0.8298	0.6350	0.4490	0.5100	0.8001	0.9656	0.9933	0.9974	(94)
Useful gains	462.5800	530.2900	604.8527	666.8002	642.1961	485.8866	326.9040	341.3760	476.0031	490.1916	449.1967	438.3133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.1684	1301.5015	1182.5697	991.3737	765.4586	509.4043	330.1730	347.4198	549.2871	829.7509	1102.9297	1335.5398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating												3318.7460	(98)
Space heating per m2											(98) / (4) =	41.3190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3553.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.6572	554.8759	460.1943	250.2066	98.1877	0.0000	0.0000	0.0000	0.0000	270.4841	503.9484	714.7072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7915	87.5866	87.1042	85.9419	83.7243	80.3000	80.3000	80.3000	80.3000	86.0179	87.3183	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5462	202.9369	212.3119	190.8567	189.6773	174.1812	166.8789	186.0308	188.0853	199.9358	210.2491	224.8887	(219)
Water heating fuel used												2376.5789	(219)
Annual totals kWh/year													
Space heating fuel - main system												3553.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6361.6687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.2613	0.2160	767.5044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.5789	0.2160	513.3410	(264)
Space and water heating			1280.8455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1504.9645	(272)
Emissions per m2 for space and water heating			15.9468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9468 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 108 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 108	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 108, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 108 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 108	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 108, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.82	$kgCO_2/yr/m^2$	
TER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.82	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.93	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 109 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 109	**Prop Type Ref**	Opp
Property	Type 4S - Det SG, Plot 109, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.78	**TER**	17.63
Environmental	95 A	**% DER<TER**	61.54		
CO_2 Emissions (t/year)	0.31	**DFEE**	45.72	**TFEE**	59.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.63		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 116 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.63 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.78 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

---

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.75 m², No overhang
Windows facing North East: 2.08 m², No overhang
Windows facing East: 8.82 m², No overhang
Windows facing South East: 1.04 m², No overhang
Windows facing South: 2.28 m², No overhang
Windows facing West: 12.22 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4200	(1b)	x 2.3900	(2b) =	142.0138	(1b) - (3b)
First floor	57.0700	(1c)	x 2.6300	(2c) =	150.0941	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		292.1079	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1369	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3619	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3076	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3922	0.3846	0.3769	0.3384	0.3307	0.2923	0.2923	0.2846	0.3076	0.3307	0.3461	0.3615	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6422	0.6346	0.6269	0.5884	0.5807	0.5423	0.5423	0.5346	0.5576	0.5807	0.5961	0.6115	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			32.2300	1.2357	39.8279			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4200	0.1300	7.7246			(28a)
External Wall	154.8400	34.3700	120.4700	0.2100	25.2987			(29a)
Main Roof	57.0700		57.0700	0.0700	3.9949			(30)
Bay roof	2.3500		2.3500	0.1600	0.3760			(30)
Total net area of external elements Aum(A, m2)			273.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		80.4321			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8638	(36)
Total fabric heat loss					(33) + (36) =		86.2959	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.9099	61.1685	60.4271	56.7201	55.9787	52.2718	52.2718	51.5304	53.7546	55.9787	57.4615	58.9443	(38)
Heat transfer coeff	148.2058	147.4644	146.7230	143.0160	142.2746	138.5677	138.5677	137.8263	140.0505	142.2746	143.7574	145.2402	(39)
Average = Sum(39)m / 12 =												142.8307	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2723	1.2659	1.2595	1.2277	1.2213	1.1895	1.1895	1.1832	1.2023	1.2213	1.2341	1.2468	(40)
HLP (average)												1.2261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8487	(42)
Average daily hot water use (litres/day)	101.8559	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.0415	107.9672	103.8930	99.8188	95.7445	91.6703	91.6703	95.7445	99.8188	103.8930	107.9672	112.0415	(44)
Energy conte	166.1542	145.3196	149.9568	130.7359	125.4443	108.2489	100.3085	115.1054	116.4802	135.7464	148.1778	160.9115	(45)
Energy content (annual)										Total = Sum(45)m =		1602.5895	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9231	21.7979	22.4935	19.6104	18.8166	16.2373	15.0463	17.2658	17.4720	20.3620	22.2267	24.1367	(46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8264	10.6719	11.7923	11.3812	11.7297	11.3156	11.6705	11.7089	11.3514	11.7625	11.4184	11.8154 (61)

Total heat required for water heating calculated for each month

	177.9806	155.9915	161.7491	142.1172	137.1739	119.5644	111.9790	126.8143	127.8315	147.5089	159.5962	172.7269 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	177.9806	155.9915	161.7491	142.1172	137.1739	119.5644	111.9790	126.8143	127.8315	147.5089	159.5962	172.7269 (64)

Total per year (kWh/year) = Sum(64)m = 1741.0336 (64)

Heat gains from water heating, kWh/month

	58.2029	50.9867	52.8087	46.3150	44.6426	38.8216	36.2702	41.1998	41.5675	48.0763	52.1237	56.4569 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.0131	22.2164	18.0676	13.6783	10.2247	8.6321	9.3273	12.1240	16.2728	20.6621	24.1157	25.7083	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	280.5706	283.4820	276.1453	260.5262	240.8099	222.2794	209.8999	206.9885	214.3252	229.9443	249.6605	268.1911	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	(71)

Water heating gains (Table 5)

	78.2297	75.8731	70.9795	64.3264	60.0035	53.9189	48.7503	55.3760	57.7326	64.6187	72.3941	75.8830	(72)

Total internal gains

	452.5433	450.3015	433.9223	407.2610	379.7682	353.5605	336.7075	343.2185	357.0607	383.9551	414.9003	438.5123	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
Northeast	2.0800	11.2829	0.7200	0.7000	0.7700	8.1969	(75)
East	8.8200	19.6403	0.7200	0.7000	0.7700	60.5034	(76)
Southeast	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(77)
South	2.2800	46.7521	0.7200	0.7000	0.7700	37.2305	(78)
West	12.2200	19.6403	0.7200	0.7000	0.7700	83.8267	(80)
Northwest	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(81)

Solar gains	224.8623	424.8208	676.1721	970.5877	1189.2876	1220.5334	1160.5171	994.6294	779.4702	496.6646	277.3353	187.0460 (83)
Total gains	677.4056	875.1224	1110.0944	1377.8486	1569.0558	1574.0939	1497.2246	1337.8479	1136.5309	880.6197	692.2356	625.5583 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7018	41.9114	42.1232	43.2150	43.4402	44.6023	44.6023	44.8423	44.1301	43.4402	42.9922	42.5532	
alpha	3.7801	3.7941	3.8082	3.8810	3.8960	3.9735	3.9735	3.9895	3.9420	3.8960	3.8661	3.8369	
util living area	0.9946	0.9856	0.9580	0.8746	0.7231	0.5367	0.4003	0.4609	0.7284	0.9418	0.9891	0.9960	(86)
MIT	19.2622	19.5396	19.9707	20.4882	20.8160	20.9587	20.9899	20.9829	20.8644	20.3656	19.7222	19.2373	(87)
Th 2	19.8626	19.8676	19.8727	19.8979	19.9030	19.9284	19.9284	19.9335	19.9182	19.9030	19.8928	19.8827	(88)
util rest of house	0.9931	0.9817	0.9469	0.8441	0.6652	0.4565	0.3061	0.3599	0.6492	0.9208	0.9856	0.9949	(89)
MIT 2	17.5542	17.9602	18.5820	19.3132	19.7267	19.8999	19.9241	19.9255	19.8077	19.1704	18.2446	17.5307	(90)
Living area fraction									fLA = Living area / (4) =			0.2190	(91)
MIT	17.9282	18.3061	18.8861	19.5705	19.9653	20.1317	20.1575	20.1571	20.0391	19.4322	18.5682	17.9044	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9282	18.3061	18.8861	19.5705	19.9653	20.1317	20.1575	20.1571	20.0391	19.4322	18.5682	17.9044	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9742	0.9343	0.8336	0.6687	0.4722	0.3266	0.3816	0.6589	0.9092	0.9794	0.9919	(94)
Useful gains	670.1233	852.5180	1037.1705	1148.6074	1049.3044	743.3349	488.9374	510.5654	748.9051	800.6475	678.0075	620.4848	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2019.7847	1976.9237	1817.3305	1526.0566	1175.9390	766.5209	492.9551	517.8242	831.7755	1256.5911	1648.6356	1990.4306	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1004.1480	755.6006	580.4391	271.7634	94.2161	0.0000	0.0000	0.0000	0.0000	339.2221	698.8522	1019.2396	(98)
Space heating												4763.4812	(98)
Space heating per m2											(98) / (4) =	40.8918	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5105.5532	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1004.1480	755.6006	580.4391	271.7634	94.2161	0.0000	0.0000	0.0000	0.0000	339.2221	698.8522	1019.2396	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1076.2573	809.8613	622.1212	291.2791	100.9819	0.0000	0.0000	0.0000	0.0000	363.5821	749.0377	1092.4326	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9806	155.9915	161.7491	142.1172	137.1739	119.5644	111.9790	126.8143	127.8315	147.5089	159.5962	172.7269	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7390	89.6629	89.4902	89.0306	88.1306	86.7000	86.7000	86.7000	86.7000	89.1778	89.6083	89.7599	(217)
Fuel for water heating, kWh/month													
	198.3314	173.9754	180.7451	159.6273	155.6484	137.9059	129.1569	146.2680	147.4412	165.4099	178.1043	192.4321	(219)
Water heating fuel used												1965.0460	(219)
Annual totals kWh/year													
Space heating fuel - main system												5105.5532	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												441.7386	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 853 * 1.00) =										-1938.0840		-1938.0840	(233)
Total delivered energy for all uses												5649.2539	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5105.5532	0.2160	1102.7995	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.0460	0.2160	424.4499	(264)
Space and water heating			1527.2494	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	441.7386	0.5190	229.2624	(268)
Energy saving/generation technologies				
PV Unit	-1938.0840	0.5190	-1005.8656	(269)
Total CO2, kg/year			789.5712	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.7800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.7800	ZC1
Total Floor Area	TFA	116.4900	
Assumed number of occupants	N	2.8487	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2725	ZC2
CO2 emissions from cooking, equation (L16)		1.6084	ZC3
Total CO2 emissions		22.6609	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.6609	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4200	(1b)	x 2.3900	(2b) =	142.0138	(1b) - (3b)
First floor	57.0700	(1c)	x 2.6300	(2c) =	150.0941	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		292.1079	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							4 * 10 =		40.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1369	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3869	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3289	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4193	0.4111	0.4029	0.3618	0.3536	0.3125	0.3125	0.3042	0.3289	0.3536	0.3700	0.3865	(22b)
Effective ac	0.5879	0.5845	0.5812	0.5654	0.5625	0.5488	0.5488	0.5463	0.5541	0.5625	0.5685	0.5747	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			26.9800	1.3258	35.7689			(27)
Ground floor			59.4200	0.1300	7.7246			(28a)
External Wall	154.8400	29.1200	125.7200	0.1800	22.6296			(29a)
Main Roof	57.0700		57.0700	0.1300	7.4191			(30)
Bay roof	2.3500		2.3500	0.1300	0.3055			(30)
Total net area of external elements Aum(A, m2)			273.6800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.4157			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0427	(36)
Total fabric heat loss (33) + (36) =	90.4584	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.6733	56.3441	56.0216	54.5063	54.2228	52.9031	52.9031	52.6587	53.4115	54.2228	54.7963	55.3959	(38)
Heat transfer coeff	147.1317	146.8026	146.4800	144.9648	144.6813	143.3616	143.3616	143.1172	143.8699	144.6813	145.2548	145.8544	(39)
Average = Sum(39)m / 12 =												144.9634	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2630	1.2602	1.2574	1.2444	1.2420	1.2307	1.2307	1.2286	1.2350	1.2420	1.2469	1.2521	(40)
HLP (average)												1.2444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8487 (42)
Average daily hot water use (litres/day)	101.8559 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.0415	107.9672	103.8930	99.8188	95.7445	91.6703	91.6703	95.7445	99.8188	103.8930	107.9672	112.0415	(44)
Energy conte	166.1542	145.3196	149.9568	130.7359	125.4443	108.2489	100.3085	115.1054	116.4802	135.7464	148.1778	160.9115	(45)
Energy content (annual)										Total = Sum(45)m =		1602.5895	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9231	21.7979	22.4935	19.6104	18.8166	16.2373	15.0463	17.2658	17.4720	20.3620	22.2267	24.1367	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2257	48.7904	45.2073	46.7142	48.7904	49.2257	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.1131	191.3470	200.9157	179.9616	174.2346	153.4561	147.0226	163.8958	165.7059	186.7053	197.4929	211.8704 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.1131	191.3470	200.9157	179.9616	174.2346	153.4561	147.0226	163.8958	165.7059	186.7053	197.4929	211.8704 (64)
								Total per year (kWh/year) = Sum(64)m =				2189.7211 (64)
Heat gains from water heating, kWh/month												
	67.9860	59.8256	62.6004	55.7761	53.9078	47.2946	45.0311	50.4701	51.0361	57.8754	61.5979	66.2428 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	142.4334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.0131	22.2164	18.0676	13.6783	10.2247	8.6321	9.3273	12.1240	16.2728	20.6621	24.1157	25.7083	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	280.5706	283.4820	276.1453	260.5262	240.8099	222.2794	209.8999	206.9885	214.3252	229.9443	249.6605	268.1911	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	37.2433	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	-113.9467	(71)
Water heating gains (Table 5)													
	91.3790	89.0262	84.1403	77.4668	72.4567	65.6869	60.5257	67.8362	70.8834	77.7895	85.5526	89.0360	(72)
Total internal gains													
	465.6927	463.4546	447.0831	420.4014	392.2214	365.3285	348.4829	355.6787	370.2115	397.1259	428.0589	451.6654	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9700	10.6334	0.6300	0.7000	0.7700	12.9013	(74)
Northeast	1.7400	11.2829	0.6300	0.7000	0.7700	5.9999	(75)
East	7.3900	19.6403	0.6300	0.7000	0.7700	44.3571	(76)
Southeast	0.8700	36.7938	0.6300	0.7000	0.7700	9.7829	(77)
South	1.9100	46.7521	0.6300	0.7000	0.7700	27.2902	(78)
West	10.2300	19.6403	0.6300	0.7000	0.7700	61.4037	(80)
Northwest	0.8700	11.2829	0.6300	0.7000	0.7700	2.9999	(81)

Solar gains	164.7351	311.2233	495.3531	711.0149	871.2021	894.0796	850.1205	728.6184	571.0209	363.8537	203.1767	137.0308 (83)
Total gains	630.4278	774.6779	942.4362	1131.4163	1263.4235	1259.4081	1198.6034	1084.2971	941.2324	760.9796	631.2356	588.6962 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9819	55.1052	55.2265	55.8038	55.9131	56.4278	56.4278	56.5242	56.2285	55.9131	55.6924	55.4634	
alpha	4.6655	4.6737	4.6818	4.7203	4.7275	4.7619	4.7619	4.7683	4.7486	4.7275	4.7128	4.6976	
util living area													
	0.9987	0.9963	0.9875	0.9512	0.8503	0.6763	0.5142	0.5837	0.8473	0.9799	0.9971	0.9991	(86)
MIT	19.5564	19.7420	20.0564	20.4628	20.7850	20.9478	20.9885	20.9798	20.8450	20.3982	19.8991	19.5261	(87)
Th 2	19.8699	19.8721	19.8743	19.8846	19.8865	19.8955	19.8955	19.8972	19.8921	19.8865	19.8826	19.8786	(88)
util rest of house													
	0.9982	0.9950	0.9829	0.9328	0.7977	0.5801	0.3913	0.4553	0.7723	0.9693	0.9959	0.9987	(89)
MIT 2	17.9475	18.2201	18.6782	19.2613	19.6815	19.8622	19.8916	19.8892	19.7683	19.1828	18.4576	17.9092	(90)
Living area fraction									fLA = Living area / (4) =			0.2190	(91)
MIT	18.2999	18.5534	18.9800	19.5244	19.9231	20.1000	20.1318	20.1281	20.0041	19.4490	18.7733	18.2632	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2999	18.5534	18.9800	19.5244	19.9231	20.1000	20.1318	20.1281	20.0041	19.4490	18.7733	18.2632	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9928	0.9777	0.9253	0.7997	0.5991	0.4184	0.4834	0.7811	0.9635	0.9940	0.9980	(94)
Useful gains	628.6798	769.0626	921.4196	1046.9126	1010.3797	754.4873	501.4593	524.1797	735.2272	733.1803	627.4593	587.5029	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2059.8220	2004.3550	1828.0701	1540.1587	1189.7351	788.4816	506.3229	533.5512	849.4209	1280.2780	1695.6040	2051.1853	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1064.7698	830.1164	674.5480	355.1372	133.4404	0.0000	0.0000	0.0000	0.0000	407.0407	769.0642	1088.9797	(98)
Space heating												5323.0963	(98)
Space heating per m2											(98) / (4) =	45.6957	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5699.2465	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1064.7698	830.1164	674.5480	355.1372	133.4404	0.0000	0.0000	0.0000	0.0000	407.0407	769.0642	1088.9797	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1140.0105	888.7756	722.2141	380.2325	142.8698	0.0000	0.0000	0.0000	0.0000	435.8037	823.4092	1165.9311	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.1131	191.3470	200.9157	179.9616	174.2346	153.4561	147.0226	163.8958	165.7059	186.7053	197.4929	211.8704	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5144	88.3191	87.8638	86.7312	84.3892	80.3000	80.3000	80.3000	80.3000	86.9606	88.1349	88.5853	(217)
Fuel for water heating, kWh/month													
	245.2858	216.6542	228.6673	207.4936	206.4656	191.1035	183.0917	204.1044	206.3585	214.7011	224.0801	239.1711	(219)
Water heating fuel used												2567.1769	(219)
Annual totals kWh/year													
Space heating fuel - main system												5699.2465	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												441.7386	(232)
Total delivered energy for all uses												8783.1621	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5699.2465	0.2160	1231.0373	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2567.1769	0.2160	554.5102	(264)
Space and water heating			1785.5475	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	441.7386	0.5190	229.2624	(268)
Total CO2, kg/m2/year			2053.7348	(272)
Emissions per m2 for space and water heating			15.3279	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9681	(272b)
Emissions per m2 for pumps and fans			0.3341	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3279 * 1.00) + 1.9681 + 0.3341, rounded to 2 d.p.			17.6300	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 109 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 109	**Prop Type Ref**	Opp
Property	Type 4S - Det SG, Plot 109, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.78	**TER**	17.63
Environmental	95 A	**% DER<TER**	61.54		
CO_2 Emissions (t/year)	0.31	**DFEE**	45.72	**TFEE**	59.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.63		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	31.43 m	59.42 m²	2.39 m
1st Storey:	30.43 m	57.07 m²	2.63 m

7.0 Living Area	25.51	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	154.84	120.47

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	57.07	57.07
Bay roof	External Flat Roof	0.16	2.35	2.35

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	59.42

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.44	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.14	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100

W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
D3 W20	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		5.23	100
W14*	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.04	100
W15*	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		2.28	100
W16*	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.04	100
W17*	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.04	100
W19*	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.04	100
W18*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		2.28	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	24.05	0.065	No
Independently assessed	E3 Sill	19.52	0.004	No
Independently assessed	E4 Jamb	56.10	0.005	No
Independently assessed	E5 Ground floor (normal)	31.43	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.43	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.00	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.42	0.051	No
Independently assessed	E14 Flat roof	6.10	0.029	No
Independently assessed	E16 Corner (normal)	28.62	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.54	-0.092	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		

As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	13	
Total number of L.E.L. fittings	13	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	

Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 109 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 109	**Prop Type Ref**	Opp
Property	Type 4S - Det SG, Plot 109, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.78	**TER**	17.63
Environmental	95 A	**% DER<TER**	61.54		
CO_2 Emissions (t/year)	0.31	**DFEE**	45.72	**TFEE**	59.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.63		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	116.49	m^2	
DER	6.78	$kgCO_2/yr/m^2$	
TER	17.63	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.78	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.54	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	116.49	m^2	
DER	17.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.27	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.61	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.49	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.49	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.98	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.27	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.61	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.86	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.86	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 110 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 110	**Prop Type Ref**	Opp
Property	Type 3 - Semi SG, Plot 110, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.15	**TER**	17.16
Environmental	95 A	**% DER<TER**	58.34		
CO_2 Emissions (t/year)	0.30	**DFEE**	36.50	**TFEE**	48.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.15 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.02 m², No overhang
Windows facing East: 1.55 m², No overhang
Windows facing South: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2300	1.2357	16.3489			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.2100	17.1108			(29a)
Main Roof	46.6300		46.6300	0.0700	3.2641			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.9957			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5688	(36)
Total fabric heat loss	(33) + (36) = 50.5644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	99.4416	98.8619	98.2822	95.3836	94.8039	91.9054	91.9054	91.3256	93.0648	94.8039	95.9633	97.1228	(39)

Average = Sum(39)m / 12 = 95.2387 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0663	1.0601	1.0539	1.0228	1.0166	0.9855	0.9855	0.9793	0.9979	1.0166	1.0290	1.0414	(40)
HLP (average)												1.0212	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.8116   10.6590   11.7776   11.3586   11.7088   11.2984   11.6546   11.6898   11.3312   11.7491   11.4052   11.8011 (61)
Total heat required for water heating calculated for each month
   170.9572  149.8488  155.4089  136.5799  131.8616  114.9811  107.7319  121.9399  122.8980  141.7695  153.3327  165.9251 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
   170.9572  149.8488  155.4089  136.5799  131.8616  114.9811  107.7319  121.9399  122.8980  141.7695  153.3327  165.9251 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m = 1673.2347 (64)
Heat gains from water heating, kWh/month
    55.8688   48.9453   50.7018   44.4757   42.8780   37.2991   34.8594   39.5806   39.9288   46.1691   50.0422   54.1965 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m     133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883  133.3883 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    23.3605   20.7485   16.8739   12.7746    9.5492    8.0618    8.7111   11.3230   15.1977   19.2969   22.5224   24.0097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   244.9491  247.4909  241.0856  227.4496  210.2365  194.0587  183.2509  180.7090  187.1143  200.7504  217.9634  234.1413 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388   36.3388 (69)
Pumps, fans    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
  -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 (71)
Water heating gains (Table 5)
    75.0925   72.8353   68.1476   61.7719   57.6317   51.8043   46.8540   53.1997   55.4566   62.0552   69.5030   72.8448 (72)
Total internal gains
   409.4185  407.0913  392.1236  368.0125  343.4339  319.9412  304.8324  311.2482  323.7851  348.1190  376.0053  397.0123 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area      Solar flux          g              FF          Access          Gains
                                     m2         Table 6a    Specific data  Specific data      factor              W
                                                   W/m2    or Table 6b    or Table 6c    Table 6d
-------------------------------------------------------------------------------------------------------------------
North                              4.0200       10.6334        0.7200         0.7000        0.7700        14.9301 (74)
East                               1.5500       19.6403        0.7200         0.7000        0.7700        10.6327 (76)
South                              7.6600       46.7521        0.7200         0.7000        0.7700       125.0816 (78)
-------------------------------------------------------------------------------------------------------------------

Solar gains 150.6443  254.1833  343.6816  422.7577  473.4603  470.7424  453.4980  415.0783  370.7186  279.5959  179.9402  129.2722 (83)
Total gains 560.0629  661.2746  735.8052  790.7703  816.8942  790.6836  758.3304  726.3265  694.5037  627.7149  555.9455  526.2845 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau         49.2364   49.5251   49.8173   51.3311   51.6450   53.2738   53.2738   53.6120   52.6101   51.6450   51.0210   50.4120
alpha        4.2824    4.3017    4.3212    4.4221    4.4430    4.5516    4.5516    4.5741    4.5073    4.4430    4.4014    4.3608
util living area
    0.9937    0.9865    0.9714    0.9321    0.8460    0.6825    0.5186    0.5575    0.7850    0.9466    0.9875    0.9951 (86)

MIT         19.5958   19.8037   20.0940   20.4643   20.7548   20.9370   20.9856   20.9803   20.8747   20.4960   19.9932   19.5829 (87)
Th 2        20.0285   20.0336   20.0387   20.0644   20.0696   20.0955   20.0955   20.1007   20.0851   20.0696   20.0592   20.0490 (88)
util rest of house
    0.9921    0.9831    0.9639    0.9138    0.8042    0.6060    0.4187    0.4577    0.7185    0.9284    0.9838    0.9939 (89)
MIT 2       18.1501   18.4555   18.8780   19.4204   19.8123   20.0464   20.0883   20.0901   19.9753   19.4761   18.7504   18.1452 (90)
Living area fraction                                                                 fLA = Living area / (4) =    0.2586 (91)
MIT         18.5240   18.8042   19.1925   19.6904   20.0561   20.2767   20.3204   20.3204   20.2079   19.7399   19.0718   18.5170 (92)
Temperature adjustment                                                                                        0.0000
adjusted MIT 18.5240  18.8042   19.1925   19.6904   20.0561   20.2767   20.3204   20.3204   20.2079   19.7399   19.0718   18.5170 (93)


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8. Space heating requirement
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              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation  0.9885    0.9772    0.9554    0.9050    0.8035    0.6223    0.4442    0.4829    0.7283    0.9204    0.9784    0.9910 (94)
Useful gains 553.6134  646.2253  702.9927  715.6558  656.3979  492.0203  336.8628  350.7466  505.8288  577.7768  543.9509  521.5311 (95)
Ext temp.     4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
 1414.4583 1374.5954 1247.4461 1029.2241  792.1908  521.7206  341.9247  358.0286  568.4322  866.4972 1148.8545 1390.5094 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   640.4686  489.4647  405.0733  225.7692  101.0299    0.0000    0.0000    0.0000    0.0000  214.8080  435.5307  646.5199 (98)
Space heating                                                                                              3158.6642 (98)
Space heating per m2                                                                                 (98) / (4) =   33.8694 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		93.3000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		3385.4922 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	640.4686	489.4647	405.0733	225.7692	101.0299	0.0000	0.0000	0.0000	0.0000	214.8080	435.5307	646.5199	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	686.4615	524.6138	434.1622	241.9820	108.2850	0.0000	0.0000	0.0000	0.0000	230.2336	466.8067	692.9473	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5169	89.4296	89.2722	88.9085	88.2258	86.7000	86.7000	86.7000	86.7000	88.8335	89.3341	89.5407	(217)
Fuel for water heating, kWh/month													
	190.9776	167.5605	174.0844	153.6185	149.4592	132.6195	124.2582	140.6458	141.7509	159.5902	171.6395	185.3069	(219)
Water heating fuel used												1891.5114	(219)
Annual totals kWh/year													
Space heating fuel - main system												3385.4922	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =										-1399.0639		-1399.0639	(233)
Total delivered energy for all uses												4365.4926	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3385.4922	0.2160	731.2663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1891.5114	0.2160	408.5665	(264)
Space and water heating			1139.8328	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			666.7586	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1500	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		24.6767	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.6767	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.2300	1.3258	17.5398			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.1800	14.6664			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8980			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.9321	(36)
Total fabric heat loss (33) + (36) =	56.8301	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	101.9410	101.6891	101.4421	100.2824	100.0654	99.0552	99.0552	98.8682	99.4443	100.0654	100.5043	100.9633	(39)
Average = Sum(39)m / 12 =												100.2813	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0931	1.0904	1.0877	1.0753	1.0730	1.0621	1.0621	1.0601	1.0663	1.0730	1.0777	1.0826	(40)
HLP (average)												1.0753	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3605	20.7485	16.8739	12.7746	9.5492	8.0618	8.7111	11.3230	15.1977	19.2969	22.5224	24.0097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5729	420.2491	405.2055	380.4398	355.2025	331.0530	315.9510	323.0233	336.2219	361.2105	389.1684	410.1701	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0200	10.6334	0.6300	0.7000	0.7700	13.0638	(74)
East	1.5500	19.6403	0.6300	0.7000	0.7700	9.3036	(76)
South	7.6600	46.7521	0.6300	0.7000	0.7700	109.4464	(78)

Solar gains	131.8138	222.4104	300.7214	369.9130	414.2778	411.8996	396.8108	363.1935	324.3788	244.6464	157.4477	113.1132	(83)
Total gains	554.3866	642.6595	705.9270	750.3528	769.4803	742.9526	712.7618	686.2168	660.6007	605.8569	546.6161	523.2833	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5308	63.6882	63.8432	64.5815	64.7216	65.3816	65.3816	65.5053	65.1258	64.7216	64.4389	64.1460	
alpha	5.2354	5.2459	5.2562	5.3054	5.3148	5.3588	5.3588	5.3670	5.3417	5.3148	5.2959	5.2764	
util living area													
	0.9981	0.9955	0.9889	0.9687	0.9098	0.7691	0.5937	0.6362	0.8579	0.9756	0.9958	0.9986	(86)
MIT	19.8307	19.9845	20.2128	20.5033	20.7646	20.9360	20.9870	20.9814	20.8778	20.5408	20.1298	19.8034	(87)
Th 2	20.0065	20.0087	20.0109	20.0211	20.0230	20.0319	20.0319	20.0335	20.0284	20.0230	20.0191	20.0151	(88)
util rest of house													
	0.9975	0.9940	0.9849	0.9565	0.8730	0.6835	0.4722	0.5156	0.7908	0.9637	0.9940	0.9981	(89)
MIT 2	18.4443	18.6702	19.0034	19.4266	19.7820	19.9866	20.0268	20.0254	19.9278	19.4859	18.8906	18.4106	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8029	19.0101	19.3162	19.7050	20.0361	20.2321	20.2751	20.2727	20.1735	19.7587	19.2111	18.7709	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8029	19.0101	19.3162	19.7050	20.0361	20.2321	20.2751	20.2727	20.1735	19.7587	19.2111	18.7709	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9918	0.9811	0.9514	0.8735	0.7028	0.5038	0.5469	0.8023	0.9595	0.9920	0.9972	(94)
Useful gains	552.3428	637.3751	692.6140	713.9177	672.1763	522.1770	359.1076	375.3110	529.9859	581.2986	542.2481	521.8384	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1478.4380	1434.8479	1300.1049	1083.5552	834.1536	557.8919	364.0407	382.8839	603.9785	916.4698	1217.2154	1471.1211	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	689.0148	535.9017	451.9733	266.1389	120.5111	0.0000	0.0000	0.0000	0.0000	249.3674	485.9764	706.2663	(98)
Space heating												3505.1500	(98)
Space heating per m2											(98) / (4) =	37.5847	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3752.8373	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	689.0148	535.9017	451.9733	266.1389	120.5111	0.0000	0.0000	0.0000	0.0000	249.3674	485.9764	706.2663	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	737.7033	573.7706	483.9114	284.9453	129.0269	0.0000	0.0000	0.0000	0.0000	266.9886	520.3174	756.1738	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8189	87.5710	87.1056	86.1411	84.2469	80.3000	80.3000	80.3000	80.3000	85.8619	87.2992	87.9117	(217)
Fuel for water heating, kWh/month													
	239.2476	211.5052	223.1094	200.1026	198.0906	183.0424	175.3686	195.4949	197.6539	210.4890	219.0655	233.2827	(219)
Water heating fuel used												2486.4525	(219)
Annual totals kWh/year													
Space heating fuel - main system												3752.8373	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Total delivered energy for all uses												6726.8428	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3752.8373	0.2160	810.6129	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2486.4525	0.2160	537.0737	(264)
Space and water heating			1347.6866	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Total CO2, kg/m2/year			1600.7266	(272)
Emissions per m2 for space and water heating			14.4509	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2959	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4509 * 1.00) + 2.2959 + 0.4174, rounded to 2 d.p.			17.1600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 110 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 110	**Prop Type Ref**	Opp
Property	Type 3 - Semi SG, Plot 110, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.15	**TER**	17.16
Environmental	95 A	**% DER<TER**	58.34		
CO_2 Emissions (t/year)	0.30	**DFEE**	36.50	**TFEE**	48.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.85	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.63	46.63

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	46.63

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.065	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 110 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 110	**Prop Type Ref**	Opp
Property	Type 3 - Semi SG, Plot 110, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.15	**TER**	17.16
Environmental	95 A	**% DER<TER**	58.34		
CO_2 Emissions (t/year)	0.30	**DFEE**	36.50	**TFEE**	48.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.15	$kgCO_2/yr/m^2$	
TER	17.16	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.15	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.34	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	36.50	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.67	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.67	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.88	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.88	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	22	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 111 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 111	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 111, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.99 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.79 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.55 m², No overhang
Windows facing South: 7.47 m², No overhang
Windows facing West: 7.88 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1692.5948 (64)
Heat gains from water heating, kWh/month
               56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
               75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
              418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)
```

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6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2         Table 6a      Specific data  Specific data      factor              W
                                                         W/m2      or Table 6b    or Table 6c    Table 6d
-----------------------------------------------------------------------------------------------------------------------------
North                                   4.5500          10.6334           0.7200         0.7000          0.7700     16.8985 (74)
South                                   7.4700          46.7521           0.7200         0.7000          0.7700    121.9790 (78)
West                                    7.8800          19.6403           0.7200         0.7000          0.7700     54.0552 (80)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains   192.9327  337.8074  483.4912  629.7309  729.7040  734.1687  703.8345  628.4027  534.3405  379.3859  232.8336  163.9408 (83)
Total gains   611.3037  753.9827  884.5462 1006.2726 1081.1498 1061.5659 1015.6896  946.5938  865.1910  734.9755  616.8677  569.5065 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha         4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
               0.9926    0.9824    0.9578    0.8923    0.7678    0.5863    0.4367    0.4833    0.7272    0.9310    0.9851    0.9944 (86)

MIT           19.5181   19.7680   20.1159   20.5321   20.8164   20.9586   20.9907   20.9860   20.8944   20.4987   19.9407   19.4962 (87)
Th 2          19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
               0.9908    0.9780    0.9473    0.8664    0.7167    0.5099    0.3454    0.3889    0.6543    0.9085    0.9807    0.9930 (89)
MIT 2         18.0046   18.3699   18.8721   19.4681   19.8359   20.0138   20.0399   20.0422   19.9458   19.4393   18.6400   17.9859 (90)
Living area fraction                                                                          fLA = Living area / (4) =     0.1928 (91)
MIT           18.2964   18.6395   19.1119   19.6733   20.0249   20.1959   20.2232   20.2241   20.1287   19.6436   18.8908   18.2771 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.2964   18.6395   19.1119   19.6733   20.0249   20.1959   20.2232   20.2241   20.1287   19.6436   18.8908   18.2771 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9862    0.9701    0.9356    0.8560    0.7170    0.5225    0.3628    0.4067    0.6621    0.8978    0.9737    0.9894 (94)
Useful gains 602.8834  731.4298  827.5821  861.3439  775.2175  554.6708  368.4804  384.9516  572.8349  659.8632  600.6578  563.4525 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1544.0913 1507.5288 1376.2678 1143.4067  878.5748  573.8318  371.5392  389.8566  625.4243  954.4171 1258.4507 1519.3150 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              700.2587  521.5385  408.2221  203.0852   76.8979    0.0000    0.0000    0.0000    0.0000  219.1481  473.6109  711.1617 (98)
Space heating                                                                                                            3313.9230 (98)
Space heating per m2                                                                                    (98) / (4) =     33.8432 (99)
```

8c. Space cooling requirement

```
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3551.9004	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.2587	521.5385	408.2221	203.0852	76.8979	0.0000	0.0000	0.0000	0.0000	219.1481	473.6109	711.1617	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	750.5452	558.9909	437.5371	217.6690	82.4200	0.0000	0.0000	0.0000	0.0000	234.8854	507.6215	762.2312	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5634	89.4634	89.2694	88.8070	87.9827	86.7000	86.7000	86.7000	86.7000	88.8409	89.3843	89.5896	(217)
Fuel for water heating, kWh/month													
	193.1176	169.4578	176.1190	155.5742	151.5961	134.1289	125.6569	142.2510	143.3756	161.4226	173.5440	187.3735	(219)
Water heating fuel used												1913.6171	(219)
Annual totals kWh/year													
Space heating fuel - main system												3551.9004	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 853 * 1.00) =										-1658.2902		-1658.2902	(233)
Total delivered energy for all uses												4282.6024	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3551.9004	0.2160	767.2105	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1913.6171	0.2160	413.3413	(264)
Space and water heating			1180.5518	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1658.2902	0.5190	-860.6526	(269)
Total CO2, kg/year			566.6189	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.7900	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		22.9777	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9777	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5500	10.6334	0.6300	0.7000	0.7700	14.7861	(74)
South	7.4700	46.7521	0.6300	0.7000	0.7700	106.7317	(78)
West	7.8800	19.6403	0.6300	0.7000	0.7700	47.2983	(80)

Solar gains	168.8161	295.5815	423.0548	551.0146	638.4910	642.3976	615.8552	549.8524	467.5480	331.9627	203.7294	143.4482	(83)
Total gains	600.3400	724.9132	837.2738	940.1872	1001.9009	981.0940	939.0165	880.0142	811.0392	700.7260	600.9253	562.1704	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9978	0.9940	0.9830	0.9466	0.8525	0.6823	0.5142	0.5669	0.8144	0.9683	0.9950	0.9984	(86)
MIT	19.7419	19.9272	20.2033	20.5421	20.8129	20.9557	20.9913	20.9860	20.8910	20.5256	20.0646	19.7084	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9971	0.9920	0.9771	0.9274	0.8022	0.5907	0.3985	0.4480	0.7368	0.9530	0.9929	0.9979	(89)
MIT 2	18.2692	18.5407	18.9416	19.4261	19.7787	19.9382	19.9638	19.9629	19.8789	19.4136	18.7491	18.2261	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.5531	18.8080	19.1848	19.6413	19.9781	20.1344	20.1619	20.1602	20.0741	19.6280	19.0027	18.5119	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5531	18.8080	19.1848	19.6413	19.9781	20.1344	20.1619	20.1602	20.0741	19.6280	19.0027	18.5119	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9889	0.9712	0.9202	0.8032	0.6065	0.4208	0.4709	0.7462	0.9466	0.9902	0.9967	(94)
Useful gains	597.6727	716.8661	813.1932	865.1503	804.7655	595.0341	395.1826	414.4211	605.1699	663.3183	595.0303	560.3316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1635.2153	1592.0618	1448.8612	1214.2091	933.9372	618.7085	398.1992	419.6506	670.2267	1018.5445	1348.1838	1627.7375	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	771.9317	588.1315	472.9371	251.3224	96.1037	0.0000	0.0000	0.0000	0.0000	264.2883	542.2706	794.1500	(98)
Space heating												3781.1353	(98)
Space heating per m2											(98) / (4) =	38.6145	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4048.3247	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	771.9317	588.1315	472.9371	251.3224	96.1037	0.0000	0.0000	0.0000	0.0000	264.2883	542.2706	794.1500	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	826.4794	629.6911	506.3566	269.0817	102.8948	0.0000	0.0000	0.0000	0.0000	282.9639	580.5895	850.2677	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0139	87.7380	87.1824	85.9683	83.6898	80.3000	80.3000	80.3000	80.3000	85.9809	87.5105	88.1084	(217)
Fuel for water heating, kWh/month													
	240.9912	213.0973	225.2705	203.0260	201.9166	185.3441	177.5738	197.9532	200.1393	212.3892	220.5760	234.9615	(219)
Water heating fuel used												2513.2387	(219)
Annual totals kWh/year													
Space heating fuel - main system												4048.3247	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												7036.9386	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4048.3247	0.2160	874.4381	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.2387	0.2160	542.8596	(264)
Space and water heating			1417.2977	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1664.0174	(272)
Emissions per m2 for space and water heating			14.4740	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4740 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			16.9900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 111 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 111	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 111, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 111 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 111	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 111, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	5.79	$kgCO_2/yr/m^2$	
TER	16.99	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.79	$kgCO_2/yr/m^2$	
Reduction DER/TER	65.93	%	
CfSH ENE1 credits achieved	6.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.79	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	16.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.03	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.22	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.22	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 112 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 112	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 112, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing East: 7.85 m², No overhang
Windows facing West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.7955    10.6404    11.7492    11.3349    11.6870    11.2803    11.6379    11.6697    11.3100    11.7235    11.3863    11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                              Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (64)
                                                                                                Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031    46.7002    48.3828    42.4542    40.9385    35.6256    33.3086    37.8009    38.1276    44.0698    47.7529    51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051    17.9460    14.5947    11.0491     8.2593     6.9729     7.5344     9.7935    13.1449    16.6904    19.4802    20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080   222.3921   216.6364   204.3832   188.9158   174.3786   164.6668   162.3828   168.1385   180.3916   195.8591   210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562 (71)
Water heating gains (Table 5)
               71.6439    69.4944    65.0306    58.9641    55.0249    49.4801    44.7697    50.8077    52.9551    59.2336    66.3235    69.5050 (72)
Total internal gains
              374.9906   372.8660   359.2952   337.4300   315.2335   293.8651   280.0045   286.0176   297.2720   319.3492   344.6963   363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                    2.4400           10.6334           0.7200           0.7000           0.7700           9.0620 (74)
East                                     7.8500           19.6403           0.7200           0.7000           0.7700          53.8494 (76)
West                                     3.4900           19.6403           0.7200           0.7000           0.7700          23.9407 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    86.8521   169.4919   280.0362   412.7660   511.6058   526.7029   500.1875   425.4780   326.8497   201.1819   108.1742    71.5253 (83)
Total gains   461.8427   542.3579   639.3314   750.1960   826.8394   820.5679   780.1920   711.4956   624.1216   520.5311   452.8706   435.2268 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            48.1295    48.4082    48.6902    50.1507    50.4534    52.0234    52.0234    52.3492    51.3838    50.4534    49.8517    49.2641
alpha           4.2086     4.2272     4.2460     4.3434     4.3636     4.4682     4.4682     4.4899     4.4256     4.3636     4.3234     4.2843
util living area
                0.9955     0.9906     0.9754     0.9239     0.8073     0.6226     0.4694     0.5287     0.7944     0.9607     0.9916     0.9965 (86)

MIT            19.4960    19.6919    20.0274    20.4723    20.7919    20.9535    20.9895    20.9828    20.8613    20.4179    19.8935    19.4877 (87)
Th 2           19.9661    19.9714    19.9767    20.0035    20.0089    20.0359    20.0359    20.0413    20.0251    20.0089    19.9982    19.9874 (88)
util rest of house
                0.9943     0.9881     0.9685     0.9028     0.7581     0.5429     0.3711     0.4262     0.7247     0.9457     0.9889     0.9956 (89)
MIT 2          17.9569    18.2456    18.7343    19.3798    19.7998    20.0022    20.0312    20.0328    19.9061    19.3204    18.5588    17.9591 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.2505 (91)
MIT            18.3425    18.6079    19.0582    19.6535    20.0483    20.2405    20.2712    20.2708    20.1453    19.5953    18.8931    18.3420 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   18.3425    18.6079    19.0582    19.6535    20.0483    20.2405    20.2712    20.2708    20.1453    19.5953    18.8931    18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9914     0.9832     0.9603     0.8940     0.7603     0.5606     0.3956     0.4515     0.7343     0.9376     0.9846     0.9933 (94)
Useful gains  457.8800   533.2649   613.9782   670.6461   628.6207   459.9766   308.6189   321.2092   458.3082   488.0386   445.8838   432.2903 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1288.8976  1250.9424  1139.3897   947.2366   730.9637   478.9648   311.7449   326.6449   519.7337   787.6117  1045.0449  1268.1402 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              618.2771   482.2793   390.9061   199.1452    76.1432     0.0000     0.0000     0.0000     0.0000   222.8824   431.3960   621.8723 (98)
Space heating                                                                                                                 3042.9015 (98)
Space heating per m2                                                                                                 (98) / (4) =     37.8847 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3261.4164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2771	482.2793	390.9061	199.1452	76.1432	0.0000	0.0000	0.0000	0.0000	222.8824	431.3960	621.8723	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6764	516.9124	418.9776	213.4460	81.6111	0.0000	0.0000	0.0000	0.0000	238.8878	462.3752	666.5298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5236	89.4502	89.2798	88.8397	88.0217	86.7000	86.7000	86.7000	86.7000	88.9046	89.3597	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3393	159.9683	166.2496	146.8871	143.1728	126.8093	118.8742	134.4666	135.4969	152.3537	163.8803	176.9481	(219)
Water heating fuel used												1807.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.4164	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4324.1122	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3261.4164	0.2160	704.4660	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.4463	0.2160	390.4084	(264)
Space and water heating			1094.8744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			708.3488	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.2783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.2783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
East	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(76)
West	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(80)

Solar gains	75.9956	148.3054	245.0317	361.1702	447.6551	460.8650	437.6640	372.2932	285.9935	176.0342	94.6525	62.5847	(83)
Total gains	464.1460	534.0634	616.5935	710.2432	773.9044	765.1203	728.0650	669.3324	594.9171	507.6587	452.2457	439.4493	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9963	0.9891	0.9600	0.8735	0.7056	0.5382	0.6021	0.8588	0.9804	0.9966	0.9987	(86)
MIT	19.7135	19.8631	20.1320	20.4918	20.7893	20.9495	20.9896	20.9822	20.8592	20.4622	20.0243	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9977	0.9950	0.9851	0.9447	0.8271	0.6142	0.4189	0.4791	0.7894	0.9703	0.9952	0.9983	(89)
MIT 2	18.2296	18.4497	18.8421	19.3625	19.7568	19.9397	19.9693	19.9676	19.8541	19.3304	18.6937	18.2013	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9929	0.9810	0.9388	0.8298	0.6350	0.4490	0.5100	0.8001	0.9656	0.9933	0.9974	(94)
Useful gains	462.5800	530.2900	604.8527	666.8002	642.1961	485.8866	326.9040	341.3760	476.0031	490.1916	449.1967	438.3133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.1684	1301.5015	1182.5697	991.3737	765.4586	509.4043	330.1730	347.4198	549.2871	829.7509	1102.9297	1335.5398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating												3318.7460	(98)
Space heating per m2											(98) / (4) =	41.3190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3553.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.6572	554.8759	460.1943	250.2066	98.1877	0.0000	0.0000	0.0000	0.0000	270.4841	503.9484	714.7072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7915	87.5866	87.1042	85.9419	83.7243	80.3000	80.3000	80.3000	80.3000	86.0179	87.3183	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5462	202.9369	212.3119	190.8567	189.6773	174.1812	166.8789	186.0308	188.0853	199.9358	210.2491	224.8887	(219)
Water heating fuel used												2376.5789	(219)
Annual totals kWh/year													
Space heating fuel - main system												3553.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6361.6687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.2613	0.2160	767.5044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.5789	0.2160	513.3410	(264)
Space and water heating			1280.8455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1504.9645	(272)
Emissions per m2 for space and water heating			15.9468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9468 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 112 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 112	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 112, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 112 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 112	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 112, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.82	$kgCO_2/yr/m^2$	
TER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.82	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.93	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 113 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 113	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 113, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.85 m², No overhang
Windows facing South: 2.44 m², No overhang
Windows facing West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)
```

---

6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                          m2          Table 6a     Specific data  Specific data      factor              W
                                                         W/m2     or Table 6b    or Table 6c     Table 6d
-----------------------------------------------------------------------------------------------------------------------------
East                                    7.8500          19.6403          0.7200         0.7000          0.7700      53.8494 (76)
South                                   2.4400          46.7521          0.7200         0.7000          0.7700      39.8432 (78)
West                                    3.4900          19.6403          0.7200         0.7000          0.7700      23.9407 (80)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains   117.6333  217.4268  333.7293  459.4422  545.8272  552.7488  528.5966  464.3804  378.2976  250.9485  144.2229   98.3990 (83)
Total gains   492.6239  590.2928  693.0245  796.8722  861.0607  846.6139  808.6011  750.3980  675.5696  570.2977  488.9192  462.1005 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
               0.9943    0.9872    0.9678    0.9095    0.7902    0.6071    0.4541    0.5040    0.7591    0.9472    0.9888    0.9956 (86)

MIT           19.5381   19.7557   20.0935   20.5171   20.8101   20.9579   20.9907   20.9857   20.8855   20.4748   19.9421   19.5249 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
               0.9927    0.9838    0.9590    0.8857    0.7393    0.5281    0.3584    0.4051    0.6862    0.9282    0.9853    0.9944 (89)
MIT 2         18.0182   18.3378   18.8278   19.4388   19.8202   20.0056   20.0318   20.0344   19.9295   19.3974   18.6289   18.0132 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9893    0.9780    0.9499    0.8774    0.7427    0.5459    0.3822    0.4296    0.6980    0.9199    0.9801    0.9917 (94)
Useful gains 487.3517  577.2789  658.2806  699.1442  639.4800  462.1516  309.0856  322.3433  471.5342  524.6284  479.1864  458.2461 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1294.0794 1258.7105 1147.2507  952.1204  732.6977  479.2780  311.8119  326.8063  521.7677  793.9105 1050.7841 1272.6141 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.2054  457.9220  363.7938  182.1429   69.3539    0.0000    0.0000    0.0000    0.0000  200.3459  411.5503  605.8898 (98)
Space heating                                                                                                       2891.2040 (98)
Space heating per m2                                                                                  (98) / (4) =     35.9961 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3098.8253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.2054	457.9220	363.7938	182.1429	69.3539	0.0000	0.0000	0.0000	0.0000	200.3459	411.5503	605.8898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	643.3070	490.8061	389.9183	195.2228	74.3343	0.0000	0.0000	0.0000	0.0000	214.7330	441.1043	649.3995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5054	89.4160	89.2264	88.7616	87.9446	86.7000	86.7000	86.7000	86.7000	88.8125	89.3266	89.5294	(217)
Fuel for water heating, kWh/month													
	182.3764	160.0293	166.3490	147.0163	143.2983	126.8093	118.8742	134.4666	135.4969	152.5117	163.9410	176.9790	(219)
Water heating fuel used												1808.1482	(219)
Annual totals kWh/year													
Space heating fuel - main system												3098.8253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4162.2229	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3098.8253	0.2160	669.3463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.1482	0.2160	390.5600	(264)
Space and water heating			1059.9063	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			673.3807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.8383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(76)
South	2.4400	46.7521	0.6300	0.7000	0.7700	34.8628	(78)
West	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(80)

Solar gains	102.9291	190.2484	292.0132	402.0119	477.5988	483.6552	462.5220	406.3329	331.0104	219.5800	126.1950	86.0991	(83)
Total gains	491.0795	576.0064	663.5750	751.0849	803.8481	787.9105	752.9230	703.3721	639.9340	551.2044	483.7882	462.9638	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9978	0.9948	0.9852	0.9509	0.8595	0.6903	0.5220	0.5767	0.8293	0.9728	0.9954	0.9984	(86)
MIT	19.7446	19.9109	20.1832	20.5297	20.8068	20.9542	20.9909	20.9853	20.8824	20.5072	20.0603	19.7169	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9971	0.9930	0.9799	0.9330	0.8106	0.5990	0.4055	0.4571	0.7542	0.9594	0.9935	0.9978	(89)
MIT 2	18.2749	18.5190	18.9153	19.4135	19.7764	19.9432	19.9698	19.9690	19.8764	19.3925	18.7461	18.2411	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9904	0.9751	0.9272	0.8144	0.6201	0.4349	0.4872	0.7673	0.9544	0.9911	0.9968	(94)
Useful gains	488.9803	570.4956	647.0245	696.4335	654.6313	488.5754	327.4087	342.6570	491.0411	526.0650	479.4989	461.4677	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.0865	1307.4866	1188.8912	995.7770	767.2138	509.7518	330.2392	347.5855	551.3441	835.0772	1107.3942	1338.9447	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating												3170.2151	(98)
Space heating per m2											(98) / (4) =	39.4698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3394.2346	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	682.7484	530.2548	431.6369	230.7573	89.6803	0.0000	0.0000	0.0000	0.0000	246.1511	484.0306	698.9753	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7411	87.4935	86.9604	85.7396	83.5223	80.3000	80.3000	80.3000	80.3000	85.7828	87.2313	87.8329	(217)
Fuel for water heating, kWh/month													
	230.6787	203.1527	212.6630	191.3072	190.1361	174.1812	166.8789	186.0308	188.0853	200.4839	210.4588	224.9973	(219)
Water heating fuel used												2379.0539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3394.2346	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6205.1170	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3394.2346	0.2160	733.1547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.0539	0.2160	513.8756	(264)
Space and water heating			1247.0303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1471.1493	(272)
Emissions per m2 for space and water heating			15.5258	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5258 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 113 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 113	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 113, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 113 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 113	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 113, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.38	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.25	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.13	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 114 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 114	**Prop Type Ref**	As
Property	Type 4S - Det SG, Plot 114, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.61	**TER**	17.56
Environmental	95 A	**% DER<TER**	62.37		
CO_2 Emissions (t/year)	0.29	**DFEE**	44.87	**TFEE**	58.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 114 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.61 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 12.22 m², No overhang
Windows facing South East: 1.50 m², No overhang
Windows facing South West: 8.98 m², No overhang
Windows facing North West: 4.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	57.0700 (1b)	x	2.3900 (2b)	=	136.3973	(1b) - (3b)
First floor	57.0700 (1c)	x	2.6300 (2c)	=	150.0941	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	286.4914	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3646	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3099	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3952	0.3874	0.3797	0.3409	0.3332	0.2944	0.2944	0.2867	0.3099	0.3332	0.3487	0.3642	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6452	0.6374	0.6297	0.5909	0.5832	0.5444	0.5444	0.5367	0.5599	0.5832	0.5987	0.6142	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.6400	1.2357	34.1559			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			57.0700	0.1300	7.4191			(28a)
External Wall	152.4400	29.7800	122.6600	0.2100	25.7586			(29a)
Main Roof	57.0700		57.0700	0.0700	3.9949			(30)
Total net area of external elements Aum(A, m2)			266.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.5385			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9085	(36)
Total fabric heat loss					(33) + (36) =		80.4470	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.9946	60.2620	59.5295	55.8668	55.1343	51.4717	51.4717	50.7391	52.9367	55.1343	56.5994	58.0644	(38)
Heat transfer coeff	141.4415	140.7090	139.9765	136.3138	135.5813	131.9187	131.9187	131.1861	133.3837	135.5813	137.0464	138.5114	(39)
Average = Sum(39)m / 12 =												136.1307	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2392	1.2328	1.2264	1.1943	1.1879	1.1558	1.1558	1.1493	1.1686	1.1879	1.2007	1.2135	(40)
HLP (average)												1.1927	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8375	(42)
Average daily hot water use (litres/day)												101.5912	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.7503	107.6866	103.6230	99.5594	95.4957	91.4321	91.4321	95.4957	99.5594	103.6230	107.6866	111.7503	(44)
Energy conte	165.7225	144.9419	149.5671	130.3962	125.1183	107.9675	100.0478	114.8063	116.1775	135.3936	147.7927	160.4934	(45)
Energy content (annual)										Total = Sum(45)m =		1598.4248	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8584	21.7413	22.4351	19.5594	18.7677	16.1951	15.0072	17.2209	17.4266	20.3090	22.1689	24.0740	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8255 10.6711 11.7915 11.3798 11.7284 11.3145 11.6695 11.7077 11.3501 11.7618 11.4176 11.8145 (61)
Total heat required for water heating calculated for each month
177.5479 155.6130 161.3586 141.7760 136.8466 119.2821 111.7173 126.5140 127.5276 147.1554 159.2103 172.3078 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.5479 155.6130 161.3586 141.7760 136.8466 119.2821 111.7173 126.5140 127.5276 147.1554 159.2103 172.3078 (64)
Total per year (kWh/year) = Sum(64)m = 1736.8567 (64)
Heat gains from water heating, kWh/month
58.0591 50.8610 52.6789 46.2017 44.5339 38.7278 36.1833 41.1000 41.4665 47.9588 51.9955 56.3177 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.7282 21.9634 17.8618 13.5225 10.1083 8.5338 9.2211 11.9859 16.0875 20.4267 23.8410 25.4155 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
277.3750 280.2533 273.0001 257.5589 238.0672 219.7478 207.5093 204.6310 211.8842 227.3253 246.8170 265.1365 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 37.1876 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 -113.5009 (71)
Water heating gains (Table 5)
78.0364 75.6860 70.8050 64.1690 59.8574 53.7887 48.6334 55.2420 57.5924 64.4608 72.2159 75.6958 (72)
Total internal gains
448.7024 446.4655 430.2298 403.8133 376.5957 350.6331 333.9266 340.4217 354.1269 380.7757 411.4368 434.8106 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.2200	11.2829	0.7200	0.7000	0.7700	48.1568	(75)
Southeast	1.5000	36.7938	0.7200	0.7000	0.7700	19.2766	(77)
Southwest	8.9800	36.7938	0.7200	0.7000	0.7700	115.4025	(79)
Northwest	4.9400	11.2829	0.7200	0.7000	0.7700	19.4676	(81)

Solar gains 202.3035 367.0597 561.8905 796.2144 983.1063 1016.1479 962.9660 817.3979 642.0694 421.7659 246.4035 170.4827 (83)
Total gains 651.0059 813.5251 992.1202 1200.0277 1359.7020 1366.7810 1296.8926 1157.8196 996.1963 802.5416 657.8403 605.2933 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.8146	43.0375	43.2627	44.4251	44.6652	45.9053	45.9053	46.1616	45.4011	44.6652	44.1877	43.7203	
alpha	3.8543	3.8692	3.8842	3.9617	3.9777	4.0604	4.0604	4.0774	4.0267	3.9777	3.9458	3.9147	
util living area	0.9949	0.9877	0.9673	0.9026	0.7679	0.5811	0.4379	0.5030	0.7681	0.9513	0.9901	0.9962	(86)
MIT	19.2998	19.5482	19.9359	20.4329	20.7825	20.9495	20.9874	20.9787	20.8437	20.3514	19.7461	19.2806	(87)
Th 2	19.8888	19.8939	19.8990	19.9246	19.9297	19.9556	19.9556	19.9607	19.9452	19.9297	19.9195	19.9092	(88)
util rest of house	0.9936	0.9845	0.9584	0.8771	0.7135	0.4991	0.3385	0.3974	0.6931	0.9332	0.9869	0.9952	(89)
MIT 2	17.6256	17.9900	18.5521	19.2641	19.7159	19.9196	19.9500	19.9504	19.8136	19.1717	18.2969	17.6106	(90)
Living area fraction									fLA = Living area / (4) =			0.2029	(91)
MIT	17.9653	18.3062	18.8329	19.5013	19.9323	20.1286	20.1605	20.1591	20.0226	19.4111	18.5910	17.9495	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9653	18.3062	18.8329	19.5013	19.9323	20.1286	20.1605	20.1591	20.0226	19.4111	18.5910	17.9495	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9899	0.9777	0.9470	0.8651	0.7137	0.5133	0.3584	0.4183	0.6993	0.9218	0.9812	0.9923	(94)
Useful gains	644.4620	795.3557	939.5255	1038.2034	970.4049	701.6191	464.8239	484.3031	696.6199	739.7446	645.4469	600.6303	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1932.8469	1886.3677	1726.3129	1445.1006	1116.1450	729.3252	469.7005	493.1398	789.9847	1194.6187	1574.7938	1904.4607	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	958.5584	733.1600	585.3698	292.9660	108.4307	0.0000	0.0000	0.0000	0.0000	338.4263	669.1298	970.0498	(98)
Space heating												4656.0908	(98)
Space heating per m2											(98) / (4) =	40.7928	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4990.4510	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	958.5584	733.1600	585.3698	292.9660	108.4307	0.0000	0.0000	0.0000	0.0000	338.4263	669.1298	970.0498	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1027.3938	785.8093	627.4060	314.0042	116.2172	0.0000	0.0000	0.0000	0.0000	362.7291	717.1809	1039.7104	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.5479	155.6130	161.3586	141.7760	136.8466	119.2821	111.7173	126.5140	127.5276	147.1554	159.2103	172.3078	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7178	89.6483	89.4970	89.0936	88.2554	86.7000	86.7000	86.7000	86.7000	89.1778	89.5850	89.7380	(217)
Fuel for water heating, kWh/month													
	197.8959	173.5818	180.2950	159.1316	155.0574	137.5802	128.8551	145.9216	147.0906	165.0134	177.7198	192.0122	(219)
Water heating fuel used												1960.1546	(219)
Annual totals kWh/year													
Space heating fuel - main system												4990.4510	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												436.7075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1004 * 1.00) =										-1951.7686		-1951.7686	(233)
Total delivered energy for all uses												5510.5444	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4990.4510	0.2160	1077.9374	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1960.1546	0.2160	423.3934	(264)
Space and water heating			1501.3308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	436.7075	0.5190	226.6512	(268)
Energy saving/generation technologies				
PV Unit	-1951.7686	0.5190	-1012.9679	(269)
Total CO2, kg/year			753.9391	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.6100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.6100	ZC1
Total Floor Area	TFA	114.1400	
Assumed number of occupants	N	2.8375	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4004	ZC2
CO2 emissions from cooking, equation (L16)		1.6392	ZC3
Total CO2 emissions		22.6497	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.6497	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	57.0700 (1b)	x	2.3900 (2b)	=	136.3973	(1b) - (3b)
First floor	57.0700 (1c)	x	2.6300 (2c)	=	150.0941	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.1400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	286.4914	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1396	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3896	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3312	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4223	0.4140	0.4057	0.3643	0.3560	0.3146	0.3146	0.3063	0.3312	0.3560	0.3726	0.3891	(22b)
Effective ac	0.5891	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5548	0.5634	0.5694	0.5757	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			26.3800	1.3258	34.9735			(27)
Ground floor			57.0700	0.1300	7.4191			(28a)
External Wall	152.4400	28.5200	123.9200	0.1800	22.3056			(29a)
Main Roof	57.0700		57.0700	0.1300	7.4191			(30)
Total net area of external elements Aum(A, m2)			266.5800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.6853			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4907	(36)
Total fabric heat loss (33) + (36) =	87.1760	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.6993	55.3720	55.0512	53.5445	53.2626	51.9502	51.9502	51.7072	52.4557	53.2626	53.8329	54.4291	(38)
Heat transfer coeff	142.8753	142.5480	142.2272	140.7204	140.4385	139.1262	139.1262	138.8832	139.6317	140.4385	141.0088	141.6051	(39)
Average = Sum(39)m / 12 =												140.7191	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2518	1.2489	1.2461	1.2329	1.2304	1.2189	1.2189	1.2168	1.2233	1.2304	1.2354	1.2406	(40)
HLP (average)												1.2329	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8375 (42)
Average daily hot water use (litres/day)	101.5912 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.7503	107.6866	103.6230	99.5594	95.4957	91.4321	91.4321	95.4957	99.5594	103.6230	107.6866	111.7503	(44)
Energy conte	165.7225	144.9419	149.5671	130.3962	125.1183	107.9675	100.0478	114.8063	116.1775	135.3936	147.7927	160.4934	(45)
Energy content (annual)										Total = Sum(45)m =		1598.4248	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8584	21.7413	22.4351	19.5594	18.7677	16.1951	15.0072	17.2209	17.4266	20.3090	22.1689	24.0740	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.0978	48.6636	45.0898	46.5928	48.6636	49.0978	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.6814	190.9693	200.5260	179.4940	173.7818	153.0573	146.6406	163.4699	165.2752	186.3525	197.1078	211.4523	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.6814	190.9693	200.5260	179.4940	173.7818	153.0573	146.6406	163.4699	165.2752	186.3525	197.1078	211.4523	(64)
								Total per year (kWh/year) = Sum(64)m =				2184.8081	(64)
Heat gains from water heating, kWh/month													
	67.8424	59.7000	62.4708	55.6312	53.7677	47.1717	44.9141	50.3390	50.9035	57.7581	61.4699	66.1038	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	141.8762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.7282	21.9634	17.8618	13.5225	10.1083	8.5338	9.2211	11.9859	16.0875	20.4267	23.8410	25.4155	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	277.3750	280.2533	273.0001	257.5589	238.0672	219.7478	207.5093	204.6310	211.8842	227.3253	246.8170	265.1365	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	37.1876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	-113.5009	(71)
Water heating gains (Table 5)													
	91.1861	88.8393	83.9661	77.2655	72.2684	65.5162	60.3684	67.6599	70.6992	77.6319	85.3748	88.8491	(72)
Total internal gains													
	461.8521	459.6188	443.3909	416.9098	389.0068	362.3606	345.6616	352.8397	367.2337	393.9468	424.5957	447.9639	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.6700	11.2829	0.6300	0.7000	0.7700	40.2407	(75)
Southeast	1.4300	36.7938	0.6300	0.7000	0.7700	16.0799	(77)
Southwest	8.5800	36.7938	0.6300	0.7000	0.7700	96.4793	(79)
Northwest	4.7000	11.2829	0.6300	0.7000	0.7700	16.2066	(81)

Solar gains	169.0064	306.6300	469.3465	665.0189	821.0694	848.6466	804.2386	682.6941	536.3004	352.3194	205.8452	142.4249	(83)
Total gains	630.8586	766.2488	912.7374	1081.9288	1210.0762	1211.0072	1149.9002	1035.5338	903.5341	746.2661	630.4409	590.3888	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4777	55.6050	55.7305	56.3272	56.4403	56.9727	56.9727	57.0724	56.7664	56.4403	56.2120	55.9753	
alpha	4.6985	4.7070	4.7154	4.7551	4.7627	4.7982	4.7982	4.8048	4.7844	4.7627	4.7475	4.7317	
util living area													
	0.9986	0.9962	0.9879	0.9545	0.8564	0.6818	0.5199	0.5922	0.8526	0.9796	0.9969	0.9990	(86)
MIT	19.5814	19.7620	20.0615	20.4569	20.7813	20.9474	20.9884	20.9792	20.8432	20.4084	19.9212	19.5517	(87)
Th 2	19.8788	19.8811	19.8833	19.8938	19.8958	19.9049	19.9049	19.9066	19.9014	19.8958	19.8918	19.8876	(88)
util rest of house													
	0.9981	0.9948	0.9835	0.9371	0.8052	0.5860	0.3969	0.4636	0.7791	0.9689	0.9956	0.9986	(89)
MIT 2	17.9902	18.2554	18.6920	19.2608	19.6859	19.8711	19.9008	19.8983	19.7752	19.2040	18.4961	17.9529	(90)
Living area fraction									fLA = Living area / (4) =			0.2029	(91)
MIT	18.3131	18.5611	18.9699	19.5035	19.9081	20.0895	20.1215	20.1176	19.9919	19.4484	18.7853	18.2774	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3131	18.5611	18.9699	19.5035	19.9081	20.0895	20.1215	20.1176	19.9919	19.4484	18.7853	18.2774	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9924	0.9783	0.9293	0.8058	0.6033	0.4220	0.4896	0.7862	0.9628	0.9935	0.9978	(94)
Useful gains	628.9549	760.4594	892.9728	1005.3990	975.1037	730.5561	485.2120	507.0147	710.3745	718.5161	626.3567	589.0751	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2002.1226	1947.3678	1773.5607	1492.1225	1152.7403	763.7319	489.9355	516.3164	822.6927	1242.6528	1647.7276	1993.4243	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1021.6368	797.6025	655.1574	350.4409	132.1617	0.0000	0.0000	0.0000	0.0000	389.9577	735.3870	1044.8358	(98)
Space heating												5127.1797	(98)
Space heating per m2											(98) / (4) =	44.9201	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5489.4858	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1021.6368	797.6025	655.1574	350.4409	132.1617	0.0000	0.0000	0.0000	0.0000	389.9577	735.3870	1044.8358	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1093.8295	853.9641	701.4533	375.2044	141.5007	0.0000	0.0000	0.0000	0.0000	417.5136	787.3523	1118.6679	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.6814	190.9693	200.5260	179.4940	173.7818	153.0573	146.6406	163.4699	165.2752	186.3525	197.1078	211.4523	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4533	88.2556	87.8117	86.7061	84.3721	80.3000	80.3000	80.3000	80.3000	86.8670	88.0588	88.5259	(217)
Fuel for water heating, kWh/month													
	244.9671	216.3821	228.3591	207.0142	205.9708	190.6069	182.6159	203.5740	205.8222	214.5262	223.8366	238.8593	(219)
Water heating fuel used												2562.5342	(219)
Annual totals kWh/year													
Space heating fuel - main system												5489.4858	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												436.7075	(232)
Total delivered energy for all uses												8563.7275	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5489.4858	0.2160	1185.7289	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2562.5342	0.2160	553.5074	(264)
Space and water heating			1739.2363	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	436.7075	0.5190	226.6512	(268)
Total CO2, kg/m2/year			2004.8125	(272)
Emissions per m2 for space and water heating			15.2377	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9857	(272b)
Emissions per m2 for pumps and fans			0.3410	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2377 * 1.00) + 1.9857 + 0.3410, rounded to 2 d.p.			17.5600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 114 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 114	**Prop Type Ref**	As
Property	Type 4S - Det SG, Plot 114, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.61	**TER**	17.56
Environmental	95 A	**% DER<TER**	62.37		
CO_2 Emissions (t/year)	0.29	**DFEE**	44.87	**TFEE**	58.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	30.43 m	57.07 m²	2.39 m
1st Storey:	30.43 m	57.07 m²	2.63 m

7.0 Living Area	23.16	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	152.44	122.66

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	57.07	57.07

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	57.07

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.44	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.05	100
D2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.14	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.05	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100
D3 W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		5.23	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	21.31	0.065	No
Independently assessed	E3 Sill	16.78	0.004	No
Independently assessed	E4 Jamb	43.50	0.005	No
Independently assessed	E5 Ground floor (normal)	30.43	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.43	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.00	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.42	0.051	No
Independently assessed	E16 Corner (normal)	19.08	0.037	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	13	
Total number of L.E.L. fittings	13	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	

Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 114 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 114	**Prop Type Ref**	As
Property	Type 4S - Det SG, Plot 114, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.61	**TER**	17.56
Environmental	95 A	**% DER<TER**	62.37		
CO_2 Emissions (t/year)	0.29	**DFEE**	44.87	**TFEE**	58.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	114.14	m^2	
DER	6.61	$kgCO_2/yr/m^2$	
TER	17.56	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.61	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.37	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.87	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	114.14	m^2	
DER	17.69	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.40	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.64	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.40	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.64	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.85	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.85	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 115 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 115	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 115, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.64 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.85 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                  Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
    53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m      123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
   -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
    71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
   374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)
```

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6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                         m2          Table 6a     Specific data  Specific data      factor           W
                                                     W/m2         or Table 6b    or Table 6c        Table 6d
-----------------------------------------------------------------------------------------------------------------------------
Northeast                                7.8500      11.2829      0.7200         0.7000             0.7700          30.9354 (75)
Southeast                                2.4400      36.7938      0.7200         0.7000             0.7700          31.3566 (77)
Southwest                                3.4900      36.7938      0.7200         0.7000             0.7700          44.8502 (79)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains  107.1422  192.7782  291.0611  406.3870  496.9441  511.7179  485.7069  415.3392  330.5561  220.4200  130.2029   90.4805 (83)
Total gains  482.1328  565.6442  650.3563  743.8170  812.1776  805.5829  765.7114  701.3568  627.8281  539.7693  474.8992  454.1820 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha         4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
    0.9947    0.9890    0.9740    0.9258    0.8146    0.6318    0.4776    0.5354    0.7918    0.9558    0.9900    0.9959 (86)

MIT          19.5238   19.7230   20.0412   20.4659   20.7835   20.9508   20.9887   20.9819   20.8632   20.4403   19.9232   19.5139 (87)
Th 2         19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
    0.9933    0.9861    0.9667    0.9051    0.7662    0.5517    0.3779    0.4320    0.7219    0.9392    0.9868    0.9948 (89)
MIT 2        17.9974   18.2906   18.7538   19.3714   19.7905   20.0000   20.0308   20.0324   19.9079   19.3509   18.6018   17.9973 (90)
Living area fraction                                                                  fLA = Living area / (4) =     0.2505 (91)
MIT          18.3797   18.6494   19.0763   19.6456   20.0392   20.2381   20.2708   20.2702   20.1472   19.6238   18.9328   18.3772 (92)
Temperature adjustment                                                                                            0.0000
adjusted MIT 18.3797   18.6494   19.0763   19.6456   20.0392   20.2381   20.2708   20.2702   20.1472   19.6238   18.9328   18.3772 (93)
```

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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation   0.9901    0.9808    0.9583    0.8962    0.7679    0.5693    0.4027    0.4575    0.7317    0.9310    0.9819    0.9922 (94)
Useful gains 477.3377  554.7696  623.2314  666.5888  623.6460  458.6034  308.3497  320.8672  459.3564  502.5097  466.3114  450.6174 (95)
Ext temp.     4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
  1292.3174 1254.7343 1141.0303  946.5391  730.1646  478.7665  311.7063  326.5962  519.8961  790.1046 1048.5632 1271.2983 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   606.3449  470.3763  385.2424  201.5642   79.2498    0.0000    0.0000    0.0000    0.0000  213.9706  419.2213  610.5866 (98)
Space heating                                                                                                    2986.5562 (98)
Space heating per m2                                                                                 (98) / (4) =   37.1832 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3201.0248	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	606.3449	470.3763	385.2424	201.5642	79.2498	0.0000	0.0000	0.0000	0.0000	213.9706	419.2213	610.5866	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	649.8874	504.1547	412.9072	216.0388	84.9409	0.0000	0.0000	0.0000	0.0000	229.3362	449.3261	654.4336	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5116	89.4338	89.2691	88.8502	88.0553	86.7000	86.7000	86.7000	86.7000	88.8696	89.3396	89.5340	(217)
Fuel for water heating, kWh/month													
	182.3636	159.9975	166.2695	146.8698	143.1181	126.8093	118.8742	134.4666	135.4969	152.4138	163.9171	176.9698	(219)
Water heating fuel used												1807.5663	(219)
Annual totals kWh/year													
Space heating fuel - main system												3201.0248	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4106.5936	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3201.0248	0.2160	691.4214	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.5663	0.2160	390.4343	(264)
Space and water heating			1081.8557	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			613.7190	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.6400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.6400	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.0983	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.0983	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(75)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439	(79)

Solar gains	93.7494	168.6809	254.6785	355.5886	434.8261	447.7531	424.9936	363.4218	289.2366	192.8675	113.9275	79.1704	(83)
Total gains	481.8998	554.4389	626.2403	704.6616	761.0754	752.0084	715.3945	660.4610	598.1602	524.4920	471.5207	456.0351	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9980	0.9956	0.9884	0.9611	0.8794	0.7145	0.5469	0.6090	0.8567	0.9776	0.9959	0.9985	(86)
MIT	19.7340	19.8864	20.1426	20.4865	20.7814	20.9465	20.9888	20.9813	20.8610	20.4798	20.0463	19.7089	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9973	0.9941	0.9841	0.9462	0.8342	0.6232	0.4261	0.4852	0.7869	0.9663	0.9942	0.9980	(89)
MIT 2	18.2595	18.4835	18.8573	19.3553	19.7478	19.9374	19.9690	19.9672	19.8559	19.3548	18.7258	18.2294	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6289	18.8349	19.1793	19.6386	20.0067	20.1902	20.2245	20.2212	20.1077	19.6366	19.0566	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6289	18.8349	19.1793	19.6386	20.0067	20.1902	20.2245	20.2212	20.1077	19.6366	19.0566	18.6000	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9918	0.9798	0.9403	0.8364	0.6439	0.4565	0.5163	0.7978	0.9615	0.9920	0.9970	(94)
Useful gains	479.9960	549.8833	613.6069	662.6250	636.5463	484.1939	326.6121	340.9896	477.1832	504.2826	467.7521	454.6533	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.7526	1304.4164	1183.8806	990.7525	764.6570	509.1850	330.1348	347.3699	549.4496	831.8428	1105.6624	1337.9423	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	643.3789	507.0462	424.2836	236.2519	95.3143	0.0000	0.0000	0.0000	0.0000	243.7048	459.2955	657.1671	(98)
Space heating												3266.4422	(98)
Space heating per m2											(98) / (4) =	40.6679	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3497.2615	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	643.3789	507.0462	424.2836	236.2519	95.3143	0.0000	0.0000	0.0000	0.0000	243.7048	459.2955	657.1671	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	688.8425	542.8760	454.2651	252.9463	102.0496	0.0000	0.0000	0.0000	0.0000	260.9259	491.7510	703.6050	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7585	87.5420	87.0754	85.9690	83.8122	80.3000	80.3000	80.3000	80.3000	85.9285	87.2656	87.8455	(217)
Fuel for water heating, kWh/month													
	230.6330	203.0402	212.3823	190.7966	189.4785	174.1812	166.8789	186.0308	188.0853	200.1440	210.3761	224.9649	(219)
Water heating fuel used												2376.9918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3497.2615	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6306.0818	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3497.2615	0.2160	755.4085	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.9918	0.2160	513.4302	(264)
Space and water heating			1268.8387	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1492.9577	(272)
Emissions per m2 for space and water heating			15.7973	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7973 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.5900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 115 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 115	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 115, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 115 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 115	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 115, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.64	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.64	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.90	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.11	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 116 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 116	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 116, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.85 m², No overhang
Windows facing South West: 3.49 m², No overhang
Windows facing North West: 2.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4079	(36)
Total fabric heat loss					(33) + (36) =		48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)
Average = Sum(39)m / 12 =												87.9543	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.7955    10.6404    11.7492    11.3349    11.6870    11.2803    11.6379    11.6697    11.3100    11.7235    11.3863    11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                              Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (64)
                                                                                                Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031    46.7002    48.3828    42.4542    40.9385    35.6256    33.3086    37.8009    38.1276    44.0698    47.7529    51.7117 (65)
```

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051    17.9460    14.5947    11.0491     8.2593     6.9729     7.5344     9.7935    13.1449    16.6904    19.4802    20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080   222.3921   216.6364   204.3832   188.9158   174.3786   164.6668   162.3828   168.1385   180.3916   195.8591   210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562 (71)
Water heating gains (Table 5)
               71.6439    69.4944    65.0306    58.9641    55.0249    49.4801    44.7697    50.8077    52.9551    59.2336    66.3235    69.5050 (72)
Total internal gains
              374.9906   372.8660   359.2952   337.4300   315.2335   293.8651   280.0045   286.0176   297.2720   319.3492   344.6963   363.7015 (73)
```

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                7.8500           11.2829           0.7200           0.7000           0.7700           30.9354 (75)
Southwest                                3.4900           36.7938           0.7200           0.7000           0.7700           44.8502 (79)
Northwest                                2.4400           11.2829           0.7200           0.7000           0.7700            9.6156 (81)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    85.4012   158.9392   253.2447   373.7504   473.3675   494.0209   466.2693   388.2696   294.3952   185.3081   104.7438    71.4984 (83)
Total gains   460.3918   531.8052   612.5399   711.1804   788.6011   787.8860   746.2738   674.2872   591.6672   504.6573   449.4402   435.1999 (84)
```

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           48.1295    48.4082    48.6902    50.1507    50.4534    52.0234    52.0234    52.3492    51.3838    50.4534    49.8517    49.2641
alpha          4.2086     4.2272     4.2460     4.3434     4.3636     4.4682     4.4682     4.4899     4.4256     4.3636     4.3234     4.2843
util living area
               0.9956     0.9913     0.9788     0.9351     0.8264     0.6429     0.4890     0.5542     0.8167     0.9646     0.9918     0.9965 (86)

MIT           19.4940    19.6777    19.9936    20.4325    20.7694    20.9473    20.9876    20.9793    20.8434    20.3991    19.8888    19.4877 (87)
Th 2          19.9661    19.9714    19.9767    20.0035    20.0089    20.0359    20.0359    20.0413    20.0251    20.0089    19.9982    19.9874 (88)
util rest of house
               0.9944     0.9889     0.9728     0.9164     0.7794     0.5623     0.3874     0.4483     0.7500     0.9508     0.9892     0.9956 (89)
MIT 2         17.9540    18.2250    18.6862    19.3268    19.7744    19.9972    20.0303    20.0309    19.8882    19.2945    18.5520    17.9590 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3398    18.5889    19.0137    19.6038    20.0237    20.2352    20.2701    20.2685    20.1274    19.5712    18.8869    18.3420 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.3398    18.5889    19.0137    19.6038    20.0237    20.2352    20.2701    20.2685    20.1274    19.5712    18.8869    18.3420 (93)
```

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9915     0.9843     0.9651     0.9072     0.7801     0.5798     0.4127     0.4743     0.7579     0.9428     0.9850     0.9933 (94)
Useful gains  456.4842   523.4471   591.1682   645.2161   615.2197   456.8555   307.9502   319.8423   448.4332   475.7944   442.6819   432.2642 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1288.6525  1249.2135  1135.3492   942.8577   728.8044   478.5135   311.6490   326.4502   518.1949   785.5015  1044.4941  1268.1357 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              619.1332   487.7150   404.8706   214.3019    84.5070     0.0000     0.0000     0.0000     0.0000   230.4221   433.3048   621.8884 (98)
Space heating                                                                                                                 3096.1431 (98)
Space heating per m2                                                                                                (98) / (4) =     38.5476 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3318.4813	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.1332	487.7150	404.8706	214.3019	84.5070	0.0000	0.0000	0.0000	0.0000	230.4221	433.3048	621.8884	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	663.5940	522.7385	433.9450	229.6912	90.5756	0.0000	0.0000	0.0000	0.0000	246.9690	464.4210	666.5470	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5244	89.4574	89.3052	88.9029	88.1100	86.7000	86.7000	86.7000	86.7000	88.9329	89.3627	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3376	159.9553	166.2022	146.7827	143.0293	126.8093	118.8742	134.4666	135.4969	152.3052	163.8747	176.9480	(219)
Water heating fuel used												1807.0821	(219)
Annual totals kWh/year													
Space heating fuel - main system												3318.4813	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4223.5659	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3318.4813	0.2160	716.7920	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0821	0.2160	390.3297	(264)
Space and water heating			1107.1217	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			638.9850	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.9600	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.4183	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.4183	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(75)
Southwest	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439	(79)
Northwest	2.4400	11.2829	0.6300	0.7000	0.7700	8.4136	(81)

Solar gains	74.7260	139.0718	221.5891	327.0316	414.1966	432.2683	407.9857	339.7359	257.5958	162.1446	91.6508	62.5611	(83)
Total gains	462.8764	524.8297	593.1509	676.1046	740.4459	736.5236	698.3866	636.7751	566.5194	493.7690	449.2441	439.4257	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9966	0.9907	0.9667	0.8886	0.7252	0.5588	0.6280	0.8767	0.9825	0.9967	0.9987	(86)
MIT	19.7121	19.8526	20.1061	20.4588	20.7682	20.9428	20.9877	20.9785	20.8425	20.4474	20.0208	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9978	0.9954	0.9873	0.9536	0.8455	0.6340	0.4361	0.5021	0.8118	0.9733	0.9953	0.9983	(89)
MIT 2	18.2275	18.4343	18.8049	19.3176	19.7326	19.9346	19.9686	19.9659	19.8375	19.3098	18.6887	18.2013	(90)
Living area fraction										fLA = Living area / (4) =		0.2505	(91)
MIT	18.5994	18.7896	19.1308	19.6034	19.9920	20.1872	20.2238	20.2196	20.0892	19.5948	19.0224	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5994	18.7896	19.1308	19.6034	19.9920	20.1872	20.2238	20.2196	20.0892	19.5948	19.0224	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9835	0.9478	0.8468	0.6545	0.4670	0.5337	0.8208	0.9688	0.9934	0.9974	(94)
Useful gains	461.3327	521.3753	583.3884	640.8030	627.0429	482.0453	326.1781	339.8320	464.9811	478.3624	446.2970	438.2901	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.9834	1300.1764	1179.3588	987.5040	763.3031	508.9059	330.0781	347.2204	547.7615	827.9956	1102.5030	1335.5364	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	655.2042	523.3544	443.4020	249.6248	101.3776	0.0000	0.0000	0.0000	0.0000	260.1271	472.4683	667.5513	(98)
Space heating												3373.1096	(98)
Space heating per m2											(98) / (4) =	41.9959	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3611.4663	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	655.2042	523.3544	443.4020	249.6248	101.3776	0.0000	0.0000	0.0000	0.0000	260.1271	472.4683	667.5513	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	701.5034	560.3366	474.7345	267.2642	108.5413	0.0000	0.0000	0.0000	0.0000	278.5086	505.8548	714.7230	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7939	87.6064	87.1729	86.1055	83.9548	80.3000	80.3000	80.3000	80.3000	86.0903	87.3264	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5401	202.8909	212.1446	190.4942	189.1567	174.1812	166.8789	186.0308	188.0853	199.7677	210.2296	224.8886	(219)
Water heating fuel used												2375.2888	(219)
Annual totals kWh/year													
Space heating fuel - main system												3611.4663	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6418.5836	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3611.4663	0.2160	780.0767	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.2888	0.2160	513.0624	(264)
Space and water heating			1293.1391	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1517.2581	(272)
Emissions per m2 for space and water heating			16.0998	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0998 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.8900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 116 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 116	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 116, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.89	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.96	$kgCO_2/m^2$	Pass
	-10.93 (-57.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.60	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.44	$kWh/m^2/yr$	
	-13.2 (-24.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West Windows facing North West	7.85 m², No overhang 3.49 m², No overhang 2.44 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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Assessment Reference	Plot 116	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 116, Boorley Gardens, Southampton, SO32		

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Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 116 BG RP	**Issued on Date**	04/04/2025
Assessment Reference	Plot 116	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 116, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.96	$kgCO_2/yr/m^2$	
TER	18.89	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.96	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.86	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.44	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	19.10	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 117 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 117	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 117, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.62 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.44 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 7.21 m², No overhang
Windows facing South: 1.04 m², No overhang
Windows facing South West: 0.72 m², No overhang
Windows facing North West: 7.93 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a       Specific data    Specific data        factor                W
                                                           W/m2       or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                1.4400           11.2829            0.7200           0.7000           0.7700            5.6748 (75)
East                                     1.0400           19.6403            0.7200           0.7000           0.7700            7.1342 (76)
Southeast                                7.2100           36.7938            0.7200           0.7000           0.7700           92.6561 (77)
South                                    1.0400           46.7521            0.7200           0.7000           0.7700           16.9824 (78)
Southwest                                0.7200           36.7938            0.7200           0.7000           0.7700            9.2528 (79)
Northwest                                7.9300           11.2829            0.7200           0.7000           0.7700           31.2507 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   162.9509  290.5200  431.3428  590.2477  711.3795  728.1602  692.9132  599.3103  485.9253  330.2658  197.5505  137.9091 (83)
Total gains   641.6030  766.7179  889.9646 1020.3411 1111.9726 1100.8682 1047.8845  961.0588  862.6801  735.7850  636.0667  601.6820 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9979    0.9952    0.9873    0.9597    0.8827    0.7236    0.5615    0.6237    0.8640    0.9780    0.9959    0.9985 (86)

MIT           19.4391   19.6268   19.9326   20.3550   20.7039   20.9217   20.9808   20.9699   20.8092   20.3493   19.8356   19.4335 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9973    0.9938    0.9835    0.9467    0.8444    0.6432    0.4499    0.5113    0.8057    0.9687    0.9945    0.9980 (89)
MIT 2         17.8790   18.1566   18.6051   19.2294   19.7077   19.9870   20.0382   20.0369   19.8629   19.2325   18.4803   17.8851 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1959 (91)
MIT           18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9957    0.9907    0.9775    0.9372    0.8390    0.6544    0.4713    0.5323    0.8065    0.9613    0.9917    0.9968 (94)
Useful gains 638.8488  759.5603  869.9212  956.2230  932.9893  720.4356  493.8249  511.5536  695.7744  707.2740  630.8081  599.7386 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2084.6728 2021.8512 1835.0545 1519.8251 1174.5834  773.3939  503.0192  527.0308  836.2406 1267.4322 1687.8192 2051.6363 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1075.6930  848.2595  718.0592  405.7936  179.7460    0.0000    0.0000    0.0000    0.0000  416.7577  761.0480 1080.2119 (98)
Space heating                                                                                                         5485.5688 (98)
Space heating per m2                                                                                  (98) / (4) =    41.2263 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5879.4949	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1075.6930	848.2595	718.0592	405.7936	179.7460	0.0000	0.0000	0.0000	0.0000	416.7577	761.0480	1080.2119	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1152.9400	909.1741	769.6240	434.9342	192.6538	0.0000	0.0000	0.0000	0.0000	446.6857	815.6999	1157.7834	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7655	89.7156	89.6094	89.3297	88.6956	86.7000	86.7000	86.7000	86.7000	89.3222	89.6485	89.7809	(217)
Fuel for water heating, kWh/month													
	200.6014	175.9110	182.6098	160.9347	156.4398	139.4795	130.6150	147.9414	149.1319	167.0545	180.1038	194.6419	(219)
Water heating fuel used												1985.4648	(219)
Annual totals kWh/year													
Space heating fuel - main system												5879.4949	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												6106.3629	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5879.4949	0.2160	1269.9709	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.4648	0.2160	428.8604	(264)
Space and water heating			1698.8313	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			786.1195	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		20.7494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.7494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	7.2100	36.7938	0.6300	0.7000	0.7700	81.0741	(77)
South	1.0400	46.7521	0.6300	0.7000	0.7700	14.8596	(78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(79)
Northwest	7.9300	11.2829	0.6300	0.7000	0.7700	27.3443	(81)

Solar gains	142.5820	254.2050	377.4250	516.4667	622.4571	637.1402	606.2990	524.3965	425.1847	288.9825	172.8567	120.6704 (83)
Total gains	634.3820	743.5546	849.2063	959.7302	1035.7070	1021.8113	973.2412	898.8090	815.1201	707.6714	624.5301	597.5950 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9983	0.9950	0.9810	0.9307	0.8001	0.6332	0.6979	0.9146	0.9901	0.9985	0.9995	(86)
MIT	19.6721	19.8160	20.0618	20.3970	20.7091	20.9156	20.9805	20.9684	20.8097	20.4064	19.9792	19.6488	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9991	0.9977	0.9930	0.9730	0.8993	0.7157	0.5035	0.5699	0.8628	0.9847	0.9979	0.9993	(89)
MIT 2	18.1918	18.4038	18.7639	19.2553	19.6880	19.9401	19.9936	19.9886	19.8287	19.2745	18.6497	18.1634	(90)
Living area fraction									fLA = Living area / (4) =			0.1959	(91)
MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9904	0.9674	0.8953	0.7280	0.5289	0.5946	0.8643	0.9808	0.9968	0.9989	(94)
Useful gains	633.4584	740.9778	841.0283	928.4842	927.2576	743.8523	514.7767	534.4275	704.4910	694.0508	622.5497	596.9563	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2129.8253	2064.8470	1871.5133	1564.9534	1208.8488	809.0266	524.6489	552.0002	869.1535	1313.4115	1750.6432	2121.8353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating												5844.9213	(98)
Space heating per m2											(98) / (4) =	43.9270	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6257.9457	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1191.9668	952.5055	820.8574	490.6400	224.3082	0.0000	0.0000	0.0000	0.0000	493.3666	869.6224	1214.6788	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5675	88.4161	88.0825	87.2831	85.4848	80.3000	80.3000	80.3000	80.3000	87.2164	88.2134	88.6317	(217)
Fuel for water heating, kWh/month													
	247.4939	218.4799	230.2368	208.1644	206.3783	193.5027	185.3903	206.6667	208.2909	216.0253	225.9896	241.3252	(219)
Water heating fuel used												2587.9440	(219)
Annual totals kWh/year													
Space heating fuel - main system												6257.9457	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9425.6051	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6257.9457	0.2160	1351.7163	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.9440	0.2160	558.9959	(264)
Space and water heating			1910.7122	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2211.5845	(272)
Emissions per m2 for space and water heating			14.3598	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3598 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 117 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 117	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 117, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North East							2.14	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 117 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 117	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 117, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	16.62	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.44	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.65	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.83	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 118 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 118	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 118, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.62 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.44 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 7.21 m², No overhang
Windows facing South: 1.04 m², No overhang
Windows facing South West: 0.72 m², No overhang
Windows facing North West: 7.93 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a       Specific data    Specific data        factor                W
                                                           W/m2       or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                1.4400           11.2829            0.7200           0.7000           0.7700            5.6748 (75)
East                                     1.0400           19.6403            0.7200           0.7000           0.7700            7.1342 (76)
Southeast                                7.2100           36.7938            0.7200           0.7000           0.7700           92.6561 (77)
South                                    1.0400           46.7521            0.7200           0.7000           0.7700           16.9824 (78)
Southwest                                0.7200           36.7938            0.7200           0.7000           0.7700            9.2528 (79)
Northwest                                7.9300           11.2829            0.7200           0.7000           0.7700           31.2507 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   162.9509  290.5200  431.3428  590.2477  711.3795  728.1602  692.9132  599.3103  485.9253  330.2658  197.5505  137.9091 (83)
Total gains   641.6030  766.7179  889.9646 1020.3411 1111.9726 1100.8682 1047.8845  961.0588  862.6801  735.7850  636.0667  601.6820 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9979    0.9952    0.9873    0.9597    0.8827    0.7236    0.5615    0.6237    0.8640    0.9780    0.9959    0.9985 (86)

MIT           19.4391   19.6268   19.9326   20.3550   20.7039   20.9217   20.9808   20.9699   20.8092   20.3493   19.8356   19.4335 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9973    0.9938    0.9835    0.9467    0.8444    0.6432    0.4499    0.5113    0.8057    0.9687    0.9945    0.9980 (89)
MIT 2         17.8790   18.1566   18.6051   19.2294   19.7077   19.9870   20.0382   20.0369   19.8629   19.2325   18.4803   17.8851 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1959 (91)
MIT           18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9957    0.9907    0.9775    0.9372    0.8390    0.6544    0.4713    0.5323    0.8065    0.9613    0.9917    0.9968 (94)
Useful gains 638.8488  759.5603  869.9212  956.2230  932.9893  720.4356  493.8249  511.5536  695.7744  707.2740  630.8081  599.7386 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2084.6728 2021.8512 1835.0545 1519.8251 1174.5834  773.3939  503.0192  527.0308  836.2406 1267.4322 1687.8192 2051.6363 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1075.6930  848.2595  718.0592  405.7936  179.7460    0.0000    0.0000    0.0000    0.0000  416.7577  761.0480 1080.2119 (98)
Space heating                                                                                                         5485.5688 (98)
Space heating per m2                                                                                  (98) / (4) =    41.2263 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5879.4949	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1075.6930	848.2595	718.0592	405.7936	179.7460	0.0000	0.0000	0.0000	0.0000	416.7577	761.0480	1080.2119	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1152.9400	909.1741	769.6240	434.9342	192.6538	0.0000	0.0000	0.0000	0.0000	446.6857	815.6999	1157.7834	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7655	89.7156	89.6094	89.3297	88.6956	86.7000	86.7000	86.7000	86.7000	89.3222	89.6485	89.7809	(217)
Fuel for water heating, kWh/month													
	200.6014	175.9110	182.6098	160.9347	156.4398	139.4795	130.6150	147.9414	149.1319	167.0545	180.1038	194.6419	(219)
Water heating fuel used												1985.4648	(219)
Annual totals kWh/year													
Space heating fuel - main system												5879.4949	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												6106.3629	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5879.4949	0.2160	1269.9709	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.4648	0.2160	428.8604	(264)
Space and water heating			1698.8313	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			786.1195	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		20.7494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.7494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	7.2100	36.7938	0.6300	0.7000	0.7700	81.0741	(77)
South	1.0400	46.7521	0.6300	0.7000	0.7700	14.8596	(78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(79)
Northwest	7.9300	11.2829	0.6300	0.7000	0.7700	27.3443	(81)

Solar gains	142.5820	254.2050	377.4250	516.4667	622.4571	637.1402	606.2990	524.3965	425.1847	288.9825	172.8567	120.6704 (83)
Total gains	634.3820	743.5546	849.2063	959.7302	1035.7070	1021.8113	973.2412	898.8090	815.1201	707.6714	624.5301	597.5950 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9983	0.9950	0.9810	0.9307	0.8001	0.6332	0.6979	0.9146	0.9901	0.9985	0.9995	(86)
MIT	19.6721	19.8160	20.0618	20.3970	20.7091	20.9156	20.9805	20.9684	20.8097	20.4064	19.9792	19.6488	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9991	0.9977	0.9930	0.9730	0.8993	0.7157	0.5035	0.5699	0.8628	0.9847	0.9979	0.9993	(89)
MIT 2	18.1918	18.4038	18.7639	19.2553	19.6880	19.9401	19.9936	19.9886	19.8287	19.2745	18.6497	18.1634	(90)
Living area fraction									fLA = Living area / (4) =			0.1959	(91)
MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9904	0.9674	0.8953	0.7280	0.5289	0.5946	0.8643	0.9808	0.9968	0.9989	(94)
Useful gains	633.4584	740.9778	841.0283	928.4842	927.2576	743.8523	514.7767	534.4275	704.4910	694.0508	622.5497	596.9563	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2129.8253	2064.8470	1871.5133	1564.9534	1208.8488	809.0266	524.6489	552.0002	869.1535	1313.4115	1750.6432	2121.8353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating												5844.9213	(98)
Space heating per m2											(98) / (4) =	43.9270	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6257.9457	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1191.9668	952.5055	820.8574	490.6400	224.3082	0.0000	0.0000	0.0000	0.0000	493.3666	869.6224	1214.6788	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5675	88.4161	88.0825	87.2831	85.4848	80.3000	80.3000	80.3000	80.3000	87.2164	88.2134	88.6317	(217)
Fuel for water heating, kWh/month													
	247.4939	218.4799	230.2368	208.1644	206.3783	193.5027	185.3903	206.6667	208.2909	216.0253	225.9896	241.3252	(219)
Water heating fuel used												2587.9440	(219)
Annual totals kWh/year													
Space heating fuel - main system												6257.9457	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9425.6051	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6257.9457	0.2160	1351.7163	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.9440	0.2160	558.9959	(264)
Space and water heating			1910.7122	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2211.5845	(272)
Emissions per m2 for space and water heating			14.3598	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3598 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 118 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 118	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 118, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North East							2.14	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 118 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 118	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 118, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	16.62	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.44	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.65	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.83	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 119 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 119	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 119, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.35	**TER**	19.07
Environmental	94 A	**% DER<TER**	56.22		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.92	**TFEE**	60.39
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.07 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.92 m², No overhang
Windows facing South East: 5.07 m², No overhang
Windows facing South West: 1.41 m², No overhang
Windows facing West: 1.04 m², No overhang
Windows facing North West: 5.74 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2160	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4410	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4780	0.4686	0.4592	0.4124	0.4030	0.3561	0.3561	0.3468	0.3749	0.4030	0.4217	0.4405	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7280	0.7186	0.7092	0.6624	0.6530	0.6061	0.6061	0.5968	0.6249	0.6530	0.6717	0.6905	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2200	1.2357	26.2224			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			47.5100	0.1200	5.7012			(28a)
External Wall	138.2700	25.5000	112.7700	0.2100	23.6817			(29a)
Main Roof	46.2700		46.2700	0.0700	3.2389			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4626			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3203	(36)
Total fabric heat loss					(33) + (36) =		70.7830	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5990	54.8832	54.1674	50.5885	49.8727	46.2937	46.2937	45.5779	47.7253	49.8727	51.3043	52.7358	(38)
Heat transfer coeff	126.3820	125.6662	124.9504	121.3714	120.6556	117.0767	117.0767	116.3609	118.5083	120.6556	122.0872	123.5188	(39)
Average = Sum(39)m / 12 =												121.1925	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3476	1.3400	1.3324	1.2942	1.2866	1.2484	1.2484	1.2408	1.2637	1.2866	1.3018	1.3171	(40)
HLP (average)												1.2923	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6740 (42)
Average daily hot water use (litres/day) 97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8122   10.6595   11.7785   11.3594   11.7095   11.2990   11.6551   11.6904   11.3319   11.7500   11.4057   11.8016 (61)
Total heat required for water heating calculated for each month
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1675.5748 (64)
Heat gains from water heating, kWh/month
               55.9494   49.0158   50.7746   44.5392   42.9389   37.3516   34.9080   39.6365   39.9853   46.2350   50.1140   54.2745 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9147   19.4644   15.8296   11.9840    8.9582    7.5629    8.1719   10.6222   14.2571   18.1027   21.1285   22.5238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              245.8627  248.4140  241.9848  228.2979  211.0207  194.7825  183.9343  181.3831  187.8122  201.4991  218.7764  235.0146 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 (71)
Water heating gains (Table 5)
               75.2007   72.9402   68.2455   61.8600   57.7136   51.8773   46.9194   53.2748   55.5352   62.1438   69.6028   72.9496 (72)
Total internal gains
              409.0883  406.9287  392.1700  368.2520  343.8025  320.3327  305.1358  311.3902  323.7146  347.8557  375.6178  396.5981 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data        factor                W
                                                         W/m2          or Table 6b      or Table 6c          Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                  1.0400            10.6334            0.7200           0.7000            0.7700            3.8625 (74)
Northeast                              6.9200            11.2829            0.7200           0.7000            0.7700           27.2704 (75)
Southeast                              5.0700            36.7938            0.7200           0.7000            0.7700           65.1549 (77)
Southwest                              1.4100            36.7938            0.7200           0.7000            0.7700           18.1200 (79)
West                                   1.0400            19.6403            0.7200           0.7000            0.7700            7.1342 (80)
Northwest                              5.7400            11.2829            0.7200           0.7000            0.7700           22.6203 (81)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    144.1623  264.7393  412.5768  594.6308  741.4872  769.1272  727.8005  613.3169  474.9110  306.2257  176.1799  121.0960 (83)
Total gains    553.2505  671.6680  804.7468  962.8828 1085.2897 1089.4599 1032.9363  924.7071  798.6256  654.0814  551.7977  517.6940 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            44.7283   44.9831   45.2408   46.5748   46.8511   48.2833   48.2833   48.5803   47.7001   46.8511   46.3017   45.7651
alpha           3.9819    3.9989    4.0161    4.1050    4.1234    4.2189    4.2189    4.2387    4.1800    4.1234    4.0868    4.0510
util living area
                0.9964    0.9918    0.9783    0.9311    0.8180    0.6362    0.4851    0.5534    0.8164    0.9662    0.9931    0.9973 (86)

MIT            19.3239   19.5391   19.8954   20.3786   20.7451   20.9384   20.9846   20.9741   20.8189   20.3224   19.7538   19.3143 (87)
Th 2           19.8037   19.8096   19.8156   19.8454   19.8514   19.8815   19.8815   19.8875   19.8694   19.8514   19.8394   19.8275 (88)
util rest of house
                0.9953    0.9893    0.9713    0.9090    0.7633    0.5438    0.3683    0.4312    0.7397    0.9511    0.9906    0.9965 (89)
MIT 2          17.5858   17.9031   18.4226   19.1243   19.6042   19.8399   19.8755   19.8762   19.7206   19.0641   18.2370   17.5872 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.1913 (91)
MIT            17.9183   18.2161   18.7044   19.3642   19.8225   20.0501   20.0876   20.0862   19.9307   19.3048   18.5271   17.9176 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   17.9183   18.2161   18.7044   19.3642   19.8225   20.0501   20.0876   20.0862   19.9307   19.3048   18.5271   17.9176 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9926    0.9843    0.9622    0.8974    0.7617    0.5586    0.3905    0.4541    0.7445    0.9413    0.9862    0.9943 (94)
Useful gains  549.1446  661.1110  774.3388  864.1230  826.7086  608.6011  403.3599  419.9092  594.6060  615.6805  544.1981  514.7374 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1721.1091 1673.3831 1524.9388 1270.0598  980.0206  638.0773  408.3195  428.9336  690.9840 1050.2795 1395.1051 1694.3843 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              871.9416  680.2468  558.4464  292.2744  114.0641    0.0000    0.0000    0.0000    0.0000  323.3417  612.6530  877.6572 (98)
Space heating                                                                                                                 4330.6253 (98)
Space heating per m2                                                                                          (98) / (4) =     46.1786 (99)
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4641.6134	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	871.9416	680.2468	558.4464	292.2744	114.0641	0.0000	0.0000	0.0000	0.0000	323.3417	612.6530	877.6572	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	934.5569	729.0963	598.5492	313.2631	122.2552	0.0000	0.0000	0.0000	0.0000	346.5613	656.6485	940.6830	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6888	89.6274	89.4902	89.1204	88.3321	86.7000	86.7000	86.7000	86.7000	89.1703	89.5548	89.7071	(217)
Fuel for water heating, kWh/month	190.8818	167.4273	173.9053	153.4677	149.4869	132.8019	124.4273	140.8397	141.9472	159.2098	171.4579	185.2249	(219)
Water heating fuel used												1891.0777	(219)
Annual totals kWh/year													
Space heating fuel - main system												4641.6134	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.0205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =											-1671.3992	-1671.3992	(233)
Total delivered energy for all uses												5323.3123	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4641.6134	0.2160	1002.5885	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1891.0777	0.2160	408.4728	(264)
Space and water heating			1411.0613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.0205	0.5190	200.8636	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			783.3937	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3500	ZC1
Total Floor Area	TFA	93.7800	
Assumed number of occupants	N	2.6740	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5356	ZC2
CO2 emissions from cooking, equation (L16)		1.9533	ZC3
Total CO2 emissions		25.8389	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.8389	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1296	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3796	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3227	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4114	0.4034	0.3953	0.3549	0.3469	0.3065	0.3065	0.2985	0.3227	0.3469	0.3630	0.3791	(22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5602	0.5470	0.5470	0.5445	0.5521	0.5602	0.5659	0.5719	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.1500	1.3258	25.3883			(27)
Ground floor			47.5100	0.1300	6.1763			(28a)
External Wall	138.2700	23.4300	114.8400	0.1800	20.6712			(29a)
Main Roof	46.2700		46.2700	0.1300	6.0151			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5481			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0900	(36)
Total fabric heat loss (33) + (36) =	75.6381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6511	44.4001	44.1540	42.9985	42.7823	41.7758	41.7758	41.5894	42.1635	42.7823	43.2196	43.6769	(38)
Heat transfer coeff	120.2891	120.0381	119.7921	118.6365	118.4203	117.4139	117.4139	117.2275	117.8015	118.4203	118.8577	119.3150	(39)
Average = Sum(39)m / 12 =												118.6355	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2827	1.2800	1.2774	1.2651	1.2627	1.2520	1.2520	1.2500	1.2561	1.2627	1.2674	1.2723	(40)
HLP (average)												1.2650	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6740 (42)
Average daily hot water use (litres/day)	97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7866	47.2209	46.8033	43.3661	44.8117	46.8033	47.2209	50.7866	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (64)
								Total per year (kWh/year) = Sum(64)m =				2112.3818 (64)
Heat gains from water heating, kWh/month												
	65.7360	57.8578	60.5266	53.5046	51.7123	45.3684	43.1972	48.4147	48.9576	55.9941	59.5913	64.0638 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0285	19.5656	15.9118	12.0462	9.0047	7.6022	8.2144	10.6774	14.3312	18.1967	21.2382	22.6408	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	245.8627	248.4140	241.9848	228.2979	211.0207	194.7825	183.9343	181.3831	187.8122	201.4991	218.7764	235.0146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	(71)
Water heating gains (Table 5)													
	88.3549	86.0979	81.3530	74.3119	69.5058	63.0117	58.0607	65.0735	67.9966	75.2609	82.7658	86.1073	(72)
Total internal gains													
	422.3563	420.1875	405.3597	380.7662	355.6413	331.5064	316.3196	323.2441	336.2501	361.0668	388.8905	409.8728	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9400	10.6334	0.6300	0.7000	0.7700	3.0547	(74)
Northeast	6.2500	11.2829	0.6300	0.7000	0.7700	21.5513	(75)
Southeast	4.5700	36.7938	0.6300	0.7000	0.7700	51.3882	(77)
Southwest	1.2700	36.7938	0.6300	0.7000	0.7700	14.2807	(79)
West	0.9400	19.6403	0.6300	0.7000	0.7700	5.6422	(80)
Northwest	5.1800	11.2829	0.6300	0.7000	0.7700	17.8617	(81)

Solar gains	113.7789	208.9599	325.6887	469.4598	585.4467	607.2873	574.6497	484.2295	374.9149	241.7162	139.0516	95.5720 (83)
Total gains	536.1351	629.1475	731.0485	850.2260	941.0880	938.7937	890.9692	807.4735	711.1650	602.7831	527.9421	505.4448 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1404	54.2536	54.3650	54.8946	54.9948	55.4662	55.4662	55.5544	55.2837	54.9948	54.7924	54.5824	
alpha	4.6094	4.6169	4.6243	4.6596	4.6663	4.6977	4.6977	4.7036	4.6856	4.6663	4.6528	4.6388	
util living area													
	0.9983	0.9962	0.9893	0.9626	0.8815	0.7223	0.5601	0.6309	0.8743	0.9815	0.9966	0.9987	(86)
MIT	19.5591	19.7225	20.0078	20.3947	20.7334	20.9279	20.9827	20.9707	20.8123	20.3720	19.8960	19.5309	(87)
Th 2	19.8544	19.8565	19.8586	19.8683	19.8701	19.8786	19.8786	19.8802	19.8753	19.8701	19.8665	19.8626	(88)
util rest of house													
	0.9978	0.9949	0.9853	0.9476	0.8347	0.6250	0.4273	0.4950	0.8054	0.9716	0.9952	0.9983	(89)
MIT 2	17.9409	18.1809	18.5972	19.1563	19.6086	19.8310	19.8725	19.8682	19.7205	19.1341	18.4419	17.9052	(90)
Living area fraction									fLA = Living area / (4) =			0.1913	(91)
MIT	18.2505	18.4758	18.8670	19.3932	19.8238	20.0409	20.0848	20.0791	19.9294	19.3709	18.7201	18.2162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2505	18.4758	18.8670	19.3932	19.8238	20.0409	20.0848	20.0791	19.9294	19.3709	18.7201	18.2162	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9924	0.9803	0.9394	0.8325	0.6404	0.4527	0.5207	0.8094	0.9653	0.9929	0.9973	(94)
Useful gains	534.2354	624.3542	716.6503	798.6612	783.4118	601.1738	403.3826	420.4726	575.6136	581.8553	524.2092	504.0729	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1678.0904	1629.6148	1481.4739	1244.8780	962.0199	638.8319	409.1695	431.2945	686.7109	1038.6506	1381.1345	1672.3450	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	851.0282	675.5351	569.0288	321.2761	132.8844	0.0000	0.0000	0.0000	0.0000	339.8557	616.9862	869.1944	(98)
Space heating												4375.7889	(98)
Space heating per m2											(98) / (4) =	46.6601	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4684.9988	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	851.0282	675.5351	569.0288	321.2761	132.8844	0.0000	0.0000	0.0000	0.0000	339.8557	616.9862	869.1944	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	911.1651	723.2710	609.2385	343.9787	142.2746	0.0000	0.0000	0.0000	0.0000	363.8712	660.5848	930.6150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2014	88.0157	87.5920	86.5932	84.4805	80.3000	80.3000	80.3000	80.3000	86.6142	87.7851	88.2783	(217)
Fuel for water heating, kWh/month													
	238.4841	210.6768	222.2076	199.3604	197.8429	183.3206	175.6351	195.7920	197.9543	208.9780	218.0986	232.5792	(219)
Water heating fuel used												2480.9297	(219)
Annual totals kWh/year													
Space heating fuel - main system												4684.9988	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												389.0310	(232)
Total delivered energy for all uses												7629.9595	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4684.9988	0.2160	1011.9597	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2480.9297	0.2160	535.8808	(264)
Space and water heating			1547.8405	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.0310	0.5190	201.9071	(268)
Total CO2, kg/m2/year			1788.6727	(272)
Emissions per m2 for space and water heating			16.5050	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1530	(272b)
Emissions per m2 for pumps and fans			0.4151	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5050 * 1.00) + 2.1530 + 0.4151, rounded to 2 d.p.			19.0700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 119 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 119	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 119, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.35	**TER**	19.07
Environmental	94 A	**% DER<TER**	56.22		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.92	**TFEE**	60.39
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.33 m	47.51 m²	2.31 m
1st Storey:	27.74 m	46.27 m²	2.63 m

7.0 Living Area	17.94	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	138.27	112.77

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.27	46.27
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	47.51

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.20	100
D2 W14	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	South West							2.14	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.20	100

W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		1.41	100
W12	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.19	0.065	No
Independently assessed	E3 Sill	14.56	0.004	No
Independently assessed	E4 Jamb	44.55	0.005	No
Independently assessed	E5 Ground floor (normal)	28.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	27.74	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.57	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.17	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.023	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 119 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 119	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 119, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.35	**TER**	19.07
Environmental	94 A	**% DER<TER**	56.22		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.92	**TFEE**	60.39
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.78	m^2	
DER	8.35	$kgCO_2/yr/m^2$	
TER	19.07	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.35	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.22	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.92	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.78	m^2	
DER	20.15	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.39	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.39	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 120 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 120	**Prop Type Ref**	As
Property	L474-R - Det SG, Plot 120, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.45	**TER**	15.56
Environmental	96 A	**% DER<TER**	64.98		
CO_2 Emissions (t/year)	0.23	**DFEE**	41.14	**TFEE**	53.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 158 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.45 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 8.19 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 11.13 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.016 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3785	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3217	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4101	0.4021	0.3941	0.3539	0.3458	0.3056	0.3056	0.2976	0.3217	0.3458	0.3619	0.3780	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6601	0.6521	0.6441	0.6039	0.5958	0.5556	0.5556	0.5476	0.5717	0.5958	0.6119	0.6280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7600	1.2357	25.6540			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			79.1500	0.1200	9.4980			(28a)
External Wall	182.4200	25.0400	157.3800	0.2100	33.0498			(29a)
Main Roof	79.1500		79.1500	0.0700	5.5405			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.1623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6082	(36)
Total fabric heat loss					(33) + (36) =		85.7705	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.1791	84.1414	83.1037	77.9153	76.8777	71.6893	71.6893	70.6516	73.7646	76.8777	78.9530	81.0284	(38)
Heat transfer coeff	170.9495	169.9118	168.8742	163.6858	162.6481	157.4597	157.4597	156.4221	159.5351	162.6481	164.7235	166.7988	(39)
Average = Sum(39)m / 12 =												163.4264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0799	1.0734	1.0668	1.0340	1.0275	0.9947	0.9947	0.9881	1.0078	1.0275	1.0406	1.0537	(40)
HLP (average)												1.0324	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465	(42)
Average daily hot water use (litres/day)	104.1795	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8343	10.6789	11.7995	11.3880	11.7413	11.3252	11.6795	11.7196	11.3574	11.7690	11.4255	11.8231	(61)
Total heat required for water heating calculated for each month													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(64)
								Total per year (kWh/year) = Sum(64)m =				1777.6897	(64)
Heat gains from water heating, kWh/month													
	59.4652	52.0907	53.9480	47.3084	45.5971	39.6451	37.0333	42.0755	42.4525	49.1076	53.2494	57.6794	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	79.9263	77.5160	72.5107	65.7061	61.2864	55.0627	49.7759	56.5531	58.9618	66.0048	73.9576	77.5261	(72)
Total internal gains													
	511.4993	508.9337	490.0132	459.2618	427.2806	397.2655	378.3324	385.2649	401.5889	432.5786	468.0929	495.4528	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.7200	0.7000	0.7700	32.2753	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	11.1300	36.7938	0.7200	0.7000	0.7700	143.0322	(79)
Northwest	0.7200	11.2829	0.7200	0.7000	0.7700	2.8374	(81)

Solar gains	187.3977	330.8706	483.6906	651.2417	776.8403	792.0702	754.9643	658.0749	541.2124	374.0352	226.5832	158.9990	(83)
Total gains	698.8970	839.8043	973.7037	1110.5035	1204.1208	1189.3356	1133.2967	1043.3399	942.8013	806.6138	694.6760	654.4518	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1008	48.3945	48.6919	50.2353	50.5558	52.2216	52.2216	52.5681	51.5423	50.5558	49.9188	49.2977	
alpha	4.2067	4.2263	4.2461	4.3490	4.3704	4.4814	4.4814	4.5045	4.4362	4.3704	4.3279	4.2865	
util living area													
	0.9980	0.9953	0.9879	0.9628	0.8934	0.7441	0.5833	0.6435	0.8732	0.9790	0.9960	0.9985	(86)
MIT	19.3758	19.5676	19.8773	20.3065	20.6671	20.9058	20.9756	20.9630	20.7875	20.3127	19.7861	19.3724	(87)
Th 2	20.0173	20.0227	20.0280	20.0551	20.0605	20.0878	20.0878	20.0932	20.0768	20.0605	20.0497	20.0388	(88)
util rest of house													
	0.9974	0.9940	0.9845	0.9515	0.8597	0.6691	0.4747	0.5358	0.8206	0.9708	0.9947	0.9981	(89)
MIT 2	17.8232	18.1069	18.5615	19.1978	19.6981	20.0109	20.0751	20.0722	19.8752	19.2170	18.4449	17.8325	(90)
Living area fraction										fLA = Living area / (4) =		0.2087	(91)
MIT	18.1471	18.4116	18.8360	19.4291	19.9003	20.1976	20.2630	20.2580	20.0655	19.4456	18.7247	18.1538	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1471	18.4116	18.8360	19.4291	19.9003	20.1976	20.2630	20.2580	20.0655	19.4456	18.7247	18.1538	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9909	0.9785	0.9419	0.8529	0.6790	0.4965	0.5566	0.8199	0.9633	0.9920	0.9969	(94)
Useful gains	695.9834	832.1691	952.7919	1045.9557	1026.9582	807.5168	562.7027	580.7612	772.9691	777.0328	689.1526	652.4048	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2367.1608	2295.7887	2083.2351	1723.4639	1333.7592	881.4012	576.7769	603.4816	951.7131	1438.7255	1914.8642	2327.4839	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1243.3559	983.5524	841.0498	487.8059	228.2599	0.0000	0.0000	0.0000	0.0000	492.2994	882.5123	1246.2589	(98)
Space heating												6405.0945	(98)
Space heating per m2											(98) / (4) =	40.4617	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6865.0531	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1243.3559	983.5524	841.0498	487.8059	228.2599	0.0000	0.0000	0.0000	0.0000	492.2994	882.5123	1246.2589	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1332.6430	1054.1827	901.4467	522.8359	244.6516	0.0000	0.0000	0.0000	0.0000	527.6521	945.8867	1335.7544	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8243	89.7803	89.6887	89.4485	88.8964	86.7000	86.7000	86.7000	86.7000	89.4301	89.7192	89.8375	(217)
Fuel for water heating, kWh/month													
	202.3718	177.4481	184.1673	162.2234	157.5398	140.7653	131.8065	149.3089	150.5130	168.4133	181.6596	196.3606	(219)
Water heating fuel used												2002.5775	(219)
Annual totals kWh/year													
Space heating fuel - main system												6865.0531	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6839.4278	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6865.0531	0.2160	1482.8515	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.5775	0.2160	432.5567	(264)
Space and water heating			1915.4082	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			862.7710	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.4500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.4500	ZC1
Total Floor Area	TFA	158.3000	
Assumed number of occupants	N	2.9465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.3313	ZC2
CO2 emissions from cooking, equation (L16)		1.1985	ZC3
Total CO2 emissions		18.9797	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		18.9797	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1023 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3523 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3818	0.3743	0.3668	0.3294	0.3219	0.2845	0.2845	0.2770	0.2995	0.3219	0.3369	0.3519	(22b)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5448	0.5518	0.5567	0.5619	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			20.7600	1.3258	27.5227			(27)
Ground floor			79.1500	0.1300	10.2895			(28a)
External Wall	182.4200	25.0400	157.3800	0.1800	28.3284			(29a)
Main Roof	79.1500		79.1500	0.1300	10.2895			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.5661			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.3390 (36)
Total fabric heat loss	(33) + (36) =	94.9051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.9200	73.5548	73.1968	71.5154	71.2008	69.7364	69.7364	69.4652	70.3005	71.2008	71.8372	72.5025	(38)
Heat transfer coeff	168.8251	168.4599	168.1019	166.4206	166.1060	164.6416	164.6416	164.3704	165.2056	166.1060	166.7424	167.4077	(39)
Average = Sum(39)m / 12 =												166.4190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0665	1.0642	1.0619	1.0513	1.0493	1.0401	1.0401	1.0383	1.0436	1.0493	1.0533	1.0575	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465 (42)
Average daily hot water use (litres/day)	104.1795 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.9034	46.2386	47.7798	49.9034	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
								Total per year (kWh/year) = Sum(64)m =				2230.7819	(64)
Heat gains from water heating, kWh/month													
	69.2463	60.9279	63.7378	56.7901	55.1376	48.3735	46.0584	51.6215	51.9419	58.9051	62.7218	67.4633	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	93.0730	90.6665	85.6691	78.8752	74.1096	67.1854	61.9064	69.3837	72.1416	79.1735	87.1137	90.6765	(72)
Total internal gains													
	524.6460	522.0842	503.1715	472.4310	440.1038	409.3882	390.4629	398.0955	414.7686	445.7472	481.2490	508.6032	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.6300	0.7000	0.7700	28.2409	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	11.1300	36.7938	0.6300	0.7000	0.7700	125.1532	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	163.9730	289.5117	423.2293	569.8365	679.7352	693.0614	660.5938	575.8156	473.5608	327.2808	198.2603	139.1241	(83)
Total gains	688.6190	811.5960	926.4008	1042.2674	1119.8391	1102.4496	1051.0567	973.9111	888.3295	773.0280	679.5093	647.7274	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1151	65.2562	65.3952	66.0559	66.1810	66.7696	66.7696	66.8798	66.5417	66.1810	65.9284	65.6664	
alpha	5.3410	5.3504	5.3597	5.4037	5.4121	5.4513	5.4513	5.4587	5.4361	5.4121	5.3952	5.3778	
util living area													
	0.9996	0.9989	0.9965	0.9861	0.9447	0.8253	0.6583	0.7222	0.9288	0.9928	0.9991	0.9997	(86)
MIT	19.7162	19.8540	20.0870	20.4043	20.7058	20.9129	20.9803	20.9681	20.8095	20.4198	20.0103	19.6936	(87)
Th 2	20.0283	20.0302	20.0321	20.0408	20.0424	20.0501	20.0501	20.0515	20.0471	20.0424	20.0391	20.0357	(88)
util rest of house													
	0.9995	0.9985	0.9952	0.9800	0.9187	0.7469	0.5316	0.5987	0.8838	0.9889	0.9987	0.9996	(89)
MIT 2	18.2926	18.4956	18.8374	19.3041	19.7265	19.9845	20.0418	20.0363	19.8723	19.3307	18.7310	18.2649	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.5896	18.7790	19.0981	19.5336	19.9308	20.1782	20.2377	20.2307	20.0678	19.5580	18.9979	18.5630	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5896	18.7790	19.0981	19.5336	19.9308	20.1782	20.2377	20.2307	20.0678	19.5580	18.9979	18.5630	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9977	0.9933	0.9757	0.9149	0.7588	0.5581	0.6240	0.8851	0.9859	0.9980	0.9994	(94)
Useful gains	688.0107	809.7505	920.1680	1016.8940	1024.5370	836.5723	586.5743	607.7629	786.2364	762.1324	678.1288	647.3182	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2412.4493	2338.0585	2117.7625	1769.6565	1367.1869	918.4083	598.9094	629.6545	985.9181	1487.9732	1983.8897	2404.4751	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1282.9823	1027.0230	891.0104	541.9890	254.9316	0.0000	0.0000	0.0000	0.0000	540.0256	940.1479	1307.3247	(98)
Space heating												6785.4342	(98)
Space heating per m2											(98) / (4) =	42.8644	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7264.9189	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1282.9823	1027.0230	891.0104	541.9890	254.9316	0.0000	0.0000	0.0000	0.0000	540.0256	940.1479	1307.3247	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1373.6427	1099.5963	953.9725	580.2880	272.9460	0.0000	0.0000	0.0000	0.0000	578.1858	1006.5823	1399.7052	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7601	88.6239	88.3275	87.6179	85.9520	80.3000	80.3000	80.3000	80.3000	87.5366	88.4416	88.8188	(217)
Fuel for water heating, kWh/month													
	248.8770	219.6497	231.3397	208.8997	207.3358	195.4631	187.2685	208.7605	209.7789	216.8258	227.1251	242.6751	(219)
Water heating fuel used												2603.9990	(219)
Annual totals kWh/year													
Space heating fuel - main system												7264.9189	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Total delivered energy for all uses												10508.3670	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7264.9189	0.2160	1569.2225	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2603.9990	0.2160	562.4638	(264)
Space and water heating			2131.6863	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Total CO2, kg/m2/year			2463.5604	(272)
Emissions per m2 for space and water heating			13.4661	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8506	(272b)
Emissions per m2 for pumps and fans			0.2459	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4661 * 1.00) + 1.8506 + 0.2459, rounded to 2 d.p.			15.5600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 120 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 120	**Prop Type Ref**	As
Property	L474-R - Det SG, Plot 120, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.45	**TER**	15.56
Environmental	96 A	**% DER<TER**	64.98		
CO_2 Emissions (t/year)	0.23	**DFEE**	41.14	**TFEE**	53.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.97 m	79.15 m²	2.31 m
1st Storey:	36.97 m	79.15 m²	2.63 m

7.0 Living Area	33.03	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	187.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	182.42	157.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	79.15	79.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	79.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.03	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.90	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W11*	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					5.69	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.14	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.05	0.005	No
Independently assessed	E5 Ground floor (normal)	36.97	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	36.97	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	24.37	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.016	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	21	
Total number of L.E.L. fittings	21	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 120 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 120	**Prop Type Ref**	As
Property	L474-R - Det SG, Plot 120, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.45	**TER**	15.56
Environmental	96 A	**% DER<TER**	64.98		
CO_2 Emissions (t/year)	0.23	**DFEE**	41.14	**TFEE**	53.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	158.3	m^2	
DER	5.45	$kgCO_2/yr/m^2$	
TER	15.56	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.45	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.98	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.14	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	158.3	m^2	
DER	15.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.48	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.48	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	20.73	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	20.73	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 121 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 121	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 121, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 8.19 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 10.34 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8318	10.6767	11.7973	11.3860	11.7376	11.3222	11.6766	11.7162	11.3556	11.7670	11.4232	11.8206	(61)
Total heat required for water heating calculated for each month													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
								Total per year (kWh/year) = Sum(64)m =				1766.1786	(64)
Heat gains from water heating, kWh/month													
	59.0688	51.7440	53.5902	46.9965	45.2973	39.3865	36.7936	41.8005	42.1746	48.7837	52.8959	57.2955	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	79.3935	77.0001	72.0298	65.2729	60.8835	54.7035	49.4538	56.1835	58.5759	65.5695	73.4666	77.0101	(72)
Total internal gains													
	487.3714	484.8707	466.9195	437.7862	407.6209	379.1718	361.1270	367.9639	383.3372	412.7072	446.3802	472.1928	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.7200	0.7000	0.7700	32.2753	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	10.3400	36.7938	0.7200	0.7000	0.7700	132.8799	(79)

Solar gains	174.4080	307.8018	449.6235	604.8350	721.0309	734.9798	700.6242	611.0071	502.9126	347.8643	210.8528	147.9936	(83)
Total gains	661.7793	792.6725	916.5431	1042.6212	1128.6518	1114.1515	1061.7511	978.9710	886.2498	760.5715	657.2331	620.1863	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area													
	0.9977	0.9947	0.9868	0.9600	0.8875	0.7348	0.5737	0.6329	0.8655	0.9770	0.9955	0.9983	(86)
MIT	19.3888	19.5819	19.8921	20.3207	20.6774	20.9103	20.9770	20.9653	20.7961	20.3262	19.7997	19.3854	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house													
	0.9971	0.9933	0.9829	0.9475	0.8510	0.6560	0.4616	0.5212	0.8087	0.9676	0.9940	0.9978	(89)
MIT 2	17.8105	18.0960	18.5511	19.1860	19.6780	19.9807	20.0402	20.0384	19.8518	19.2051	18.4338	17.8204	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.1278	18.3947	18.8207	19.4141	19.8789	20.1676	20.2286	20.2247	20.0416	19.4305	18.7084	18.1350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1278	18.3947	18.8207	19.4141	19.8789	20.1676	20.2286	20.2247	20.0416	19.4305	18.7084	18.1350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9899	0.9765	0.9375	0.8446	0.6665	0.4835	0.5423	0.8088	0.9597	0.9910	0.9964	(94)
Useful gains	658.6570	784.6554	895.0078	977.4851	953.3053	742.6309	513.3738	530.9225	716.7671	729.9406	651.3456	617.9765	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2173.7199	2108.3571	1913.0655	1581.8843	1222.6635	805.4688	524.9472	549.6430	871.0309	1320.0633	1757.7128	2136.8620	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1127.2068	889.5275	757.4349	435.1674	200.4025	0.0000	0.0000	0.0000	0.0000	439.0513	796.5844	1130.0508	(98)
Space heating												5775.4258	(98)
Space heating per m2											(98) / (4) =	41.4544	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6190.1669	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1127.2068	889.5275	757.4349	435.1674	200.4025	0.0000	0.0000	0.0000	0.0000	439.0513	796.5844	1130.0508	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1208.1530	953.4057	811.8274	466.4174	214.7937	0.0000	0.0000	0.0000	0.0000	470.5802	853.7882	1211.2013	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7852	89.7372	89.6372	89.3765	88.7892	86.7000	86.7000	86.7000	86.7000	89.3569	89.6710	89.7994	(217)
Fuel for water heating, kWh/month													
	201.1313	176.3709	183.0720	161.3040	156.7138	139.8673	130.9744	148.3539	149.5485	167.4606	180.5710	195.1575	(219)
Water heating fuel used												1990.5252	(219)
Annual totals kWh/year													
Space heating fuel - main system												6190.1669	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =										-2338.3122		-2338.3122	(233)
Total delivered energy for all uses												6440.1884	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6190.1669	0.2160	1337.0761	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5252	0.2160	429.9534	(264)
Space and water heating			1767.0295	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			863.7081	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.2000	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.6839	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.6839	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.6300	0.7000	0.7700	28.2409	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	10.3400	36.7938	0.6300	0.7000	0.7700	116.2699	(79)

Solar gains	152.6070	269.3266	393.4206	529.2306	630.9021	643.1073	613.0461	534.6312	440.0486	304.3813	184.4962	129.4944	(83)
Total gains	653.1259	767.3485	873.4993	980.1866	1051.2300	1034.2904	986.1921	915.3094	836.5661	730.2578	644.0333	614.8384	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9994	0.9984	0.9953	0.9823	0.9349	0.8078	0.6400	0.7025	0.9164	0.9905	0.9986	0.9996	(86)
MIT	19.6979	19.8410	20.0811	20.4066	20.7113	20.9158	20.9809	20.9693	20.8151	20.4208	20.0002	19.6745	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9992	0.9979	0.9935	0.9748	0.9052	0.7254	0.5118	0.5764	0.8657	0.9853	0.9980	0.9994	(89)
MIT 2	18.2439	18.4546	18.8066	19.2843	19.7079	19.9593	20.0133	20.0085	19.8525	19.3099	18.6947	18.2154	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.5362	18.7334	19.0629	19.5100	19.9096	20.1516	20.2079	20.2017	20.0460	19.5332	18.9572	18.5087	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5362	18.7334	19.0629	19.5100	19.9096	20.1516	20.2079	20.2017	20.0460	19.5332	18.9572	18.5087	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9968	0.9910	0.9697	0.9014	0.7378	0.5376	0.6014	0.8675	0.9816	0.9971	0.9990	(94)
Useful gains	652.2692	764.8847	865.6543	950.4447	947.5330	763.0661	530.1832	550.4655	725.7504	716.8138	642.1523	614.2519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2189.2466	2122.4908	1923.2777	1607.3370	1241.2440	831.6315	540.4621	568.5109	893.9082	1350.6481	1799.9116	2181.1071	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1143.5112	912.3113	786.8719	472.9625	218.5210	0.0000	0.0000	0.0000	0.0000	471.5727	833.5867	1165.7402	(98)
Space heating												6005.0774	(98)
Space heating per m2											(98) / (4) =	43.1028	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6429.4191	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1143.5112	912.3113	786.8719	472.9625	218.5210	0.0000	0.0000	0.0000	0.0000	471.5727	833.5867	1165.7402	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1224.3160	976.7787	842.4752	506.3838	233.9625	0.0000	0.0000	0.0000	0.0000	504.8958	892.4912	1248.1159	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6038	88.4522	88.1246	87.3460	85.5833	80.3000	80.3000	80.3000	80.3000	87.2617	88.2537	88.6676	(217)
Fuel for water heating, kWh/month													
	247.9726	218.8990	230.6534	208.4776	206.7705	194.0940	185.9568	207.2983	208.7397	216.3945	226.4060	241.7890	(219)
Water heating fuel used												2593.4514	(219)
Annual totals kWh/year													
Space heating fuel - main system												6429.4191	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9620.6790	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6429.4191	0.2160	1388.7545	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2593.4514	0.2160	560.1855	(264)
Space and water heating			1948.9400	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2259.2027	(272)
Emissions per m2 for space and water heating			13.9889	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9889 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.2200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 121 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 121	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 121, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 121 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 121	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 121, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	6.20	$kgCO_2/yr/m^2$	
TER	16.22	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.20	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.77	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.28	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.28	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.09	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.57	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.57	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 122 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 122	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 122, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.97	**TER**	16.68
Environmental	96 A	**% DER<TER**	64.21		
CO_2 Emissions (t/year)	0.23	**DFEE**	42.92	**TFEE**	55.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.14		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.68 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 7.21 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 7.93 m², No overhang
Windows facing North West: 1.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c       Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                  1.0400            10.6334            0.7200           0.7000           0.7700            3.8625 (74)
Northeast                              7.2100            11.2829            0.7200           0.7000           0.7700           28.4133 (75)
East                                   1.0400            19.6403            0.7200           0.7000           0.7700            7.1342 (76)
Southeast                              0.7200            36.7938            0.7200           0.7000           0.7700            9.2528 (77)
Southwest                              7.9300            36.7938            0.7200           0.7000           0.7700          101.9089 (79)
Northwest                              1.4400            11.2829            0.7200           0.7000           0.7700            5.6748 (81)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   156.2464  280.0740  419.6162  579.9834  703.7504  722.2807  686.5400  590.7166  474.6671  319.4147  189.6980  132.0560 (83)
Total gains   634.8985  756.2719  878.2380 1010.0767 1104.3435 1094.9887 1041.5113  952.4651  851.4220  724.9339  628.2142  595.8289 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9980    0.9954    0.9879    0.9610    0.8848    0.7263    0.5644    0.6282    0.8686    0.9791    0.9961    0.9985 (86)

MIT           19.4335   19.6182   19.9234   20.3478   20.7002   20.9205   20.9804   20.9690   20.8042   20.3410   19.8291   19.4286 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9974    0.9941    0.9843    0.9484    0.8470    0.6459    0.4524    0.5155    0.8112    0.9703    0.9947    0.9981 (89)
MIT 2         17.8709   18.1441   18.5918   19.2195   19.7033   19.9860   20.0380   20.0364   19.8575   19.2209   18.4709   17.8779 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1959 (91)
MIT           18.1769   18.4328   18.8526   19.4405   19.8985   20.1690   20.2226   20.2190   20.0429   19.4403   18.7369   18.1816 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.1769   18.4328   18.8526   19.4405   19.8985   20.1690   20.2226   20.2190   20.0429   19.4403   18.7369   18.1816 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9959    0.9911    0.9784    0.9389    0.8415    0.6570    0.4739    0.5365    0.8117    0.9630    0.9921    0.9969 (94)
Useful gains 632.2765  749.5450  859.2965  948.4050  929.2551  719.4380  493.5802  510.9760  691.0875  698.1133  623.2492  593.9745 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2083.5313 2020.1089 1833.1952 1518.4776 1173.9647  773.2465  502.9842  526.9484  835.4918 1265.8650 1686.5351 2050.6543 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1079.7335  853.8190  724.5806  410.4523  182.0639    0.0000    0.0000    0.0000    0.0000  422.4073  765.5658 1083.7698 (98)
Space heating                                                                                                              5522.3922 (98)
Space heating per m2                                                                                          (98) / (4) =    41.5030 (99)
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5918.9627	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1079.7335	853.8190	724.5806	410.4523	182.0639	0.0000	0.0000	0.0000	0.0000	422.4073	765.5658	1083.7698	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1157.2707	915.1329	776.6138	439.9275	195.1382	0.0000	0.0000	0.0000	0.0000	452.7409	820.5421	1161.5968	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7672	89.7188	89.6145	89.3378	88.7069	86.7000	86.7000	86.7000	86.7000	89.3317	89.6516	89.7824	(217)
Fuel for water heating, kWh/month													
	200.5976	175.9047	182.5996	160.9201	156.4197	139.4795	130.6150	147.9414	149.1319	167.0366	180.0975	194.6387	(219)
Water heating fuel used												1985.3825	(219)
Annual totals kWh/year													
Space heating fuel - main system												5918.9627	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												6145.7483	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5918.9627	0.2160	1278.4959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.3825	0.2160	428.8426	(264)
Space and water heating			1707.3386	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			794.6268	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9700	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		20.8094	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.8094	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	7.2100	11.2829	0.6300	0.7000	0.7700	24.8616	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	7.9300	36.7938	0.6300	0.7000	0.7700	89.1703	(79)
Northwest	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654	(81)

Solar gains	136.7156	245.0648	367.1641	507.4855	615.7816	631.9956	600.7225	516.8771	415.3337	279.4878	165.9857	115.5490 (83)
Total gains	628.5156	734.4143	838.9454	950.7489	1029.0316	1016.6667	967.6647	891.2896	805.2692	698.1767	617.6592	592.4736 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9994	0.9984	0.9952	0.9818	0.9322	0.8025	0.6362	0.7023	0.9180	0.9907	0.9986	0.9995	(86)
MIT	19.6679	19.8096	20.0547	20.3912	20.7058	20.9143	20.9801	20.9675	20.8052	20.4000	19.9743	19.6452	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9991	0.9978	0.9934	0.9740	0.9013	0.7183	0.5062	0.5742	0.8674	0.9855	0.9980	0.9994	(89)
MIT 2	18.1857	18.3944	18.7536	19.2472	19.6839	19.9390	19.9934	19.9881	19.8237	19.2654	18.6426	18.1581	(90)
Living area fraction									fLA = Living area / (4) =			0.1959	(91)
MIT	18.4760	18.6716	19.0084	19.4712	19.8840	20.1301	20.1867	20.1799	20.0160	19.4876	18.9035	18.4494	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4760	18.6716	19.0084	19.4712	19.8840	20.1301	20.1867	20.1799	20.0160	19.4876	18.9035	18.4494	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9967	0.9908	0.9685	0.8972	0.7305	0.5317	0.5989	0.8685	0.9817	0.9970	0.9990	(94)
Useful gains	627.6378	732.0019	831.2563	920.8269	923.2396	742.6528	514.5056	533.7658	699.4081	685.4209	615.7932	591.8648	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2128.9720	2063.5295	1870.0716	1563.8213	1208.2654	808.8675	524.6140	551.9152	868.4337	1312.1441	1749.6603	2121.0946	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1116.9926	894.7865	772.8786	462.9560	212.0592	0.0000	0.0000	0.0000	0.0000	466.2820	816.3843	1137.7470	(98)
Space heating												5880.0863	(98)
Space heating per m2											(98) / (4) =	44.1912	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6295.5956	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1116.9926	894.7865	772.8786	462.9560	212.0592	0.0000	0.0000	0.0000	0.0000	466.2820	816.3843	1137.7470	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1195.9236	958.0155	827.4932	495.6702	227.0441	0.0000	0.0000	0.0000	0.0000	499.2313	874.0731	1218.1446	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5724	88.4252	88.0968	87.3050	85.5154	80.3000	80.3000	80.3000	80.3000	87.2421	88.2222	88.6358	(217)
Fuel for water heating, kWh/month													
	247.4801	218.4572	230.1993	208.1121	206.3045	193.5027	185.3903	206.6667	208.2909	215.9617	225.9672	241.3139	(219)
Water heating fuel used												2587.6465	(219)
Annual totals kWh/year													
Space heating fuel - main system												6295.5956	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9462.9575	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6295.5956	0.2160	1359.8487	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.6465	0.2160	558.9317	(264)
Space and water heating			1918.7803	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2219.6526	(272)
Emissions per m2 for space and water heating			14.4204	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4204 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 122 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 122	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 122, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.97	**TER**	16.68
Environmental	96 A	**% DER<TER**	64.21		
CO_2 Emissions (t/year)	0.23	**DFEE**	42.92	**TFEE**	55.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.14		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 122 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 122	**Prop Type Ref**	As
Property	L470-R - Det SG, Plot 122, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.97	**TER**	16.68
Environmental	96 A	**% DER<TER**	64.21		
CO_2 Emissions (t/year)	0.23	**DFEE**	42.92	**TFEE**	55.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.14		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	5.97	$kgCO_2/yr/m^2$	
TER	16.68	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.97	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.21	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.92	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	17.02	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.86	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.86	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.74	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.74	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 123 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 123	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 123, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 8.19 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 10.34 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8318	10.6767	11.7973	11.3860	11.7376	11.3222	11.6766	11.7162	11.3556	11.7670	11.4232	11.8206	(61)
Total heat required for water heating calculated for each month													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
								Total per year (kWh/year) = Sum(64)m =				1766.1786	(64)
Heat gains from water heating, kWh/month													
	59.0688	51.7440	53.5902	46.9965	45.2973	39.3865	36.7936	41.8005	42.1746	48.7837	52.8959	57.2955	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	79.3935	77.0001	72.0298	65.2729	60.8835	54.7035	49.4538	56.1835	58.5759	65.5695	73.4666	77.0101	(72)
Total internal gains													
	487.3714	484.8707	466.9195	437.7862	407.6209	379.1718	361.1270	367.9639	383.3372	412.7072	446.3802	472.1928	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.7200	0.7000	0.7700	32.2753	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	10.3400	36.7938	0.7200	0.7000	0.7700	132.8799	(79)

Solar gains	174.4080	307.8018	449.6235	604.8350	721.0309	734.9798	700.6242	611.0071	502.9126	347.8643	210.8528	147.9936	(83)
Total gains	661.7793	792.6725	916.5431	1042.6212	1128.6518	1114.1515	1061.7511	978.9710	886.2498	760.5715	657.2331	620.1863	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area													
	0.9977	0.9947	0.9868	0.9600	0.8875	0.7348	0.5737	0.6329	0.8655	0.9770	0.9955	0.9983	(86)
MIT	19.3888	19.5819	19.8921	20.3207	20.6774	20.9103	20.9770	20.9653	20.7961	20.3262	19.7997	19.3854	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house													
	0.9971	0.9933	0.9829	0.9475	0.8510	0.6560	0.4616	0.5212	0.8087	0.9676	0.9940	0.9978	(89)
MIT 2	17.8105	18.0960	18.5511	19.1860	19.6780	19.9807	20.0402	20.0384	19.8518	19.2051	18.4338	17.8204	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.1278	18.3947	18.8207	19.4141	19.8789	20.1676	20.2286	20.2247	20.0416	19.4305	18.7084	18.1350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1278	18.3947	18.8207	19.4141	19.8789	20.1676	20.2286	20.2247	20.0416	19.4305	18.7084	18.1350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9899	0.9765	0.9375	0.8446	0.6665	0.4835	0.5423	0.8088	0.9597	0.9910	0.9964	(94)
Useful gains	658.6570	784.6554	895.0078	977.4851	953.3053	742.6309	513.3738	530.9225	716.7671	729.9406	651.3456	617.9765	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2173.7199	2108.3571	1913.0655	1581.8843	1222.6635	805.4688	524.9472	549.6430	871.0309	1320.0633	1757.7128	2136.8620	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1127.2068	889.5275	757.4349	435.1674	200.4025	0.0000	0.0000	0.0000	0.0000	439.0513	796.5844	1130.0508	(98)
Space heating												5775.4258	(98)
Space heating per m2											(98) / (4) =	41.4544	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6190.1669	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1127.2068	889.5275	757.4349	435.1674	200.4025	0.0000	0.0000	0.0000	0.0000	439.0513	796.5844	1130.0508	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1208.1530	953.4057	811.8274	466.4174	214.7937	0.0000	0.0000	0.0000	0.0000	470.5802	853.7882	1211.2013	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7852	89.7372	89.6372	89.3765	88.7892	86.7000	86.7000	86.7000	86.7000	89.3569	89.6710	89.7994	(217)
Fuel for water heating, kWh/month													
	201.1313	176.3709	183.0720	161.3040	156.7138	139.8673	130.9744	148.3539	149.5485	167.4606	180.5710	195.1575	(219)
Water heating fuel used												1990.5252	(219)
Annual totals kWh/year													
Space heating fuel - main system												6190.1669	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =										-2338.3122		-2338.3122	(233)
Total delivered energy for all uses												6440.1884	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6190.1669	0.2160	1337.0761	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5252	0.2160	429.9534	(264)
Space and water heating			1767.0295	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			863.7081	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.2000	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.6839	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.6839	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1900	11.2829	0.6300	0.7000	0.7700	28.2409	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	10.3400	36.7938	0.6300	0.7000	0.7700	116.2699	(79)

Solar gains	152.6070	269.3266	393.4206	529.2306	630.9021	643.1073	613.0461	534.6312	440.0486	304.3813	184.4962	129.4944	(83)
Total gains	653.1259	767.3485	873.4993	980.1866	1051.2300	1034.2904	986.1921	915.3094	836.5661	730.2578	644.0333	614.8384	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9994	0.9984	0.9953	0.9823	0.9349	0.8078	0.6400	0.7025	0.9164	0.9905	0.9986	0.9996	(86)
MIT	19.6979	19.8410	20.0811	20.4066	20.7113	20.9158	20.9809	20.9693	20.8151	20.4208	20.0002	19.6745	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9992	0.9979	0.9935	0.9748	0.9052	0.7254	0.5118	0.5764	0.8657	0.9853	0.9980	0.9994	(89)
MIT 2	18.2439	18.4546	18.8066	19.2843	19.7079	19.9593	20.0133	20.0085	19.8525	19.3099	18.6947	18.2154	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.5362	18.7334	19.0629	19.5100	19.9096	20.1516	20.2079	20.2017	20.0460	19.5332	18.9572	18.5087	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5362	18.7334	19.0629	19.5100	19.9096	20.1516	20.2079	20.2017	20.0460	19.5332	18.9572	18.5087	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9968	0.9910	0.9697	0.9014	0.7378	0.5376	0.6014	0.8675	0.9816	0.9971	0.9990	(94)
Useful gains	652.2692	764.8847	865.6543	950.4447	947.5330	763.0661	530.1832	550.4655	725.7504	716.8138	642.1523	614.2519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2189.2466	2122.4908	1923.2777	1607.3370	1241.2440	831.6315	540.4621	568.5109	893.9082	1350.6481	1799.9116	2181.1071	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1143.5112	912.3113	786.8719	472.9625	218.5210	0.0000	0.0000	0.0000	0.0000	471.5727	833.5867	1165.7402	(98)
Space heating												6005.0774	(98)
Space heating per m2											(98) / (4) =	43.1028	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6429.4191	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1143.5112	912.3113	786.8719	472.9625	218.5210	0.0000	0.0000	0.0000	0.0000	471.5727	833.5867	1165.7402	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1224.3160	976.7787	842.4752	506.3838	233.9625	0.0000	0.0000	0.0000	0.0000	504.8958	892.4912	1248.1159	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6038	88.4522	88.1246	87.3460	85.5833	80.3000	80.3000	80.3000	80.3000	87.2617	88.2537	88.6676	(217)
Fuel for water heating, kWh/month													
	247.9726	218.8990	230.6534	208.4776	206.7705	194.0940	185.9568	207.2983	208.7397	216.3945	226.4060	241.7890	(219)
Water heating fuel used												2593.4514	(219)
Annual totals kWh/year													
Space heating fuel - main system												6429.4191	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9620.6790	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6429.4191	0.2160	1388.7545	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2593.4514	0.2160	560.1855	(264)
Space and water heating			1948.9400	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2259.2027	(272)
Emissions per m2 for space and water heating			13.9889	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9889 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.2200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 123 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 123	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 123, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 123 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 123	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 123, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.20	**TER**	16.22
Environmental	95 A	**% DER<TER**	61.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	41.72	**TFEE**	54.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	6.20	$kgCO_2/yr/m^2$	
TER	16.22	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.20	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.77	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.28	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.28	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.09	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.57	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.57	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 124 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 124	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 124, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.12	**TER**	17.71
Environmental	95 A	**% DER<TER**	59.80		
CO_2 Emissions (t/year)	0.33	**DFEE**	45.19	**TFEE**	59.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.12 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.07 m², No overhang
Windows facing North East: 6.92 m², No overhang
Windows facing South West: 9.05 m², No overhang
Windows facing West: 1.07 m², No overhang
Windows facing North West: 6.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8268	10.6723	11.7927	11.3819	11.7303	11.3161	11.6710	11.7094	11.3519	11.7628	11.4187	11.8158 (61)

Total heat required for water heating calculated for each month

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (64)

Total per year (kWh/year) = Sum(64)m = 1742.9413 (64)

Heat gains from water heating, kWh/month

	58.2686	51.0442	52.8680	46.3668	44.6923	38.8645	36.3099	41.2453	41.6136	48.1300	52.1823	56.5205 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)

Water heating gains (Table 5)

	78.3179	75.9586	71.0591	64.3983	60.0703	53.9785	48.8036	55.4373	57.7967	64.6908	72.4754	75.9684	(72)

Total internal gains

	454.4556	452.2051	435.7469	408.9569	381.3228	354.9930	338.0709	344.5956	358.5138	385.5371	416.6277	440.3588	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0700	10.6334	0.7200	0.7000	0.7700	3.9739	(74)
Northeast	6.9200	11.2829	0.7200	0.7000	0.7700	27.2704	(75)
Southwest	9.0500	36.7938	0.7200	0.7000	0.7700	116.3021	(79)
West	1.0700	19.6403	0.7200	0.7000	0.7700	7.3400	(80)
Northwest	6.7500	11.2829	0.7200	0.7000	0.7700	26.6005	(81)

Solar gains	181.4869	329.7142	505.1727	715.5259	882.5062	911.5871	864.1234	734.2538	577.2504	379.0346	221.1411	152.8729	(83)
Total gains	635.9425	781.9193	940.9195	1124.4827	1263.8290	1266.5801	1202.1943	1078.8495	935.7641	764.5717	637.7688	593.2317	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3274	47.5916	47.8587	49.2408	49.5269	51.0084	51.0084	51.3155	50.4053	49.5269	48.9580	48.4021	
alpha	4.1552	4.1728	4.1906	4.2827	4.3018	4.4006	4.4006	4.4210	4.3604	4.3018	4.2639	4.2268	
util living area	0.9972	0.9930	0.9803	0.9344	0.8211	0.6367	0.4832	0.5510	0.8170	0.9687	0.9943	0.9979	(86)
MIT	19.3914	19.6065	19.9537	20.4187	20.7675	20.9465	20.9873	20.9784	20.8370	20.3603	19.8065	19.3802	(87)
Th 2	19.8894	19.8948	19.9003	19.9278	19.9333	19.9610	19.9610	19.9665	19.9499	19.9333	19.9223	19.9113	(88)
util rest of house	0.9964	0.9910	0.9742	0.9141	0.7698	0.5501	0.3747	0.4373	0.7449	0.9553	0.9923	0.9973	(89)
MIT 2	17.7446	18.0618	18.5685	19.2447	19.7036	19.9237	19.9557	19.9566	19.8126	19.1796	18.3729	17.7427	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.1617	18.4530	18.9194	19.5421	19.9731	20.1828	20.2170	20.2154	20.0721	19.4786	18.7360	18.1574	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1617	18.4530	18.9194	19.5421	19.9731	20.1828	20.2170	20.2154	20.0721	19.4786	18.7360	18.1574	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9870	0.9667	0.9051	0.7720	0.5696	0.4021	0.4658	0.7545	0.9476	0.9890	0.9958	(94)
Useful gains	632.3532	771.7430	909.6311	1017.7608	975.6179	721.4290	483.3907	502.4869	706.0002	724.5118	630.7555	590.7208	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2019.6554	1963.7158	1789.4100	1490.2955	1151.8583	754.7090	488.9710	512.7005	816.9973	1236.1687	1638.9025	1988.4422	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1032.1528	801.0057	654.5555	340.2249	131.1229	0.0000	0.0000	0.0000	0.0000	380.6727	725.8658	1039.9048	(98)
Space heating												5105.5052	(98)
Space heating per m2										(98) / (4) =		43.3957	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5472.1385	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1032.1528	801.0057	654.5555	340.2249	131.1229	0.0000	0.0000	0.0000	0.0000	380.6727	725.8658	1039.9048	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1106.2731	858.5270	701.5601	364.6569	140.5390	0.0000	0.0000	0.0000	0.0000	408.0094	777.9913	1114.5818	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7514	89.6924	89.5625	89.2078	88.4219	86.7000	86.7000	86.7000	86.7000	89.2641	89.6286	89.7686	(217)
Fuel for water heating, kWh/month													
	198.5242	174.1110	180.7984	159.4850	155.3048	138.0547	129.2947	146.4262	147.6013	165.4309	178.2605	192.6267	(219)
Water heating fuel used												1965.9186	(219)
Annual totals kWh/year													
Space heating fuel - main system												5472.1385	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.43 * 1029 * 1.00) = -2000.7390	-2000.7390	(233)
Total delivered energy for all uses	5957.5299	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5472.1385	0.2160	1181.9819	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.9186	0.2160	424.6384	(264)
Space and water heating			1606.6203	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2000.7390	0.5190	-1038.3835	(269)
Total CO2, kg/year			838.2267	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1200	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.9235	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9235	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
								Total per year (kWh/year) = Sum(64)m =				2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0700	10.6334	0.6300	0.7000	0.7700	3.4772	(74)
Northeast	6.9200	11.2829	0.6300	0.7000	0.7700	23.8616	(75)
Southwest	9.0500	36.7938	0.6300	0.7000	0.7700	101.7643	(79)
West	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(80)
Northwest	6.7500	11.2829	0.6300	0.7000	0.7700	23.2754	(81)

Solar gains	158.8010	288.4999	442.0261	626.0851	772.1929	797.6387	756.1080	642.4721	505.0941	331.6553	193.4984	133.7638	(83)
Total gains	626.4058	753.8580	890.9336	1048.2025	1165.9882	1164.4181	1105.9727	999.5472	876.7787	730.3631	623.2846	587.2755	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9988	0.9969	0.9903	0.9630	0.8785	0.7139	0.5499	0.6223	0.8726	0.9832	0.9974	0.9991	(86)
MIT	19.5755	19.7466	20.0357	20.4231	20.7543	20.9370	20.9857	20.9750	20.8259	20.3884	19.9109	19.5475	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9984	0.9958	0.9866	0.9483	0.8317	0.6186	0.4223	0.4907	0.8044	0.9741	0.9963	0.9988	(89)
MIT 2	17.9869	18.2385	18.6606	19.2210	19.6622	19.8705	19.9069	19.9034	19.7647	19.1817	18.4864	17.9519	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.3893	18.6205	19.0089	19.5254	19.9388	20.1407	20.1802	20.1748	20.0335	19.4873	18.8472	18.3560	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3893	18.6205	19.0089	19.5254	19.9388	20.1407	20.1802	20.1748	20.0335	19.4873	18.8472	18.3560	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9938	0.9825	0.9418	0.8335	0.6402	0.4548	0.5240	0.8137	0.9693	0.9947	0.9981	(94)
Useful gains	624.8325	749.2200	875.3167	987.2435	971.8294	745.4118	503.0278	523.8120	713.4157	707.9705	619.9549	586.1849	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2058.6184	2000.2210	1819.5707	1529.5222	1183.6379	788.7072	509.6314	536.4231	847.6386	1276.8079	1694.3971	2050.3203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1066.7367	840.6727	702.5250	390.4407	157.5855	0.0000	0.0000	0.0000	0.0000	423.2150	773.5984	1089.3168	(98)
Space heating												5444.0908	(98)
Space heating per m2											(98) / (4) =	46.2736	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5828.7910	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1066.7367	840.6727	702.5250	390.4407	157.5855	0.0000	0.0000	0.0000	0.0000	423.2150	773.5984	1089.3168	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1142.1164	900.0778	752.1681	418.0307	168.7211	0.0000	0.0000	0.0000	0.0000	453.1210	828.2638	1166.2920	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5158	88.3384	87.9385	86.9469	84.7965	80.3000	80.3000	80.3000	80.3000	87.0465	88.1437	88.5844	(217)
Fuel for water heating, kWh/month													
	245.5046	216.8021	228.6753	207.2245	205.7177	191.3303	183.3090	204.3466	206.6034	214.6743	224.2574	239.3891	(219)
Water heating fuel used												2567.8343	(219)
Annual totals kWh/year													
Space heating fuel - main system												5828.7910	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												8916.8371	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5828.7910	0.2160	1259.0188	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2567.8343	0.2160	554.6522	(264)
Space and water heating			1813.6711	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2083.6610	(272)
Emissions per m2 for space and water heating			15.4158	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4158 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.7100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 124 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 124	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 124, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.12	**TER**	17.71
Environmental	95 A	**% DER<TER**	59.80		
CO_2 Emissions (t/year)	0.33	**DFEE**	45.19	**TFEE**	59.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 124 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 124	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 124, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.12	**TER**	17.71
Environmental	95 A	**% DER<TER**	59.80		
CO_2 Emissions (t/year)	0.33	**DFEE**	45.19	**TFEE**	59.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	7.12	$kgCO_2/yr/m^2$	
TER	17.71	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.12	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.80	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.19	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	18.06	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.86	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.86	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.03	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.03	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 125 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 125	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 125, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.07	**TER**	16.29
Environmental	96 A	**% DER<TER**	68.88		
CO_2 Emissions (t/year)	0.12	**DFEE**	41.43	**TFEE**	54.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.29 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.07 m², No overhang
Windows facing North East: 0.48 m², No overhang
Windows facing South East: 9.16 m², No overhang
Windows facing South West: 7.51 m², No overhang
Windows facing West: 1.07 m², No overhang
Windows facing North West: 6.76 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data      factor                W
                                                         W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                  1.0700            10.6334            0.7200           0.7000            0.7700            3.9739 (74)
Northeast                              0.4800            11.2829            0.7200           0.7000            0.7700            1.8916 (75)
Southeast                              9.1600            36.7938            0.7200           0.7000            0.7700          117.7157 (77)
Southwest                              7.5100            36.7938            0.7200           0.7000            0.7700           96.5114 (79)
West                                   1.0700            19.6403            0.7200           0.7000            0.7700            7.3400 (80)
Northwest                              6.7600            11.2829            0.7200           0.7000            0.7700           26.6399 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains   254.0725  444.9376  640.4700  845.6931  994.1010 1007.3300  962.6908  848.9772  711.1357  500.3532  306.5491  215.9829 (83)
Total gains   724.2307  912.8217 1091.2977 1268.7140 1388.3449 1374.2357 1312.0805 1204.9514 1081.6042  898.8638  737.3231  671.4743 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9958    0.9890    0.9711    0.9173    0.8020    0.6217    0.4683    0.5238    0.7759    0.9531    0.9913    0.9969 (86)

MIT           19.4017   19.6484   20.0055   20.4531   20.7774   20.9473   20.9876   20.9806   20.8611   20.4114   19.8338   19.3837 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9947    0.9860    0.9629    0.8944    0.7507    0.5388    0.3657    0.4175    0.7019    0.9353    0.9884    0.9961 (89)
MIT 2         17.7875   18.1498   18.6685   19.3154   19.7400   19.9506   19.9830   19.9844   19.8613   19.2746   18.4395   17.7752 (90)
Living area fraction                                                                                fLA = Living area / (4) =     0.1191 (91)
MIT           17.9798   18.3284   18.8278   19.4510   19.8636   20.0694   20.1027   20.1031   19.9804   19.4100   18.6056   17.9669 (92)
Temperature adjustment                                                                                                      0.0000
adjusted MIT  17.9798   18.3284   18.8278   19.4510   19.8636   20.0694   20.1027   20.1031   19.9804   19.4100   18.6056   17.9669 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9795    0.9516    0.8808    0.7453    0.5458    0.3776    0.4295    0.7021    0.9228    0.9828    0.9936 (94)
Useful gains  718.0082  894.0728 1038.5037 1117.4989 1034.7654  750.0416  495.4189  517.5019  759.3836  829.4858  724.6671  667.1667 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              2105.1124 2055.0161 1876.1196 1560.8951 1200.7825  781.2542  500.3290  525.8164  849.9595 1295.8616 1711.8956 2071.7397 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              1032.0055  780.1539  623.1862  319.2452  123.5167    0.0000    0.0000    0.0000    0.0000  346.9836  710.8045 1045.0023 (98)
Space heating                                                                                                           4980.8979 (98)
Space heating per m2                                                                                    (98) / (4) =     38.8890 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5338.5830	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1032.0055	780.1539	623.1862	319.2452	123.5167	0.0000	0.0000	0.0000	0.0000	346.9836	710.8045	1045.0023	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1106.1152	836.1778	667.9380	342.1707	132.3866	0.0000	0.0000	0.0000	0.0000	371.9010	761.8484	1120.0454	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7477	89.6749	89.5285	89.1527	88.3614	86.7000	86.7000	86.7000	86.7000	89.1884	89.6128	89.7672	(217)
Fuel for water heating, kWh/month													
	200.0931	175.5109	182.2788	160.8198	156.6102	139.1090	130.2717	147.5475	148.7340	166.8542	179.6859	194.1406	(219)
Water heating fuel used												1981.6558	(219)
Annual totals kWh/year													
Space heating fuel - main system												5338.5830	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												5524.4985	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5338.5830	0.2160	1153.1339	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.6558	0.2160	428.0377	(264)
Space and water heating			1581.1716	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			649.1823	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.0700	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.2073	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.2073	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019 (64)
Heat gains from water heating, kWh/month												
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0700	10.6334	0.6300	0.7000	0.7700	3.4772	(74)
Northeast	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(75)
Southeast	9.1600	36.7938	0.6300	0.7000	0.7700	103.0012	(77)
Southwest	7.5100	36.7938	0.6300	0.7000	0.7700	84.4475	(79)
West	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(80)
Northwest	6.7600	11.2829	0.6300	0.7000	0.7700	23.3099	(81)

Solar gains	222.3134	389.3204	560.4112	739.9815	869.8384	881.4138	842.3545	742.8550	622.2437	437.8090	268.2305	188.9851 (83)
Total gains	705.6199	870.3565	1024.3987	1176.1727	1276.6912	1260.2367	1203.6690	1111.4453	1005.8932	849.4895	712.1620	657.6284 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9986	0.9959	0.9875	0.9567	0.8698	0.7048	0.5372	0.5984	0.8458	0.9774	0.9968	0.9990	(86)
MIT	19.6389	19.8272	20.1145	20.4778	20.7794	20.9447	20.9882	20.9805	20.8599	20.4535	19.9732	19.6064	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9982	0.9945	0.9829	0.9402	0.8220	0.6111	0.4146	0.4724	0.7723	0.9658	0.9954	0.9987	(89)
MIT 2	18.0993	18.3757	18.7942	19.3174	19.7158	19.9028	19.9350	19.9329	19.8236	19.2932	18.5967	18.0576	(90)
Living area fraction									fLA = Living area / (4) =			0.1191	(91)
MIT	18.2827	18.5486	18.9515	19.4557	19.8425	20.0270	20.0605	20.0577	19.9471	19.4314	18.7607	18.2421	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2827	18.5486	18.9515	19.4557	19.8425	20.0270	20.0605	20.0577	19.9471	19.4314	18.7607	18.2421	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9918	0.9771	0.9308	0.8173	0.6195	0.4291	0.4870	0.7732	0.9582	0.9931	0.9978	(94)
Useful gains	703.4993	863.2373	1000.9600	1094.8397	1043.4927	780.7292	516.4540	541.3099	777.8050	813.9729	707.2691	656.2060	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2160.1567	2103.9425	1915.2937	1607.2768	1237.4707	817.4310	521.2319	550.0250	883.7573	1342.1688	1779.0049	2150.9532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1083.7531	833.7539	680.2643	368.9547	144.3196	0.0000	0.0000	0.0000	0.0000	392.9778	771.6498	1112.0919	(98)
Space heating												5387.7651	(98)
Space heating per m2											(98) / (4) =	42.0656	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5768.4852	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1083.7531	833.7539	680.2643	368.9547	144.3196	0.0000	0.0000	0.0000	0.0000	392.9778	771.6498	1112.0919	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1160.3352	892.6702	728.3344	395.0265	154.5178	0.0000	0.0000	0.0000	0.0000	420.7471	826.1775	1190.6765	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5302	88.3143	87.8662	86.8027	84.5577	80.3000	80.3000	80.3000	80.3000	86.8644	88.1282	88.6056	(217)
Fuel for water heating, kWh/month													
	247.0435	218.2454	230.2991	208.8714	208.0320	192.9379	184.8492	206.0635	207.8622	216.4388	225.7111	240.8594	(219)
Water heating fuel used												2587.2134	(219)
Annual totals kWh/year													
Space heating fuel - main system												5768.4852	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												8898.2704	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5768.4852	0.2160	1245.9928	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.2134	0.2160	558.8381	(264)
Space and water heating			1804.8309	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2086.4257	(272)
Emissions per m2 for space and water heating			14.0914	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0914 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.2900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 125 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 125	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 125, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.07	**TER**	16.29
Environmental	96 A	**% DER<TER**	68.88		
CO_2 Emissions (t/year)	0.12	**DFEE**	41.43	**TFEE**	54.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	0.48	100
W14	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00	2.05	100
D2	Half Glazed Door	[1] External Wall	North East			2.14	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	1.07	100
W15	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value 0.021 W/m²K

18.0 Pressure Testing Yes

Designed AP_{50} 4.50 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP_{50} m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather: Windows fully open

Cross ventilation possible: Yes

Night Ventilation: No

Air change rate: 8.00

Mechanical Ventilation

Mechanical Ventilation System Present: Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 125 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 125	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 125, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.07	**TER**	16.29
Environmental	96 A	**% DER<TER**	68.88		
CO_2 Emissions (t/year)	0.12	**DFEE**	41.43	**TFEE**	54.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.07	$kgCO_2/yr/m^2$	
TER	16.29	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.07	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.88	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.43	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.59	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.11	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.25	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.25	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 126 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 126	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 126, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 158 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.77 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 11.13 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 8.19 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.016 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3785	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3217	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4101	0.4021	0.3941	0.3539	0.3458	0.3056	0.3056	0.2976	0.3217	0.3458	0.3619	0.3780	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6601	0.6521	0.6441	0.6039	0.5958	0.5556	0.5556	0.5476	0.5717	0.5958	0.6119	0.6280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7600	1.2357	25.6540			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			79.1500	0.1200	9.4980			(28a)
External Wall	182.4200	25.0400	157.3800	0.2100	33.0498			(29a)
Main Roof	79.1500		79.1500	0.0700	5.5405			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.1623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6082	(36)
Total fabric heat loss					(33) + (36) =		85.7705	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.1791	84.1414	83.1037	77.9153	76.8777	71.6893	71.6893	70.6516	73.7646	76.8777	78.9530	81.0284	(38)
Heat transfer coeff	170.9495	169.9118	168.8742	163.6858	162.6481	157.4597	157.4597	156.4221	159.5351	162.6481	164.7235	166.7988	(39)
Average = Sum(39)m / 12 =												163.4264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0799	1.0734	1.0668	1.0340	1.0275	0.9947	0.9947	0.9881	1.0078	1.0275	1.0406	1.0537	(40)
HLP (average)												1.0324	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465	(42)
Average daily hot water use (litres/day)	104.1795	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8343 10.6789 11.7995 11.3880 11.7413 11.3252 11.6795 11.7196 11.3574 11.7690 11.4255 11.8231 (61)
Total heat required for water heating calculated for each month
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (64)
Total per year (kWh/year) = Sum(64)m = 1777.6897 (64)
Heat gains from water heating, kWh/month
59.4652 52.0907 53.9480 47.3084 45.5971 39.6451 37.0333 42.0755 42.4525 49.1076 53.2494 57.6794 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	79.9263	77.5160	72.5107	65.7061	61.2864	55.0627	49.7759	56.5531	58.9618	66.0048	73.9576	77.5261	(72)
Total internal gains													
	511.4993	508.9337	490.0132	459.2618	427.2806	397.2655	378.3324	385.2649	401.5889	432.5786	468.0929	495.4528	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.7200	0.7000	0.7700	43.8613	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	8.1900	36.7938	0.7200	0.7000	0.7700	105.2501	(79)
Northwest	0.7200	11.2829	0.7200	0.7000	0.7700	2.8374	(81)

Solar gains	161.2016	290.0973	438.1249	611.9173	748.4325	770.7468	731.5436	625.4583	497.6414	331.7282	195.9071	136.1271	(83)
Total gains	672.7009	799.0310	928.1380	1071.1791	1175.7130	1168.0123	1109.8760	1010.7232	899.2303	764.3068	664.0000	631.5799	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1008	48.3945	48.6919	50.2353	50.5558	52.2216	52.2216	52.5681	51.5423	50.5558	49.9188	49.2977	
alpha	4.2067	4.2263	4.2461	4.3490	4.3704	4.4814	4.4814	4.5045	4.4362	4.3704	4.3279	4.2865	
util living area													
	0.9983	0.9961	0.9898	0.9671	0.9001	0.7526	0.5935	0.6594	0.8881	0.9827	0.9966	0.9987	(86)
MIT	19.3562	19.5375	19.8446	20.2811	20.6538	20.9012	20.9738	20.9592	20.7686	20.2833	19.7632	19.3552	(87)
Th 2	20.0173	20.0227	20.0280	20.0551	20.0605	20.0878	20.0878	20.0932	20.0768	20.0605	20.0497	20.0388	(88)
util rest of house													
	0.9978	0.9950	0.9869	0.9569	0.8678	0.6781	0.4839	0.5509	0.8391	0.9758	0.9956	0.9983	(89)
MIT 2	17.7946	18.0630	18.5144	19.1624	19.6815	20.0067	20.0741	20.0697	19.8537	19.1754	18.4115	17.8074	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9923	0.9816	0.9476	0.8606	0.6876	0.5059	0.5717	0.8371	0.9690	0.9932	0.9973	(94)
Useful gains	670.2582	792.9184	911.0643	1015.0062	1011.7653	803.0720	561.4541	577.8288	752.7241	740.5937	659.5072	629.8496	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2362.6014	2288.8245	2075.7912	1718.0190	1331.1678	880.7250	576.5958	603.0549	948.3781	1432.3739	1909.7325	2323.5653	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating												6549.6850	(98)
Space heating per m2											(98) / (4) =	41.3751	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7020.0268	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1349.5213	1077.4372	928.7855	542.5179	254.7004	0.0000	0.0000	0.0000	0.0000	551.6447	964.8041	1350.6158	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8294	89.7900	89.7037	89.4723	88.9307	86.7000	86.7000	86.7000	86.7000	89.4591	89.7288	89.8419	(217)
Fuel for water heating, kWh/month													
	202.3601	177.4291	184.1365	162.1803	157.4790	140.7653	131.8065	149.3089	150.5130	168.3587	181.6402	196.3509	(219)
Water heating fuel used												2002.3284	(219)
Annual totals kWh/year													
Space heating fuel - main system												7020.0268	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6994.1524	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7020.0268	0.2160	1516.3258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.3284	0.2160	432.5029	(264)
Space and water heating			1948.8287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			896.1915	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.6600	ZC1
Total Floor Area	TFA	158.3000	
Assumed number of occupants	N	2.9465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.3313	ZC2
CO2 emissions from cooking, equation (L16)		1.1985	ZC3
Total CO2 emissions		19.1897	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.1897	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1023 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3523 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3818	0.3743	0.3668	0.3294	0.3219	0.2845	0.2845	0.2770	0.2995	0.3219	0.3369	0.3519	(22b)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5448	0.5518	0.5567	0.5619	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			20.7600	1.3258	27.5227			(27)
Ground floor			79.1500	0.1300	10.2895			(28a)
External Wall	182.4200	25.0400	157.3800	0.1800	28.3284			(29a)
Main Roof	79.1500		79.1500	0.1300	10.2895			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.5661			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.3390 (36)
Total fabric heat loss	(33) + (36) =	94.9051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.9200	73.5548	73.1968	71.5154	71.2008	69.7364	69.7364	69.4652	70.3005	71.2008	71.8372	72.5025	(38)
Heat transfer coeff	168.8251	168.4599	168.1019	166.4206	166.1060	164.6416	164.6416	164.3704	165.2056	166.1060	166.7424	167.4077	(39)
Average = Sum(39)m / 12 =												166.4190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0665	1.0642	1.0619	1.0513	1.0493	1.0401	1.0401	1.0383	1.0436	1.0493	1.0533	1.0575	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465 (42)
Average daily hot water use (litres/day)	104.1795 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.9034	46.2386	47.7798	49.9034	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
								Total per year (kWh/year) = Sum(64)m =				2230.7819	(64)
Heat gains from water heating, kWh/month													
	69.2463	60.9279	63.7378	56.7901	55.1376	48.3735	46.0584	51.6215	51.9419	58.9051	62.7218	67.4633	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	93.0730	90.6665	85.6691	78.8752	74.1096	67.1854	61.9064	69.3837	72.1416	79.1735	87.1137	90.6765	(72)
Total internal gains													
	524.6460	522.0842	503.1715	472.4310	440.1038	409.3882	390.4629	398.0955	414.7686	445.7472	481.2490	508.6032	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.6300	0.7000	0.7700	38.3786	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	8.1900	36.7938	0.6300	0.7000	0.7700	92.0939	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	141.0514	253.8351	383.3593	535.4276	654.8784	674.4035	640.1007	547.2760	435.4363	290.2622	171.4187	119.1112	(83)
Total gains	665.6974	775.9193	886.5308	1007.8586	1094.9822	1083.7916	1030.5636	945.3715	850.2049	736.0094	652.6677	627.7145	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1151	65.2562	65.3952	66.0559	66.1810	66.7696	66.7696	66.8798	66.5417	66.1810	65.9284	65.6664	
alpha	5.3410	5.3504	5.3597	5.4037	5.4121	5.4513	5.4513	5.4587	5.4361	5.4121	5.3952	5.3778	
util living area													
	0.9997	0.9991	0.9972	0.9880	0.9492	0.8329	0.6689	0.7379	0.9392	0.9943	0.9992	0.9998	(86)
MIT	19.7024	19.8326	20.0633	20.3850	20.6945	20.9085	20.9787	20.9645	20.7934	20.3982	19.9942	19.6815	(87)
Th 2	20.0283	20.0302	20.0321	20.0408	20.0424	20.0501	20.0501	20.0515	20.0471	20.0424	20.0391	20.0357	(88)
util rest of house													
	0.9995	0.9988	0.9961	0.9827	0.9247	0.7557	0.5414	0.6144	0.8987	0.9911	0.9989	0.9997	(89)
MIT 2	18.2724	18.4643	18.8030	19.2766	19.7121	19.9806	20.0411	20.0343	19.8536	19.2998	18.7074	18.2472	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9982	0.9944	0.9787	0.9207	0.7672	0.5680	0.6396	0.8989	0.9885	0.9983	0.9995	(94)
Useful gains	665.1969	774.4856	881.6094	986.3481	1008.1284	831.4347	585.3564	604.6891	764.2261	727.5551	651.5693	627.3738	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2409.2700	2333.1421	2112.3675	1765.3725	1364.9080	917.7525	598.7593	629.2764	982.9262	1483.1573	1980.2187	2401.7157	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating												6925.9392	(98)
Space heating per m2											(98) / (4) =	43.7520	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7415.3524	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1389.2831	1121.4316	980.3898	600.5327	284.2013	0.0000	0.0000	0.0000	0.0000	601.8930	1024.2265	1413.3944	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7756	88.6525	88.3721	87.6865	86.0523	80.3000	80.3000	80.3000	80.3000	87.6184	88.4689	88.8318	(217)
Fuel for water heating, kWh/month													
	248.8336	219.5789	231.2229	208.7363	207.0941	195.4631	187.2685	208.7605	209.7789	216.6236	227.0551	242.6398	(219)
Water heating fuel used												2603.0551	(219)
Annual totals kWh/year													
Space heating fuel - main system												7415.3524	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Total delivered energy for all uses												10657.8567	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7415.3524	0.2160	1601.7161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2603.0551	0.2160	562.2599	(264)
Space and water heating			2163.9760	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Total CO2, kg/m2/year			2495.8502	(272)
Emissions per m2 for space and water heating			13.6701	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8506	(272b)
Emissions per m2 for pumps and fans			0.2459	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6701 * 1.00) + 1.8506 + 0.2459, rounded to 2 d.p.			15.7700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 126 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 126	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 126, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.97 m	79.15 m²	2.31 m
1st Storey:	36.97 m	79.15 m²	2.63 m

7.0 Living Area	33.03	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	187.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	182.42	157.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	79.15	79.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	79.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.03	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11*	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.69	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.14	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.05	0.005	No
Independently assessed	E5 Ground floor (normal)	36.97	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	36.97	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	24.37	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.016	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	21	
Total number of L.E.L. fittings	21	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 126 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 126	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 126, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	158.3	m^2	
DER	5.66	$kgCO_2/yr/m^2$	
TER	15.77	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.66	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.10	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.05	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	158.3	m^2	
DER	16.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 127 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 127	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 127, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 158 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.77 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 11.13 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 8.19 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.016 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3785	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3217	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4101	0.4021	0.3941	0.3539	0.3458	0.3056	0.3056	0.2976	0.3217	0.3458	0.3619	0.3780	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6601	0.6521	0.6441	0.6039	0.5958	0.5556	0.5556	0.5476	0.5717	0.5958	0.6119	0.6280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7600	1.2357	25.6540			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			79.1500	0.1200	9.4980			(28a)
External Wall	182.4200	25.0400	157.3800	0.2100	33.0498			(29a)
Main Roof	79.1500		79.1500	0.0700	5.5405			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.1623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6082	(36)
Total fabric heat loss					(33) + (36) =		85.7705	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.1791	84.1414	83.1037	77.9153	76.8777	71.6893	71.6893	70.6516	73.7646	76.8777	78.9530	81.0284	(38)
Heat transfer coeff	170.9495	169.9118	168.8742	163.6858	162.6481	157.4597	157.4597	156.4221	159.5351	162.6481	164.7235	166.7988	(39)
Average = Sum(39)m / 12 =												163.4264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0799	1.0734	1.0668	1.0340	1.0275	0.9947	0.9947	0.9881	1.0078	1.0275	1.0406	1.0537	(40)
HLP (average)												1.0324	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465	(42)
Average daily hot water use (litres/day)	104.1795	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8343 10.6789 11.7995 11.3880 11.7413 11.3252 11.6795 11.7196 11.3574 11.7690 11.4255 11.8231 (61)
Total heat required for water heating calculated for each month
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (64)
Total per year (kWh/year) = Sum(64)m = 1777.6897 (64)
Heat gains from water heating, kWh/month
59.4652 52.0907 53.9480 47.3084 45.5971 39.6451 37.0333 42.0755 42.4525 49.1076 53.2494 57.6794 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	79.9263	77.5160	72.5107	65.7061	61.2864	55.0627	49.7759	56.5531	58.9618	66.0048	73.9576	77.5261	(72)
Total internal gains													
	511.4993	508.9337	490.0132	459.2618	427.2806	397.2655	378.3324	385.2649	401.5889	432.5786	468.0929	495.4528	(73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.7200	0.7000	0.7700	43.8613	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	8.1900	36.7938	0.7200	0.7000	0.7700	105.2501	(79)
Northwest	0.7200	11.2829	0.7200	0.7000	0.7700	2.8374	(81)

Solar gains	161.2016	290.0973	438.1249	611.9173	748.4325	770.7468	731.5436	625.4583	497.6414	331.7282	195.9071	136.1271	(83)
Total gains	672.7009	799.0310	928.1380	1071.1791	1175.7130	1168.0123	1109.8760	1010.7232	899.2303	764.3068	664.0000	631.5799	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1008	48.3945	48.6919	50.2353	50.5558	52.2216	52.2216	52.5681	51.5423	50.5558	49.9188	49.2977	
alpha	4.2067	4.2263	4.2461	4.3490	4.3704	4.4814	4.4814	4.5045	4.4362	4.3704	4.3279	4.2865	
util living area													
	0.9983	0.9961	0.9898	0.9671	0.9001	0.7526	0.5935	0.6594	0.8881	0.9827	0.9966	0.9987	(86)
MIT	19.3562	19.5375	19.8446	20.2811	20.6538	20.9012	20.9738	20.9592	20.7686	20.2833	19.7632	19.3552	(87)
Th 2	20.0173	20.0227	20.0280	20.0551	20.0605	20.0878	20.0878	20.0932	20.0768	20.0605	20.0497	20.0388	(88)
util rest of house													
	0.9978	0.9950	0.9869	0.9569	0.8678	0.6781	0.4839	0.5509	0.8391	0.9758	0.9956	0.9983	(89)
MIT 2	17.7946	18.0630	18.5144	19.1624	19.6815	20.0067	20.0741	20.0697	19.8537	19.1754	18.4115	17.8074	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9923	0.9816	0.9476	0.8606	0.6876	0.5059	0.5717	0.8371	0.9690	0.9932	0.9973	(94)
Useful gains	670.2582	792.9184	911.0643	1015.0062	1011.7653	803.0720	561.4541	577.8288	752.7241	740.5937	659.5072	629.8496	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2362.6014	2288.8245	2075.7912	1718.0190	1331.1678	880.7250	576.5958	603.0549	948.3781	1432.3739	1909.7325	2323.5653	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating												6549.6850	(98)
Space heating per m2											(98) / (4) =	41.3751	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7020.0268	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1349.5213	1077.4372	928.7855	542.5179	254.7004	0.0000	0.0000	0.0000	0.0000	551.6447	964.8041	1350.6158	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8294	89.7900	89.7037	89.4723	88.9307	86.7000	86.7000	86.7000	86.7000	89.4591	89.7288	89.8419	(217)
Fuel for water heating, kWh/month													
	202.3601	177.4291	184.1365	162.1803	157.4790	140.7653	131.8065	149.3089	150.5130	168.3587	181.6402	196.3509	(219)
Water heating fuel used												2002.3284	(219)
Annual totals kWh/year													
Space heating fuel - main system												7020.0268	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6994.1524	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7020.0268	0.2160	1516.3258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.3284	0.2160	432.5029	(264)
Space and water heating			1948.8287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			896.1915	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.6600	ZC1
Total Floor Area	TFA	158.3000	
Assumed number of occupants	N	2.9465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.3313	ZC2
CO2 emissions from cooking, equation (L16)		1.1985	ZC3
Total CO2 emissions		19.1897	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.1897	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1023 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3523 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3818	0.3743	0.3668	0.3294	0.3219	0.2845	0.2845	0.2770	0.2995	0.3219	0.3369	0.3519	(22b)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5448	0.5518	0.5567	0.5619	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			20.7600	1.3258	27.5227			(27)
Ground floor			79.1500	0.1300	10.2895			(28a)
External Wall	182.4200	25.0400	157.3800	0.1800	28.3284			(29a)
Main Roof	79.1500		79.1500	0.1300	10.2895			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.5661			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.3390 (36)
Total fabric heat loss	(33) + (36) =	94.9051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.9200	73.5548	73.1968	71.5154	71.2008	69.7364	69.7364	69.4652	70.3005	71.2008	71.8372	72.5025	(38)
Heat transfer coeff	168.8251	168.4599	168.1019	166.4206	166.1060	164.6416	164.6416	164.3704	165.2056	166.1060	166.7424	167.4077	(39)
Average = Sum(39)m / 12 =												166.4190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0665	1.0642	1.0619	1.0513	1.0493	1.0401	1.0401	1.0383	1.0436	1.0493	1.0533	1.0575	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465 (42)
Average daily hot water use (litres/day)	104.1795 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.9034	46.2386	47.7798	49.9034	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
								Total per year (kWh/year) = Sum(64)m =				2230.7819	(64)
Heat gains from water heating, kWh/month													
	69.2463	60.9279	63.7378	56.7901	55.1376	48.3735	46.0584	51.6215	51.9419	58.9051	62.7218	67.4633	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	93.0730	90.6665	85.6691	78.8752	74.1096	67.1854	61.9064	69.3837	72.1416	79.1735	87.1137	90.6765	(72)
Total internal gains													
	524.6460	522.0842	503.1715	472.4310	440.1038	409.3882	390.4629	398.0955	414.7686	445.7472	481.2490	508.6032	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.6300	0.7000	0.7700	38.3786	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	8.1900	36.7938	0.6300	0.7000	0.7700	92.0939	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	141.0514	253.8351	383.3593	535.4276	654.8784	674.4035	640.1007	547.2760	435.4363	290.2622	171.4187	119.1112	(83)
Total gains	665.6974	775.9193	886.5308	1007.8586	1094.9822	1083.7916	1030.5636	945.3715	850.2049	736.0094	652.6677	627.7145	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1151	65.2562	65.3952	66.0559	66.1810	66.7696	66.7696	66.8798	66.5417	66.1810	65.9284	65.6664	
alpha	5.3410	5.3504	5.3597	5.4037	5.4121	5.4513	5.4513	5.4587	5.4361	5.4121	5.3952	5.3778	
util living area													
	0.9997	0.9991	0.9972	0.9880	0.9492	0.8329	0.6689	0.7379	0.9392	0.9943	0.9992	0.9998	(86)
MIT	19.7024	19.8326	20.0633	20.3850	20.6945	20.9085	20.9787	20.9645	20.7934	20.3982	19.9942	19.6815	(87)
Th 2	20.0283	20.0302	20.0321	20.0408	20.0424	20.0501	20.0501	20.0515	20.0471	20.0424	20.0391	20.0357	(88)
util rest of house													
	0.9995	0.9988	0.9961	0.9827	0.9247	0.7557	0.5414	0.6144	0.8987	0.9911	0.9989	0.9997	(89)
MIT 2	18.2724	18.4643	18.8030	19.2766	19.7121	19.9806	20.0411	20.0343	19.8536	19.2998	18.7074	18.2472	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9982	0.9944	0.9787	0.9207	0.7672	0.5680	0.6396	0.8989	0.9885	0.9983	0.9995	(94)
Useful gains	665.1969	774.4856	881.6094	986.3481	1008.1284	831.4347	585.3564	604.6891	764.2261	727.5551	651.5693	627.3738	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2409.2700	2333.1421	2112.3675	1765.3725	1364.9080	917.7525	598.7593	629.2764	982.9262	1483.1573	1980.2187	2401.7157	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating												6925.9392	(98)
Space heating per m2											(98) / (4) =	43.7520	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7415.3524	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1389.2831	1121.4316	980.3898	600.5327	284.2013	0.0000	0.0000	0.0000	0.0000	601.8930	1024.2265	1413.3944	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7756	88.6525	88.3721	87.6865	86.0523	80.3000	80.3000	80.3000	80.3000	87.6184	88.4689	88.8318	(217)
Fuel for water heating, kWh/month													
	248.8336	219.5789	231.2229	208.7363	207.0941	195.4631	187.2685	208.7605	209.7789	216.6236	227.0551	242.6398	(219)
Water heating fuel used												2603.0551	(219)
Annual totals kWh/year													
Space heating fuel - main system												7415.3524	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Total delivered energy for all uses												10657.8567	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7415.3524	0.2160	1601.7161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2603.0551	0.2160	562.2599	(264)
Space and water heating			2163.9760	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Total CO2, kg/m2/year			2495.8502	(272)
Emissions per m2 for space and water heating			13.6701	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8506	(272b)
Emissions per m2 for pumps and fans			0.2459	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6701 * 1.00) + 1.8506 + 0.2459, rounded to 2 d.p.			15.7700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 127 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 127	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 127, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.97 m	79.15 m²	2.31 m
1st Storey:	36.97 m	79.15 m²	2.63 m

7.0 Living Area	33.03	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	187.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	182.42	157.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	79.15	79.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	79.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.03	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11*	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.69	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.14	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.05	0.005	No
Independently assessed	E5 Ground floor (normal)	36.97	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	36.97	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	24.37	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.016	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	21	
Total number of L.E.L. fittings	21	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 127 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 127	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 127, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	158.3	m^2	
DER	5.66	$kgCO_2/yr/m^2$	
TER	15.77	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.66	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.10	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.05	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	158.3	m^2	
DER	16.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 128 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 128	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 128, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 158 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.77 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 11.13 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 8.19 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.016 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3785	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3217	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4101	0.4021	0.3941	0.3539	0.3458	0.3056	0.3056	0.2976	0.3217	0.3458	0.3619	0.3780	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6601	0.6521	0.6441	0.6039	0.5958	0.5556	0.5556	0.5476	0.5717	0.5958	0.6119	0.6280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7600	1.2357	25.6540			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			79.1500	0.1200	9.4980			(28a)
External Wall	182.4200	25.0400	157.3800	0.2100	33.0498			(29a)
Main Roof	79.1500		79.1500	0.0700	5.5405			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.1623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6082	(36)
Total fabric heat loss					(33) + (36) =		85.7705	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	85.1791	84.1414	83.1037	77.9153	76.8777	71.6893	71.6893	70.6516	73.7646	76.8777	78.9530	81.0284	(38)
Heat transfer coeff	170.9495	169.9118	168.8742	163.6858	162.6481	157.4597	157.4597	156.4221	159.5351	162.6481	164.7235	166.7988	(39)
Average = Sum(39)m / 12 =												163.4264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0799	1.0734	1.0668	1.0340	1.0275	0.9947	0.9947	0.9881	1.0078	1.0275	1.0406	1.0537	(40)
HLP (average)												1.0324	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465	(42)
Average daily hot water use (litres/day)	104.1795	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8343 10.6789 11.7995 11.3880 11.7413 11.3252 11.6795 11.7196 11.3574 11.7690 11.4255 11.8231 (61)
Total heat required for water heating calculated for each month
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
181.7790 159.3135 165.1772 145.1064 140.0473 122.0435 114.2762 129.4508 130.4948 150.6121 162.9836 176.4054 (64)
Total per year (kWh/year) = Sum(64)m = 1777.6897 (64)
Heat gains from water heating, kWh/month
59.4652 52.0907 53.9480 47.3084 45.5971 39.6451 37.0333 42.0755 42.4525 49.1076 53.2494 57.6794 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	79.9263	77.5160	72.5107	65.7061	61.2864	55.0627	49.7759	56.5531	58.9618	66.0048	73.9576	77.5261	(72)
Total internal gains													
	511.4993	508.9337	490.0132	459.2618	427.2806	397.2655	378.3324	385.2649	401.5889	432.5786	468.0929	495.4528	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.7200	0.7000	0.7700	43.8613	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	8.1900	36.7938	0.7200	0.7000	0.7700	105.2501	(79)
Northwest	0.7200	11.2829	0.7200	0.7000	0.7700	2.8374	(81)

Solar gains	161.2016	290.0973	438.1249	611.9173	748.4325	770.7468	731.5436	625.4583	497.6414	331.7282	195.9071	136.1271	(83)
Total gains	672.7009	799.0310	928.1380	1071.1791	1175.7130	1168.0123	1109.8760	1010.7232	899.2303	764.3068	664.0000	631.5799	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1008	48.3945	48.6919	50.2353	50.5558	52.2216	52.2216	52.5681	51.5423	50.5558	49.9188	49.2977	
alpha	4.2067	4.2263	4.2461	4.3490	4.3704	4.4814	4.4814	4.5045	4.4362	4.3704	4.3279	4.2865	
util living area													
	0.9983	0.9961	0.9898	0.9671	0.9001	0.7526	0.5935	0.6594	0.8881	0.9827	0.9966	0.9987	(86)
MIT	19.3562	19.5375	19.8446	20.2811	20.6538	20.9012	20.9738	20.9592	20.7686	20.2833	19.7632	19.3552	(87)
Th 2	20.0173	20.0227	20.0280	20.0551	20.0605	20.0878	20.0878	20.0932	20.0768	20.0605	20.0497	20.0388	(88)
util rest of house													
	0.9978	0.9950	0.9869	0.9569	0.8678	0.6781	0.4839	0.5509	0.8391	0.9758	0.9956	0.9983	(89)
MIT 2	17.7946	18.0630	18.5144	19.1624	19.6815	20.0067	20.0741	20.0697	19.8537	19.1754	18.4115	17.8074	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1205	18.3707	18.7919	19.3958	19.8843	20.1933	20.2619	20.2553	20.0446	19.4066	18.6936	18.1303	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9923	0.9816	0.9476	0.8606	0.6876	0.5059	0.5717	0.8371	0.9690	0.9932	0.9973	(94)
Useful gains	670.2582	792.9184	911.0643	1015.0062	1011.7653	803.0720	561.4541	577.8288	752.7241	740.5937	659.5072	629.8496	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2362.6014	2288.8245	2075.7912	1718.0190	1331.1678	880.7250	576.5958	603.0549	948.3781	1432.3739	1909.7325	2323.5653	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating												6549.6850	(98)
Space heating per m2											(98) / (4) =	41.3751	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7020.0268	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1259.1033	1005.2489	866.5568	506.1692	237.6355	0.0000	0.0000	0.0000	0.0000	514.6845	900.1622	1260.1245	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1349.5213	1077.4372	928.7855	542.5179	254.7004	0.0000	0.0000	0.0000	0.0000	551.6447	964.8041	1350.6158	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7790	159.3135	165.1772	145.1064	140.0473	122.0435	114.2762	129.4508	130.4948	150.6121	162.9836	176.4054	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8294	89.7900	89.7037	89.4723	88.9307	86.7000	86.7000	86.7000	86.7000	89.4591	89.7288	89.8419	(217)
Fuel for water heating, kWh/month													
	202.3601	177.4291	184.1365	162.1803	157.4790	140.7653	131.8065	149.3089	150.5130	168.3587	181.6402	196.3509	(219)
Water heating fuel used												2002.3284	(219)
Annual totals kWh/year													
Space heating fuel - main system												7020.0268	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6994.1524	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7020.0268	0.2160	1516.3258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.3284	0.2160	432.5029	(264)
Space and water heating			1948.8287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			896.1915	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.6600	ZC1
Total Floor Area	TFA	158.3000	
Assumed number of occupants	N	2.9465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.3313	ZC2
CO2 emissions from cooking, equation (L16)		1.1985	ZC3
Total CO2 emissions		19.1897	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.1897	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.1500 (1b)	x	2.3100 (2b)	=	182.8365	(1b) - (3b)
First floor	79.1500 (1c)	x	2.6300 (2c)	=	208.1645	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	158.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	391.0010	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1023 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3523 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3818	0.3743	0.3668	0.3294	0.3219	0.2845	0.2845	0.2770	0.2995	0.3219	0.3369	0.3519	(22b)
Effective ac	0.5729	0.5701	0.5673	0.5543	0.5518	0.5405	0.5405	0.5384	0.5448	0.5518	0.5567	0.5619	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			20.7600	1.3258	27.5227			(27)
Ground floor			79.1500	0.1300	10.2895			(28a)
External Wall	182.4200	25.0400	157.3800	0.1800	28.3284			(29a)
Main Roof	79.1500		79.1500	0.1300	10.2895			(30)
Total net area of external elements Aum(A, m2)			340.7200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.5661			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.3390 (36)
Total fabric heat loss	(33) + (36) =	94.9051 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.9200	73.5548	73.1968	71.5154	71.2008	69.7364	69.7364	69.4652	70.3005	71.2008	71.8372	72.5025	(38)
Heat transfer coeff	168.8251	168.4599	168.1019	166.4206	166.1060	164.6416	164.6416	164.3704	165.2056	166.1060	166.7424	167.4077	(39)
Average = Sum(39)m / 12 =												166.4190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0665	1.0642	1.0619	1.0513	1.0493	1.0401	1.0401	1.0383	1.0436	1.0493	1.0533	1.0575	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9465 (42)
Average daily hot water use (litres/day)	104.1795 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5974	110.4302	106.2630	102.0959	97.9287	93.7615	93.7615	97.9287	102.0959	106.2630	110.4302	114.5974	(44)
Energy conte	169.9446	148.6347	153.3777	133.7184	128.3060	110.7183	102.5968	117.7313	119.1374	138.8431	151.5581	164.5823	(45)
Energy content (annual)										Total = Sum(45)m =		1639.1486	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4917	22.2952	23.0066	20.0578	19.2459	16.6077	15.3895	17.6597	17.8706	20.8265	22.7337	24.6873	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.9034	46.2386	47.7798	49.9034	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
								Total per year (kWh/year) = Sum(64)m =				2230.7819	(64)
Heat gains from water heating, kWh/month													
	69.2463	60.9279	63.7378	56.7901	55.1376	48.3735	46.0584	51.6215	51.9419	58.9051	62.7218	67.4633	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	147.3252	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.9614	28.3879	23.0866	17.4780	13.0650	11.0300	11.9184	15.4919	20.7932	26.4018	30.8148	32.8498	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	329.4140	332.8323	324.2183	305.8802	282.7316	260.9752	246.4406	243.0223	251.6363	269.9744	293.1230	314.8794	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	37.7325	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	-117.8601	(71)
Water heating gains (Table 5)													
	93.0730	90.6665	85.6691	78.8752	74.1096	67.1854	61.9064	69.3837	72.1416	79.1735	87.1137	90.6765	(72)
Total internal gains													
	524.6460	522.0842	503.1715	472.4310	440.1038	409.3882	390.4629	398.0955	414.7686	445.7472	481.2490	508.6032	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	11.1300	11.2829	0.6300	0.7000	0.7700	38.3786	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	8.1900	36.7938	0.6300	0.7000	0.7700	92.0939	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	141.0514	253.8351	383.3593	535.4276	654.8784	674.4035	640.1007	547.2760	435.4363	290.2622	171.4187	119.1112	(83)
Total gains	665.6974	775.9193	886.5308	1007.8586	1094.9822	1083.7916	1030.5636	945.3715	850.2049	736.0094	652.6677	627.7145	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1151	65.2562	65.3952	66.0559	66.1810	66.7696	66.7696	66.8798	66.5417	66.1810	65.9284	65.6664	
alpha	5.3410	5.3504	5.3597	5.4037	5.4121	5.4513	5.4513	5.4587	5.4361	5.4121	5.3952	5.3778	
util living area													
	0.9997	0.9991	0.9972	0.9880	0.9492	0.8329	0.6689	0.7379	0.9392	0.9943	0.9992	0.9998	(86)
MIT	19.7024	19.8326	20.0633	20.3850	20.6945	20.9085	20.9787	20.9645	20.7934	20.3982	19.9942	19.6815	(87)
Th 2	20.0283	20.0302	20.0321	20.0408	20.0424	20.0501	20.0501	20.0515	20.0471	20.0424	20.0391	20.0357	(88)
util rest of house													
	0.9995	0.9988	0.9961	0.9827	0.9247	0.7557	0.5414	0.6144	0.8987	0.9911	0.9989	0.9997	(89)
MIT 2	18.2724	18.4643	18.8030	19.2766	19.7121	19.9806	20.0411	20.0343	19.8536	19.2998	18.7074	18.2472	(90)
Living area fraction									fLA = Living area / (4) =			0.2087	(91)
MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5708	18.7498	19.0660	19.5079	19.9171	20.1742	20.2367	20.2284	20.0497	19.5290	18.9759	18.5465	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9992	0.9982	0.9944	0.9787	0.9207	0.7672	0.5680	0.6396	0.8989	0.9885	0.9983	0.9995	(94)
Useful gains	665.1969	774.4856	881.6094	986.3481	1008.1284	831.4347	585.3564	604.6891	764.2261	727.5551	651.5693	627.3738	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2409.2700	2333.1421	2112.3675	1765.3725	1364.9080	917.7525	598.7593	629.2764	982.9262	1483.1573	1980.2187	2401.7157	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating												6925.9392	(98)
Space heating per m2											(98) / (4) =	43.7520	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7415.3524	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1297.5904	1047.4171	915.6840	560.8975	265.4440	0.0000	0.0000	0.0000	0.0000	562.1681	956.6276	1320.1104	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1389.2831	1121.4316	980.3898	600.5327	284.2013	0.0000	0.0000	0.0000	0.0000	601.8930	1024.2265	1413.3944	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.9035	194.6621	204.3366	183.0334	178.2093	156.9568	150.3766	167.6347	168.4524	189.8020	200.8732	215.5412	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7756	88.6525	88.3721	87.6865	86.0523	80.3000	80.3000	80.3000	80.3000	87.6184	88.4689	88.8318	(217)
Fuel for water heating, kWh/month													
	248.8336	219.5789	231.2229	208.7363	207.0941	195.4631	187.2685	208.7605	209.7789	216.6236	227.0551	242.6398	(219)
Water heating fuel used												2603.0551	(219)
Annual totals kWh/year													
Space heating fuel - main system												7415.3524	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												564.4492	(232)
Total delivered energy for all uses												10657.8567	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7415.3524	0.2160	1601.7161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2603.0551	0.2160	562.2599	(264)
Space and water heating			2163.9760	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	564.4492	0.5190	292.9491	(268)
Total CO2, kg/m2/year			2495.8502	(272)
Emissions per m2 for space and water heating			13.6701	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8506	(272b)
Emissions per m2 for pumps and fans			0.2459	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6701 * 1.00) + 1.8506 + 0.2459, rounded to 2 d.p.			15.7700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 128 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 128	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 128, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.97 m	79.15 m²	2.31 m
1st Storey:	36.97 m	79.15 m²	2.63 m

7.0 Living Area	33.03	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	187.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	182.42	157.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	79.15	79.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	79.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.03	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11*	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.69	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.14	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.05	0.005	No
Independently assessed	E5 Ground floor (normal)	36.97	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	36.97	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	24.37	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.016	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	21	
Total number of L.E.L. fittings	21	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 128 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 128	**Prop Type Ref**	Opp
Property	L474-R - Det SG, Plot 128, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	15.77
Environmental	96 A	**% DER<TER**	64.10		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.05	**TFEE**	54.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	158.3	m^2	
DER	5.66	$kgCO_2/yr/m^2$	
TER	15.77	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.66	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.10	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.05	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	158.3	m^2	
DER	16.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.71	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.33	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.20	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	20.96	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 129 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 129	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 129, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.62 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.93 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South: 1.04 m², No overhang
Windows facing South West: 7.21 m², No overhang
Windows facing West: 1.04 m², No overhang
Windows facing North West: 1.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data      factor                W
                                                         W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------------
Northeast                              7.9300           11.2829            0.7200           0.7000        0.7700           31.2507 (75)
Southeast                              0.7200           36.7938            0.7200           0.7000        0.7700            9.2528 (77)
South                                  1.0400           46.7521            0.7200           0.7000        0.7700           16.9824 (78)
Southwest                              7.2100           36.7938            0.7200           0.7000        0.7700           92.6561 (79)
West                                   1.0400           19.6403            0.7200           0.7000        0.7700            7.1342 (80)
Northwest                              1.4400           11.2829            0.7200           0.7000        0.7700            5.6748 (81)
-------------------------------------------------------------------------------------------------------------------------------------

Solar gains    162.9509  290.5200  431.3428  590.2477  711.3795  728.1602  692.9132  599.3103  485.9253  330.2658  197.5505  137.9091 (83)
Total gains    641.6030  766.7179  889.9646 1020.3411 1111.9726 1100.8682 1047.8845  961.0588  862.6801  735.7850  636.0667  601.6820 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha         4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9979    0.9952    0.9873    0.9597    0.8827    0.7236    0.5615    0.6237    0.8640    0.9780    0.9959    0.9985 (86)

MIT           19.4391   19.6268   19.9326   20.3550   20.7039   20.9217   20.9808   20.9699   20.8092   20.3493   19.8356   19.4335 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9973    0.9938    0.9835    0.9467    0.8444    0.6432    0.4499    0.5113    0.8057    0.9687    0.9945    0.9980 (89)
MIT 2         17.8790   18.1566   18.6051   19.2294   19.7077   19.9870   20.0382   20.0369   19.8629   19.2325   18.4803   17.8851 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1959 (91)
MIT           18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  18.1845   18.4445   18.8651   19.4499   19.9028   20.1701   20.2228   20.2196   20.0483   19.4513   18.7457   18.1883 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9957    0.9907    0.9775    0.9372    0.8390    0.6544    0.4713    0.5323    0.8065    0.9613    0.9917    0.9968 (94)
Useful gains 638.8488  759.5603  869.9212  956.2230  932.9893  720.4356  493.8249  511.5536  695.7744  707.2740  630.8081  599.7386 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2084.6728 2021.8512 1835.0545 1519.8251 1174.5834  773.3939  503.0192  527.0308  836.2406 1267.4322 1687.8192 2051.6363 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1075.6930  848.2595  718.0592  405.7936  179.7460    0.0000    0.0000    0.0000    0.0000  416.7577  761.0480 1080.2119 (98)
Space heating                                                                                                               5485.5688 (98)
Space heating per m2                                                                                        (98) / (4) =     41.2263 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5879.4949	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1075.6930	848.2595	718.0592	405.7936	179.7460	0.0000	0.0000	0.0000	0.0000	416.7577	761.0480	1080.2119	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1152.9400	909.1741	769.6240	434.9342	192.6538	0.0000	0.0000	0.0000	0.0000	446.6857	815.6999	1157.7834	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7655	89.7156	89.6094	89.3297	88.6956	86.7000	86.7000	86.7000	86.7000	89.3222	89.6485	89.7809	(217)
Fuel for water heating, kWh/month													
	200.6014	175.9110	182.6098	160.9347	156.4398	139.4795	130.6150	147.9414	149.1319	167.0545	180.1038	194.6419	(219)
Water heating fuel used												1985.4648	(219)
Annual totals kWh/year													
Space heating fuel - main system												5879.4949	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												6106.3629	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5879.4949	0.2160	1269.9709	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.4648	0.2160	428.8604	(264)
Space and water heating			1698.8313	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			786.1195	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		20.7494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.7494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.9300	11.2829	0.6300	0.7000	0.7700	27.3443	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
South	1.0400	46.7521	0.6300	0.7000	0.7700	14.8596	(78)
Southwest	7.2100	36.7938	0.6300	0.7000	0.7700	81.0741	(79)
West	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(80)
Northwest	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654	(81)

Solar gains	142.5820	254.2050	377.4250	516.4667	622.4571	637.1402	606.2990	524.3965	425.1847	288.9825	172.8567	120.6704 (83)
Total gains	634.3820	743.5546	849.2063	959.7302	1035.7070	1021.8113	973.2412	898.8090	815.1201	707.6714	624.5301	597.5950 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9983	0.9950	0.9810	0.9307	0.8001	0.6332	0.6979	0.9146	0.9901	0.9985	0.9995	(86)
MIT	19.6721	19.8160	20.0618	20.3970	20.7091	20.9156	20.9805	20.9684	20.8097	20.4064	19.9792	19.6488	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9991	0.9977	0.9930	0.9730	0.8993	0.7157	0.5035	0.5699	0.8628	0.9847	0.9979	0.9993	(89)
MIT 2	18.1918	18.4038	18.7639	19.2553	19.6880	19.9401	19.9936	19.9886	19.8287	19.2745	18.6497	18.1634	(90)
Living area fraction									fLA = Living area / (4) =			0.1959	(91)
MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4817	18.6804	19.0181	19.4789	19.8880	20.1311	20.1869	20.1805	20.0209	19.4962	18.9101	18.4544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9904	0.9674	0.8953	0.7280	0.5289	0.5946	0.8643	0.9808	0.9968	0.9989	(94)
Useful gains	633.4584	740.9778	841.0283	928.4842	927.2576	743.8523	514.7767	534.4275	704.4910	694.0508	622.5497	596.9563	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2129.8253	2064.8470	1871.5133	1564.9534	1208.8488	809.0266	524.6489	552.0002	869.1535	1313.4115	1750.6432	2121.8353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating												5844.9213	(98)
Space heating per m2											(98) / (4) =	43.9270	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6257.9457	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1113.2970	889.6401	766.6808	458.2578	209.5039	0.0000	0.0000	0.0000	0.0000	460.8044	812.2273	1134.5100	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1191.9668	952.5055	820.8574	490.6400	224.3082	0.0000	0.0000	0.0000	0.0000	493.3666	869.6224	1214.6788	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5675	88.4161	88.0825	87.2831	85.4848	80.3000	80.3000	80.3000	80.3000	87.2164	88.2134	88.6317	(217)
Fuel for water heating, kWh/month													
	247.4939	218.4799	230.2368	208.1644	206.3783	193.5027	185.3903	206.6667	208.2909	216.0253	225.9896	241.3252	(219)
Water heating fuel used												2587.9440	(219)
Annual totals kWh/year													
Space heating fuel - main system												6257.9457	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9425.6051	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6257.9457	0.2160	1351.7163	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.9440	0.2160	558.9959	(264)
Space and water heating			1910.7122	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2211.5845	(272)
Emissions per m2 for space and water heating			14.3598	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3598 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 129 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 129	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 129, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North West							2.14	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 129 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 129	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 129, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.62
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.22	**DFEE**	42.65	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	16.62	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.44	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.65	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.79	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.83	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.67	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 130 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 130	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 130, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.58	**TER**	17.20
Environmental	95 A	**% DER<TER**	61.73		
CO_2 Emissions (t/year)	0.27	**DFEE**	42.92	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.28		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.20 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.58 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 9.05 m², No overhang
Windows facing East: 1.07 m², No overhang
Windows facing South East: 6.75 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 6.92 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8268	10.6723	11.7927	11.3819	11.7303	11.3161	11.6710	11.7094	11.3519	11.7628	11.4187	11.8158 (61)

Total heat required for water heating calculated for each month

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (64)

Total per year (kWh/year) = Sum(64)m = 1742.9413 (64)

Heat gains from water heating, kWh/month

	58.2686	51.0442	52.8680	46.3668	44.6923	38.8645	36.3099	41.2453	41.6136	48.1300	52.1823	56.5205 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)

Water heating gains (Table 5)

	78.3179	75.9586	71.0591	64.3983	60.0703	53.9785	48.8036	55.4373	57.7967	64.6908	72.4754	75.9684	(72)

Total internal gains

	454.4556	452.2051	435.7469	408.9569	381.3228	354.9930	338.0709	344.5956	358.5138	385.5371	416.6277	440.3588	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.0500	11.2829	0.7200	0.7000	0.7700	35.6644	(75)
East	1.0700	19.6403	0.7200	0.7000	0.7700	7.3400	(76)
Southeast	6.7500	36.7938	0.7200	0.7000	0.7700	86.7446	(77)
South	1.0700	46.7521	0.7200	0.7000	0.7700	17.4722	(78)
Southwest	6.9200	36.7938	0.7200	0.7000	0.7700	88.9293	(79)

Solar gains	236.1505	414.8071	600.3217	797.7901	942.1539	956.5170	913.3855	802.5683	668.2802	467.3409	285.1545	200.5993 (83)
Total gains	690.6061	867.0122	1036.0686	1206.7469	1323.4767	1311.5100	1251.4564	1147.1640	1026.7940	852.8780	701.7822	640.9580 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3274	47.5916	47.8587	49.2408	49.5269	51.0084	51.0084	51.3155	50.4053	49.5269	48.9580	48.4021	
alpha	4.1552	4.1728	4.1906	4.2827	4.3018	4.4006	4.4006	4.4210	4.3604	4.3018	4.2639	4.2268	
util living area	0.9962	0.9898	0.9726	0.9193	0.8024	0.6194	0.4657	0.5221	0.7777	0.9551	0.9919	0.9972	(86)
MIT	19.4395	19.6797	20.0303	20.4717	20.7894	20.9519	20.9890	20.9825	20.8680	20.4272	19.8623	19.4226	(87)
Th 2	19.8894	19.8948	19.9003	19.9278	19.9333	19.9610	19.9610	19.9665	19.9499	19.9333	19.9223	19.9113	(88)
util rest of house	0.9950	0.9869	0.9645	0.8956	0.7490	0.5336	0.3604	0.4126	0.7007	0.9371	0.9891	0.9964	(89)
MIT 2	17.8147	18.1677	18.6770	19.3147	19.7279	19.9278	19.9565	19.9586	19.8424	19.2707	18.4538	17.8045	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.2263	18.5507	19.0198	19.6078	19.9968	20.1872	20.2180	20.2180	20.1022	19.5637	18.8106	18.2144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2263	18.5507	19.0198	19.6078	19.9968	20.1872	20.2180	20.2180	20.1022	19.5637	18.8106	18.2144	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9818	0.9558	0.8872	0.7525	0.5532	0.3870	0.4401	0.7131	0.9290	0.9848	0.9944	(94)
Useful gains	685.4140	851.1976	990.3177	1070.5872	995.8918	725.5507	484.3029	504.8540	732.2393	792.3282	691.1175	637.3763	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2029.0609	1977.8650	1803.8798	1499.4998	1155.1545	755.3116	489.1044	513.0433	821.1166	1248.0075	1649.4000	1996.5572	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	999.6733	757.1205	605.2902	308.8171	118.4915	0.0000	0.0000	0.0000	0.0000	339.0254	689.9633	1011.2306	(98)
Space heating												4829.6119	(98)
Space heating per m2											(98) / (4) =	41.0507	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5176.4329	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	999.6733	757.1205	605.2902	308.8171	118.4915	0.0000	0.0000	0.0000	0.0000	339.0254	689.9633	1011.2306	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1071.4612	811.4903	648.7569	330.9937	127.0005	0.0000	0.0000	0.0000	0.0000	363.3713	739.5106	1083.8485	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7363	89.6634	89.5155	89.1327	88.3311	86.7000	86.7000	86.7000	86.7000	89.1765	89.6005	89.7558	(217)
Fuel for water heating, kWh/month													
	198.5575	174.1673	180.8932	159.6193	155.4643	138.0547	129.2947	146.4262	147.6013	165.5933	178.3165	192.6542	(219)
Water heating fuel used												1966.6426	(219)
Annual totals kWh/year													
Space heating fuel - main system												5176.4329	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1029 * 1.00) =										-2000.7390		-2000.7390	(233)
Total delivered energy for all uses												5662.5484	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5176.4329	0.2160	1118.1095	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.6426	0.2160	424.7948	(264)
Space and water heating			1542.9043	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2000.7390	0.5190	-1038.3835	(269)
Total CO2, kg/year			774.5107	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.5800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.5800	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.3835	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.3835	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
								Total per year (kWh/year) = Sum(64)m =				2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.0500	11.2829	0.6300	0.7000	0.7700	31.2063	(75)
East	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(76)
Southeast	6.7500	36.7938	0.6300	0.7000	0.7700	75.9015	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	6.9200	36.7938	0.6300	0.7000	0.7700	77.8131	(79)

Solar gains	206.6317	362.9563	525.2815	698.0663	824.3847	836.9524	799.2123	702.2473	584.7452	408.9233	249.5102	175.5244	(83)
Total gains	674.2365	828.3143	974.1890	1120.1837	1218.1799	1203.7318	1149.0771	1059.3224	956.4298	807.6311	679.2963	629.0361	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9983	0.9953	0.9861	0.9532	0.8632	0.6971	0.5314	0.5927	0.8402	0.9752	0.9962	0.9988	(86)
MIT	19.6127	19.8039	20.0973	20.4690	20.7757	20.9432	20.9876	20.9796	20.8563	20.4432	19.9542	19.5801	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9978	0.9937	0.9810	0.9354	0.8134	0.6016	0.4070	0.4647	0.7644	0.9626	0.9947	0.9984	(89)
MIT 2	18.0414	18.3218	18.7489	19.2831	19.6865	19.8751	19.9077	19.9056	19.7946	19.2577	18.5494	17.9997	(90)
Living area fraction										fLA = Living area / (4) =		0.2533	(91)
MIT	18.4394	18.6972	19.0904	19.5835	19.9624	20.1457	20.1812	20.1776	20.0635	19.5580	18.9053	18.4000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4394	18.6972	19.0904	19.5835	19.9624	20.1457	20.1812	20.1776	20.0635	19.5580	18.9053	18.4000	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9911	0.9759	0.9290	0.8164	0.6236	0.4387	0.4972	0.7768	0.9572	0.9925	0.9975	(94)
Useful gains	671.9519	820.9772	950.7470	1040.6579	994.5663	750.6309	504.1180	526.7110	742.9853	773.0354	674.2035	627.4826	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2065.9371	2011.4093	1831.4256	1537.8774	1187.0242	789.4165	509.7808	536.8154	851.9224	1286.9627	1702.7744	2056.6837	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1037.1250	799.9703	655.2249	357.9980	143.1887	0.0000	0.0000	0.0000	0.0000	382.3619	740.5711	1063.3256	(98)
Space heating												5179.7655	(98)
Space heating per m2											(98) / (4) =	44.0269	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5545.7875	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1037.1250	799.9703	655.2249	357.9980	143.1887	0.0000	0.0000	0.0000	0.0000	382.3619	740.5711	1063.3256	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1110.4122	856.4993	701.5256	383.2955	153.3069	0.0000	0.0000	0.0000	0.0000	409.3811	792.9026	1138.4642	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4723	88.2558	87.8064	86.7471	84.5589	80.3000	80.3000	80.3000	80.3000	86.8153	88.0663	88.5482	(217)
Fuel for water heating, kWh/month													
	245.6254	217.0050	229.0192	207.7017	206.2957	191.3303	183.3090	204.3466	206.6034	215.2458	224.4544	239.4871	(219)
Water heating fuel used												2570.4237	(219)
Annual totals kWh/year													
Space heating fuel - main system												5545.7875	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												8636.4230	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5545.7875	0.2160	1197.8901	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.4237	0.2160	555.2115	(264)
Space and water heating			1753.1016	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2023.0916	(272)
Emissions per m2 for space and water heating			14.9010	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9010 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.2000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 130 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 130	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 130, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.58	**TER**	17.20
Environmental	95 A	**% DER<TER**	61.73		
CO_2 Emissions (t/year)	0.27	**DFEE**	42.92	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.28		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 130 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 130	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 130, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.58	**TER**	17.20
Environmental	95 A	**% DER<TER**	61.73		
CO_2 Emissions (t/year)	0.27	**DFEE**	42.92	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.28		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	6.58	$kgCO_2/yr/m^2$	
TER	17.20	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.58	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.73	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.92	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	17.48	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.28	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.28	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.65	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.45	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.45	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 131 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 131	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 131, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 0.48 m², No overhang
Windows facing East: 1.07 m², No overhang
Windows facing South East: 6.76 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 7.51 m², No overhang
Windows facing North West: 9.16 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m = 1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2          Table 6a      Specific data  Specific data      factor              W
                                                          W/m2    or Table 6b    or Table 6c    Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                0.4800           11.2829         0.7200         0.7000         0.7700          1.8916 (75)
East                                     1.0700           19.6403         0.7200         0.7000         0.7700          7.3400 (76)
Southeast                                6.7600           36.7938         0.7200         0.7000         0.7700         86.8731 (77)
South                                    1.0700           46.7521         0.7200         0.7000         0.7700         17.4722 (78)
Southwest                                7.5100           36.7938         0.7200         0.7000         0.7700         96.5114 (79)
Northwest                                9.1600           11.2829         0.7200         0.7000         0.7700         36.0979 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   246.1862  432.6740  626.8192  834.0602  985.9179 1001.3450  956.0300  839.4110  698.1288  487.6407  297.3157  209.0967 (83)
Total gains   716.3445  900.5580 1077.6469 1257.0811 1380.1617 1368.2507 1305.4197 1195.3852 1068.5973  886.1513  728.0896  664.5881 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9960    0.9895    0.9722    0.9194    0.8044    0.6238    0.4705    0.5275    0.7811    0.9551    0.9916    0.9971 (86)

MIT           19.3950   19.6383   19.9951   20.4461   20.7746   20.9466   20.9874   20.9800   20.8572   20.4024   19.8261   19.3778 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9949    0.9867    0.9644    0.8969    0.7534    0.5408    0.3675    0.4207    0.7077    0.9380    0.9889    0.9962 (89)
MIT 2         17.7777   18.1352   18.6538   19.3062   19.7369   19.9501   19.9829   19.9842   19.8575   19.2624   18.4283   17.7666 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1191 (91)
MIT           17.9704   18.3143   18.8136   19.4420   19.8605   20.0688   20.1026   20.1028   19.9766   19.3982   18.5948   17.9586 (92)
Temperature adjustment                                                                                                0.0000
adjusted MIT  17.9704   18.3143   18.8136   19.4420   19.8605   20.0688   20.1026   20.1028   19.9766   19.3982   18.5948   17.9586 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9917    0.9803    0.9533    0.8833    0.7478    0.5478    0.3794    0.4327    0.7076    0.9256    0.9835    0.9938 (94)
Useful gains  710.4110  882.8238 1027.3076 1110.4047 1032.1432  749.5274  495.3090  517.2190  756.1111  820.2383  716.0905  660.4741 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2103.6689 2052.8637 1873.9600 1559.5688 1200.3255  781.1738  500.3121  525.7731  849.4106 1294.1252 1710.2934 2070.4925 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1036.5839  786.2669  629.9094  323.3981  125.1276    0.0000    0.0000    0.0000    0.0000  352.5718  715.8261 1049.0537 (98)
Space heating                                                                                                        5018.7375 (98)
Space heating per m2                                                                                  (98) / (4) =   39.1844 (99)


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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5379.1399	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1036.5839	786.2669	629.9094	323.3981	125.1276	0.0000	0.0000	0.0000	0.0000	352.5718	715.8261	1049.0537	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1111.0224	842.7297	675.1440	346.6218	134.1132	0.0000	0.0000	0.0000	0.0000	377.8905	767.2305	1124.3876	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7497	89.6789	89.5350	89.1628	88.3730	86.7000	86.7000	86.7000	86.7000	89.2007	89.6167	89.7690	(217)
Fuel for water heating, kWh/month													
	200.0885	175.5031	182.2656	160.8016	156.5896	139.1090	130.2717	147.5475	148.7340	166.8313	179.6781	194.1368	(219)
Water heating fuel used												1981.5569	(219)
Annual totals kWh/year													
Space heating fuel - main system												5379.1399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												5564.9564	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5379.1399	0.2160	1161.8942	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.5569	0.2160	428.0163	(264)
Space and water heating			1589.9105	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			657.9213	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.1400	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.2773	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.2773	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019 (64)
Heat gains from water heating, kWh/month												
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(75)
East	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(76)
Southeast	6.7600	36.7938	0.6300	0.7000	0.7700	76.0140	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	7.5100	36.7938	0.6300	0.7000	0.7700	84.4475	(79)
Northwest	9.1600	11.2829	0.6300	0.7000	0.7700	31.5856	(81)

Solar gains	215.4130	378.5897	548.4668	729.8027	862.6782	876.1769	836.5262	734.4846	610.8627	426.6856	260.1512	182.9596 (83)
Total gains	698.7194	859.6258	1012.4543	1165.9939	1269.5309	1254.9998	1197.8408	1103.0749	994.5121	838.3661	704.0827	651.6030 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9987	0.9962	0.9881	0.9581	0.8718	0.7069	0.5396	0.6022	0.8503	0.9785	0.9969	0.9991	(86)
MIT	19.6339	19.8196	20.1064	20.4719	20.7767	20.9439	20.9880	20.9800	20.8561	20.4463	19.9675	19.6021	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9982	0.9948	0.9837	0.9420	0.8244	0.6133	0.4165	0.4758	0.7777	0.9674	0.9957	0.9987	(89)
MIT 2	18.0920	18.3646	18.7826	19.3093	19.7128	19.9023	19.9349	19.9327	19.8200	19.2832	18.5883	18.0512	(90)
Living area fraction										fLA = Living area / (4) =		0.1191	(91)
MIT	18.2757	18.5380	18.9403	19.4479	19.8395	20.0264	20.0604	20.0574	19.9434	19.4218	18.7526	18.2360	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2757	18.5380	18.9403	19.4479	19.8395	20.0264	20.0604	20.0574	19.9434	19.4218	18.7526	18.2360	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9922	0.9781	0.9326	0.8196	0.6216	0.4311	0.4904	0.7783	0.9600	0.9934	0.9979	(94)
Useful gains	696.7033	852.9278	990.2387	1087.4454	1040.5111	780.1098	516.3403	540.9997	774.0680	804.8129	699.4607	650.2474	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2159.0767	2102.2961	1913.5654	1606.0891	1237.0143	817.3446	521.2162	549.9823	883.2022	1340.6996	1777.7699	2150.0138	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1088.0058	839.5755	686.9550	373.4235	146.1984	0.0000	0.0000	0.0000	0.0000	398.6997	776.3827	1115.8262	(98)
Space heating												5425.0668	(98)
Space heating per m2											(98) / (4) =	42.3569	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5808.4227	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1088.0058	839.5755	686.9550	373.4235	146.1984	0.0000	0.0000	0.0000	0.0000	398.6997	776.3827	1115.8262	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1164.8885	898.9031	735.4979	399.8110	156.5294	0.0000	0.0000	0.0000	0.0000	426.8734	831.2448	1194.6747	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5362	88.3258	87.8848	86.8305	84.5896	80.3000	80.3000	80.3000	80.3000	86.8976	88.1390	88.6106	(217)
Fuel for water heating, kWh/month													
	247.0268	218.2170	230.2505	208.8045	207.9536	192.9379	184.8492	206.0635	207.8622	216.3562	225.6836	240.8459	(219)
Water heating fuel used												2586.8509	(219)
Annual totals kWh/year													
Space heating fuel - main system												5808.4227	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												8937.8455	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5808.4227	0.2160	1254.6193	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.8509	0.2160	558.7598	(264)
Space and water heating			1813.3791	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2094.9739	(272)
Emissions per m2 for space and water heating			14.1582	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1582 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.3600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 131 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 131	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 131, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	0.48	100
W14	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	2.05	100
D2	Half Glazed Door	[1] External Wall	North East			2.14	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00	1.07	100
W15	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 131 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 131	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 131, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.14	$kgCO_2/yr/m^2$	
TER	16.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.14	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.58	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.66	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.80	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.80	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.33	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.33	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 132 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 132	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 132, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.40	**TER**	17.02
Environmental	95 A	**% DER<TER**	62.40		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.16	**TFEE**	55.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.02 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.40 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 6.92 m², No overhang
Windows facing East: 1.07 m², No overhang
Windows facing South East: 6.75 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 9.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8268   10.6723   11.7927   11.3819   11.7303   11.3161   11.6710   11.7094   11.3519   11.7628   11.4187   11.8158 (61)
Total heat required for water heating calculated for each month
              178.1782  156.1643  161.9275  142.2730  137.3234  119.6934  112.0985  126.9515  127.9704  147.6704  159.7724  172.9183 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1782  156.1643  161.9275  142.2730  137.3234  119.6934  112.0985  126.9515  127.9704  147.6704  159.7724  172.9183 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1742.9413 (64)
Heat gains from water heating, kWh/month
               58.2686   51.0442   52.8680   46.3668   44.6923   38.8645   36.3099   41.2453   41.6136   48.1300   52.1823   56.5205 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879  142.6879 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                25.2097   22.3911   18.2096   13.7859   10.3051    8.7000    9.4007   12.2193   16.4008   20.8245   24.3053   25.9104 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               282.1215  285.0490  277.6717  261.9663  242.1411  223.5081  211.0602  208.1327  215.5100  231.2154  251.0406  269.6735 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688   37.2688 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 -114.1503 (71)
Water heating gains (Table 5)
                78.3179   75.9586   71.0591   64.3983   60.0703   53.9785   48.8036   55.4373   57.7967   64.6908   72.4754   75.9684 (72)
Total internal gains
               454.4556  452.2051  435.7469  408.9569  381.3228  354.9930  338.0709  344.5956  358.5138  385.5371  416.6277  440.3588 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data        factor                W
                                                         W/m2       or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                              6.9200           11.2829            0.7200           0.7000           0.7700           27.2704 (75)
East                                   1.0700           19.6403            0.7200           0.7000           0.7700            7.3400 (76)
Southeast                              6.7500           36.7938            0.7200           0.7000           0.7700           86.7446 (77)
South                                  1.0700           46.7521            0.7200           0.7000           0.7700           17.4722 (78)
Southwest                              9.0500           36.7938            0.7200           0.7000           0.7700          116.3021 (79)
-------------------------------------------------------------------------------------------------------------------

Solar gains   255.1293  444.3470  633.3336  826.2802  962.7351  971.9656  930.3536  826.1988  699.8469  497.9919  307.3790  217.1697 (83)
Total gains   709.5849  896.5520 1069.0804 1235.2371 1344.0579 1326.9586 1268.4244 1170.7944 1058.3607  883.5290  724.0067  657.5285 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.3274   47.5916   47.8587   49.2408   49.5269   51.0084   51.0084   51.3155   50.4053   49.5269   48.9580   48.4021
alpha          4.1552    4.1728    4.1906    4.2827    4.3018    4.4006    4.4006    4.4210    4.3604    4.3018    4.2639    4.2268
util living area
                0.9958    0.9885    0.9696    0.9138    0.7959    0.6137    0.4599    0.5127    0.7642    0.9498    0.9909    0.9969 (86)

MIT            19.4562   19.7048   20.0562   20.4891   20.7965   20.9536   20.9896   20.9837   20.8772   20.4495   19.8815   19.4373 (87)
Th 2           19.8894   19.8948   19.9003   19.9278   19.9333   19.9610   19.9610   19.9665   19.9499   19.9333   19.9223   19.9113 (88)
util rest of house
                0.9945    0.9852    0.9607    0.8890    0.7418    0.5282    0.3557    0.4046    0.6860    0.9301    0.9877    0.9960 (89)
MIT 2          17.8390   18.2040   18.7135   19.3376   19.7356   19.9291   19.9567   19.9592   19.8511   19.3006   18.4816   17.8260 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.2533 (91)
MIT            18.2486   18.5842   19.0536   19.6293   20.0043   20.1886   20.2183   20.2187   20.1110   19.5916   18.8362   18.2341 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   18.2486   18.5842   19.0536   19.6293   20.0043   20.1886   20.2183   20.2187   20.1110   19.5916   18.8362   18.2341 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9917    0.9797    0.9517    0.8807    0.7458    0.5478    0.3820    0.4318    0.6992    0.9220    0.9831    0.9939 (94)
Useful gains  703.7295  878.3492 1017.4411 1087.9302 1002.4193  726.8508  484.5813  505.5404  740.0120  814.6066  711.8051  653.5053 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2032.3126 1982.7137 1808.7524 1502.5094 1156.2090  755.5013  489.1451  513.1427  822.3219 1251.8914 1653.0065 1999.3661 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              988.4658  742.1330  588.7356  298.4970  114.4195    0.0000    0.0000    0.0000    0.0000  325.3399  677.6650 1001.3204 (98)
Space heating                                                                                                                4736.5763 (98)
Space heating per m2                                                                                        (98) / (4) =     40.2599 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5076.7163	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	988.4658	742.1330	588.7356	298.4970	114.4195	0.0000	0.0000	0.0000	0.0000	325.3399	677.6650	1001.3204	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1059.4489	795.4265	631.0135	319.9325	122.6362	0.0000	0.0000	0.0000	0.0000	348.7030	726.3290	1073.2266	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7310	89.6528	89.4984	89.1057	88.3000	86.7000	86.7000	86.7000	86.7000	89.1444	89.5903	89.7512	(217)
Fuel for water heating, kWh/month													
	198.5694	174.1878	180.9279	159.6676	155.5192	138.0547	129.2947	146.4262	147.6013	165.6530	178.3368	192.6640	(219)
Water heating fuel used												1966.9025	(219)
Annual totals kWh/year													
Space heating fuel - main system												5076.7163	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1029 * 1.00) =										-2000.7390		-2000.7390	(233)
Total delivered energy for all uses												5563.0916	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5076.7163	0.2160	1096.5707	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.9025	0.2160	424.8509	(264)
Space and water heating			1521.4217	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2000.7390	0.5190	-1038.3835	(269)
Total CO2, kg/year			753.0281	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4000	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.2035	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.2035	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
Total per year (kWh/year) = Sum(64)m =												2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.9200	11.2829	0.6300	0.7000	0.7700	23.8616	(75)
East	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(76)
Southeast	6.7500	36.7938	0.6300	0.7000	0.7700	75.9015	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	9.0500	36.7938	0.6300	0.7000	0.7700	101.7643	(79)

Solar gains	223.2382	388.8036	554.1669	722.9952	842.3932	850.4699	814.0594	722.9239	612.3660	435.7429	268.9567	190.0235	(83)
Total gains	690.8430	854.1616	1003.0744	1145.1125	1236.1885	1217.2493	1163.9241	1079.9990	984.0507	834.4507	698.7428	643.5352	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9982	0.9947	0.9844	0.9495	0.8578	0.6914	0.5253	0.5830	0.8287	0.9719	0.9957	0.9987	(86)
MIT	19.6256	19.8237	20.1184	20.4844	20.7828	20.9452	20.9882	20.9810	20.8657	20.4617	19.9692	19.5915	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9975	0.9928	0.9787	0.9307	0.8070	0.5960	0.4020	0.4563	0.7507	0.9579	0.9940	0.9982	(89)
MIT 2	18.0602	18.3505	18.7789	19.3037	19.6943	19.8766	19.9079	19.9062	19.8034	19.2831	18.5712	18.0162	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.4567	18.7237	19.1182	19.6028	19.9700	20.1472	20.1815	20.1784	20.0725	19.5816	18.9253	18.4152	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4567	18.7237	19.1182	19.6028	19.9700	20.1472	20.1815	20.1784	20.0725	19.5816	18.9253	18.4152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9900	0.9734	0.9243	0.8105	0.6180	0.4334	0.4885	0.7641	0.9524	0.9916	0.9973	(94)
Useful gains	688.2609	845.6574	976.3675	1058.4215	1001.9544	752.2850	504.4507	527.5550	751.9160	794.7497	692.8978	641.7896	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2068.4726	2015.2650	1835.4609	1540.6514	1188.1184	789.6407	509.8264	536.9298	853.2016	1290.3538	1705.6661	2058.8897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1026.8775	785.9763	639.1655	347.2055	138.5061	0.0000	0.0000	0.0000	0.0000	368.7295	729.1931	1054.3224	(98)
Space heating												5089.9760	(98)
Space heating per m2											(98) / (4) =	43.2637	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5449.6531	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1026.8775	785.9763	639.1655	347.2055	138.5061	0.0000	0.0000	0.0000	0.0000	368.7295	729.1931	1054.3224	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1099.4406	841.5164	684.3314	371.7404	148.2934	0.0000	0.0000	0.0000	0.0000	394.7853	780.7207	1128.8249	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4567	88.2258	87.7583	86.6755	84.4772	80.3000	80.3000	80.3000	80.3000	86.7310	88.0384	88.5353	(217)
Fuel for water heating, kWh/month													
	245.6685	217.0787	229.1448	207.8734	206.4951	191.3303	183.3090	204.3466	206.6034	215.4553	224.5255	239.5220	(219)
Water heating fuel used												2571.3528	(219)
Annual totals kWh/year													
Space heating fuel - main system												5449.6531	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												8541.2176	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5449.6531	0.2160	1177.1251	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.3528	0.2160	555.4122	(264)
Space and water heating			1732.5373	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2002.5272	(272)
Emissions per m2 for space and water heating			14.7262	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7262 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.0200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 132 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 132	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 132, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.40	**TER**	17.02
Environmental	95 A	**% DER<TER**	62.40		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.16	**TFEE**	55.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 132 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 132	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 132, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.40	**TER**	17.02
Environmental	95 A	**% DER<TER**	62.40		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.16	**TFEE**	55.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	6.40	$kgCO_2/yr/m^2$	
TER	17.02	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.40	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.40	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.16	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	17.29	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.09	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.09	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.46	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.26	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.26	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 133 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 133	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 133, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.39	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.49		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.10	**TFEE**	54.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.39 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.90 m², No overhang
Windows facing South East: 0.72 m², No overhang
Windows facing South West: 7.03 m², No overhang
Windows facing North West: 0.96 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.6100	1.2357	18.0542			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.2100	26.6301			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8964	(36)
Total fabric heat loss					(33) + (36) =		62.7206	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	116.9976	116.3301	115.6626	112.3251	111.6576	108.3202	108.3202	107.6527	109.6552	111.6576	112.9926	114.3276	(39)
Average = Sum(39)m / 12 =												112.1583	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1715	1.1648	1.1312	1.1244	1.0908	1.0908	1.0841	1.1043	1.1244	1.1379	1.1513	(40)
HLP (average)												1.1295	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8169	10.6637	11.7839	11.3667	11.7162	11.3045	11.6603	11.6966	11.3384	11.7548	11.4100	11.8062	(61)
Total heat required for water heating calculated for each month													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
								Total per year (kWh/year) = Sum(64)m =				1697.6662	(64)
Heat gains from water heating, kWh/month													
	56.7099	49.6809	51.4612	45.1385	43.5138	37.8477	35.3677	40.1640	40.5192	46.8565	50.7922	55.0110	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.1477	21.4477	17.4425	13.2051	9.8709	8.3335	9.0046	11.7045	15.7098	19.9472	23.2813	24.8188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	76.2229	73.9299	69.1683	62.6923	58.4863	52.5663	47.5372	53.9839	56.2767	62.9792	70.5448	73.9395	(72)
Total internal gains													
	422.5560	420.2112	404.7712	379.8515	354.3787	330.0668	314.4492	320.9477	333.9189	359.0650	387.8975	409.6840	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9000	11.2829	0.7200	0.7000	0.7700	23.2508	(75)
Southeast	0.7200	36.7938	0.7200	0.7000	0.7700	9.2528	(77)
Southwest	7.0300	36.7938	0.7200	0.7000	0.7700	90.3429	(79)
Northwest	0.9600	11.2829	0.7200	0.7000	0.7700	3.7832	(81)

Solar gains	126.6297	224.6768	331.2640	450.4308	541.0107	553.1494	526.6153	456.5848	372.1454	254.7467	153.3084	107.3105	(83)
Total gains	549.1856	644.8879	736.0352	830.2823	895.3893	883.2162	841.0645	777.5325	706.0642	613.8116	541.2059	516.9945	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.1520	47.4225	47.6962	49.1134	49.4070	50.9293	50.9293	51.2450	50.3092	49.4070	48.8232	48.2531	
alpha	4.1435	4.1615	4.1797	4.2742	4.2938	4.3953	4.3953	4.4163	4.3539	4.2938	4.2549	4.2169	
util living area													
	0.9963	0.9922	0.9818	0.9489	0.8659	0.7051	0.5455	0.6024	0.8402	0.9684	0.9929	0.9971	(86)
MIT	19.4293	19.6212	19.9312	20.3556	20.7028	20.9197	20.9797	20.9694	20.8146	20.3597	19.8362	19.4219	(87)
Th 2	19.9375	19.9429	19.9483	19.9755	19.9809	20.0083	20.0083	20.0138	19.9973	19.9809	19.9700	19.9591	(88)
util rest of house													
	0.9952	0.9900	0.9764	0.9330	0.8239	0.6220	0.4323	0.4883	0.7758	0.9557	0.9906	0.9963	(89)
MIT 2	17.8393	18.1225	18.5758	19.2000	19.6717	19.9476	19.9990	19.9982	19.8330	19.2184	18.4554	17.8428	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.0353	18.3073	18.7429	19.3424	19.7988	20.0674	20.1198	20.1179	19.9540	19.3591	18.6256	18.0374	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0353	18.3073	18.7429	19.3424	19.7988	20.0674	20.1198	20.1179	19.9540	19.3591	18.6256	18.0374	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9850	0.9677	0.9204	0.8151	0.6274	0.4456	0.5011	0.7726	0.9449	0.9859	0.9940	(94)
Useful gains	544.9416	635.2005	712.2972	764.2071	729.8215	554.1424	374.7406	389.6106	545.4881	580.0138	533.5884	513.8707	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1606.9912	1559.6674	1416.0459	1172.9437	904.2881	592.2320	381.2702	400.2450	641.9238	978.0194	1302.3091	1581.9974	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	790.1649	621.2417	523.5890	294.2904	129.8032	0.0000	0.0000	0.0000	0.0000	296.1161	553.4789	794.6863	(98)
Space heating												4003.3705	(98)
Space heating per m2											(98) / (4) =	40.3159	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4290.8580	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	790.1649	621.2417	523.5890	294.2904	129.8032	0.0000	0.0000	0.0000	0.0000	296.1161	553.4789	794.6863	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	846.9077	665.8540	561.1887	315.4238	139.1245	0.0000	0.0000	0.0000	0.0000	317.3806	593.2250	851.7538	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6300	89.5687	89.4404	89.1154	88.4363	86.7000	86.7000	86.7000	86.7000	89.0906	89.4847	89.6492	(217)
Fuel for water heating, kWh/month													
	193.5602	169.7716	176.3124	155.5007	151.2679	134.5243	126.0233	142.6715	143.8012	161.4520	173.8729	187.8165	(219)
Water heating fuel used												1916.5746	(219)
Annual totals kWh/year													
Space heating fuel - main system												4290.8580	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =											-1671.3992	-1671.3992	(233)
Total delivered energy for all uses												5037.4885	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4290.8580	0.2160	926.8253	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.5746	0.2160	413.9801	(264)
Space and water heating			1340.8054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			733.6045	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.3900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.3900	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		24.4776	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.4776	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.1800	22.8258			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.6721			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7119	(36)
Total fabric heat loss (33) + (36) =	68.3840	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	115.4425	115.1867	114.9359	113.7580	113.5376	112.5116	112.5116	112.3217	112.9068	113.5376	113.9834	114.4495	(39)
Average = Sum(39)m / 12 =												113.7569	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1626	1.1600	1.1575	1.1456	1.1434	1.1330	1.1330	1.1311	1.1370	1.1434	1.1479	1.1526	(40)
HLP (average)												1.1456	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.1477	21.4477	17.4425	13.2051	9.8709	8.3335	9.0046	11.7045	15.7098	19.9472	23.2813	24.8188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.7085	433.3673	417.9348	392.5359	366.3940	341.4150	325.8045	332.9697	346.6130	372.2384	401.0589	422.8401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9000	11.2829	0.6300	0.7000	0.7700	20.3445	(75)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
Southwest	7.0300	36.7938	0.6300	0.7000	0.7700	79.0501	(79)
Northwest	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(81)

Solar gains	110.8010	196.5922	289.8560	394.1269	473.3843	484.0057	460.7884	399.5117	325.6272	222.9033	134.1449	93.8967	(83)
Total gains	546.5095	629.9595	707.7908	786.6628	839.7783	825.4208	786.5929	732.4813	672.2402	595.1417	535.2038	516.7368	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7339	59.8666	59.9972	60.6185	60.7361	61.2900	61.2900	61.3936	61.0754	60.7361	60.4986	60.2522	
alpha	4.9823	4.9911	4.9998	5.0412	5.0491	5.0860	5.0860	5.0929	5.0717	5.0491	5.0332	5.0168	
util living area													
	0.9987	0.9970	0.9920	0.9736	0.9141	0.7739	0.6058	0.6655	0.8903	0.9841	0.9972	0.9990	(86)
MIT	19.6958	19.8422	20.0891	20.4220	20.7270	20.9229	20.9824	20.9723	20.8288	20.4365	20.0059	19.6703	(87)
Th 2	19.9501	19.9521	19.9542	19.9638	19.9656	19.9739	19.9739	19.9755	19.9707	19.9656	19.9619	19.9581	(88)
util rest of house													
	0.9982	0.9959	0.9890	0.9627	0.8774	0.6852	0.4764	0.5364	0.8294	0.9758	0.9960	0.9987	(89)
MIT 2	18.2071	18.4223	18.7834	19.2689	19.6859	19.9196	19.9671	19.9634	19.8245	19.2962	18.6690	18.1755	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3906	18.5973	18.9443	19.4110	19.8142	20.0433	20.0923	20.0877	19.9483	19.4368	18.8338	18.3598	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3906	18.5973	18.9443	19.4110	19.8142	20.0433	20.0923	20.0877	19.9483	19.4368	18.8338	18.3598	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9938	0.9848	0.9550	0.8708	0.6919	0.4921	0.5516	0.8277	0.9696	0.9940	0.9978	(94)
Useful gains	544.9233	626.0718	697.0214	751.2368	731.2797	571.0729	387.0761	404.0245	556.4357	577.0421	531.9957	515.5976	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1626.6499	1577.7465	1430.2982	1195.7119	921.2693	612.4329	392.9235	414.2110	660.3108	1003.3055	1337.4612	1620.5797	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	804.8046	639.5254	545.5579	320.0221	141.3523	0.0000	0.0000	0.0000	0.0000	317.1400	579.9352	822.1067	(98)
Space heating												4170.4441	(98)
Space heating per m2											(98) / (4) =	41.9984	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4465.1436	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	804.8046	639.5254	545.5579	320.0221	141.3523	0.0000	0.0000	0.0000	0.0000	317.1400	579.9352	822.1067	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	861.6752	684.7167	584.1092	342.6361	151.3408	0.0000	0.0000	0.0000	0.0000	339.5503	620.9156	880.1999	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0846	87.8944	87.4822	86.5500	84.5975	80.3000	80.3000	80.3000	80.3000	86.4221	87.6422	88.1649	(217)
Fuel for water heating, kWh/month													
	241.3928	213.2400	225.0394	202.3175	200.4001	185.9471	178.1515	198.5972	200.7905	211.8007	220.7781	235.3869	(219)
Water heating fuel used												2513.8418	(219)
Annual totals kWh/year													
Space heating fuel - main system												4465.1436	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Total delivered energy for all uses												7480.4406	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4465.1436	0.2160	964.4710	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.8418	0.2160	542.9898	(264)
Space and water heating			1507.4608	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Total CO2, kg/m2/year			1767.7161	(272)
Emissions per m2 for space and water heating			15.1809	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2289	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1809 * 1.00) + 2.2289 + 0.3920, rounded to 2 d.p.			17.8000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 133 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 133	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 133, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.39	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.49		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.10	**TFEE**	54.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.09 m	49.65 m²	2.31 m
1st Storey:	29.09 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	143.56	126.81

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.48	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.26	0.065	No
Independently assessed	E3 Sill	9.65	0.004	No
Independently assessed	E4 Jamb	28.80	0.005	No
Independently assessed	E5 Ground floor (normal)	29.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	29.09	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.94	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.15	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 133 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 133	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 133, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.39	**TER**	17.80
Environmental	95 A	**% DER<TER**	58.49		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.10	**TFEE**	54.24
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	7.39	$kgCO_2/yr/m^2$	
TER	17.80	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.39	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.49	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.10	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	18.46	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.55	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.55	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.73	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.82	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.82	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 134 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 134	**Prop Type Ref**	As
Property	L361-R - Det SG, Plot 134, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	19.01
Environmental	94 A	**% DER<TER**	56.44		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.61	**TFEE**	60.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.92 m², No overhang
Windows facing South East: 5.74 m², No overhang
Windows facing South West: 1.41 m², No overhang
Windows facing West: 1.04 m², No overhang
Windows facing North West: 5.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2160	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4410	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4780	0.4686	0.4592	0.4124	0.4030	0.3561	0.3561	0.3468	0.3749	0.4030	0.4217	0.4405	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7280	0.7186	0.7092	0.6624	0.6530	0.6061	0.6061	0.5968	0.6249	0.6530	0.6717	0.6905	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2200	1.2357	26.2224			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			47.5100	0.1200	5.7012			(28a)
External Wall	138.2700	25.5000	112.7700	0.2100	23.6817			(29a)
Main Roof	46.2700		46.2700	0.0700	3.2389			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4626			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3203	(36)
Total fabric heat loss					(33) + (36) =		70.7830	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5990	54.8832	54.1674	50.5885	49.8727	46.2937	46.2937	45.5779	47.7253	49.8727	51.3043	52.7358	(38)
Heat transfer coeff	126.3820	125.6662	124.9504	121.3714	120.6556	117.0767	117.0767	116.3609	118.5083	120.6556	122.0872	123.5188	(39)
Average = Sum(39)m / 12 =												121.1925	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3476	1.3400	1.3324	1.2942	1.2866	1.2484	1.2484	1.2408	1.2637	1.2866	1.3018	1.3171	(40)
HLP (average)												1.2923	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6740 (42)
Average daily hot water use (litres/day) 97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8122	10.6595	11.7785	11.3594	11.7095	11.2990	11.6551	11.6904	11.3319	11.7500	11.4057	11.8016 (61)

Total heat required for water heating calculated for each month

	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598 (64)
								Total per year (kWh/year) = Sum(64)m =				1675.5748 (64)

Heat gains from water heating, kWh/month

	55.9494	49.0158	50.7746	44.5392	42.9389	37.3516	34.9080	39.6365	39.9853	46.2350	50.1140	54.2745 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.9147	19.4644	15.8296	11.9840	8.9582	7.5629	8.1719	10.6222	14.2571	18.1027	21.1285	22.5238	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	245.8627	248.4140	241.9848	228.2979	211.0207	194.7825	183.9343	181.3831	187.8122	201.4991	218.7764	235.0146	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	(71)

Water heating gains (Table 5)

	75.2007	72.9402	68.2455	61.8600	57.7136	51.8773	46.9194	53.2748	55.5352	62.1438	69.6028	72.9496	(72)

Total internal gains

	409.0883	406.9287	392.1700	368.2520	343.8025	320.3327	305.1358	311.3902	323.7146	347.8557	375.6178	396.5981	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
Northeast	6.9200	11.2829	0.7200	0.7000	0.7700	27.2704	(75)
Southeast	5.7400	36.7938	0.7200	0.7000	0.7700	73.7651	(77)
Southwest	1.4100	36.7938	0.7200	0.7000	0.7700	18.1200	(79)
West	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(80)
Northwest	5.0700	11.2829	0.7200	0.7000	0.7700	19.9799	(81)

Solar gains	150.1321	274.0312	422.9609	603.5924	747.9611	773.9866	733.1378	620.7499	484.8404	315.8671	183.1707	126.3083	(83)
Total gains	559.2204	680.9599	815.1308	971.8445	1091.7636	1094.3193	1038.2736	932.1401	808.5550	663.7228	558.7885	522.9064	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.7283	44.9831	45.2408	46.5748	46.8511	48.2833	48.2833	48.5803	47.7001	46.8511	46.3017	45.7651	
alpha	3.9819	3.9989	4.0161	4.1050	4.1234	4.2189	4.2189	4.2387	4.1800	4.1234	4.0868	4.0510	
util living area													
	0.9963	0.9914	0.9773	0.9293	0.8157	0.6340	0.4828	0.5496	0.8115	0.9646	0.9928	0.9972	(86)
MIT	19.3302	19.5487	19.9056	20.3858	20.7481	20.9392	20.9848	20.9748	20.8234	20.3313	19.7611	19.3199	(87)
Th 2	19.8037	19.8096	19.8156	19.8454	19.8514	19.8815	19.8815	19.8875	19.8694	19.8514	19.8394	19.8275	(88)
util rest of house													
	0.9951	0.9888	0.9701	0.9067	0.7607	0.5417	0.3665	0.4280	0.7340	0.9489	0.9902	0.9963	(89)
MIT 2	17.5950	17.9171	18.4370	19.1337	19.6075	19.8405	19.8756	19.8765	19.7250	19.0763	18.2476	17.5953	(90)
Living area fraction										fLA = Living area / (4) =		0.1913	(91)
MIT	17.9270	18.2292	18.7179	19.3732	19.8257	20.0507	20.0878	20.0866	19.9351	19.3164	18.5371	17.9253	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9270	18.2292	18.7179	19.3732	19.8257	20.0507	20.0878	20.0866	19.9351	19.3164	18.5371	17.9253	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9836	0.9608	0.8952	0.7593	0.5566	0.3886	0.4508	0.7392	0.9389	0.9857	0.9941	(94)
Useful gains	554.9199	669.7859	783.1907	869.9596	828.9686	609.0706	403.4669	420.1969	597.7171	623.1922	550.7730	519.8159	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1722.2012	1675.0307	1526.6337	1271.1488	980.4140	638.1504	408.3361	428.9778	691.5093	1051.6818	1396.3249	1695.3264	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	868.4573	675.5245	553.1216	288.8562	112.6754	0.0000	0.0000	0.0000	0.0000	318.7963	608.7974	874.5798	(98)
Space heating												4300.8084	(98)
Space heating per m2											(98) / (4) =	45.8606	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4609.6554	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	868.4573	675.5245	553.1216	288.8562	112.6754	0.0000	0.0000	0.0000	0.0000	318.7963	608.7974	874.5798	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	930.8224	724.0348	592.8420	309.5994	120.7668	0.0000	0.0000	0.0000	0.0000	341.6895	652.5159	937.3846	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6868	89.6236	89.4841	89.1110	88.3212	86.7000	86.7000	86.7000	86.7000	89.1593	89.5511	89.7053	(217)
Fuel for water heating, kWh/month													
	190.8861	167.4344	173.9170	153.4838	149.5053	132.8019	124.4273	140.8397	141.9472	159.2295	171.4651	185.2285	(219)
Water heating fuel used												1891.1658	(219)
Annual totals kWh/year													
Space heating fuel - main system												4609.6554	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.0205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =											-1671.3992	-1671.3992	(233)
Total delivered energy for all uses												5291.4425	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4609.6554	0.2160	995.6856	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1891.1658	0.2160	408.4918	(264)
Space and water heating			1404.1774	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.0205	0.5190	200.8636	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			776.5098	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2800	ZC1
Total Floor Area	TFA	93.7800	
Assumed number of occupants	N	2.6740	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5356	ZC2
CO2 emissions from cooking, equation (L16)		1.9533	ZC3
Total CO2 emissions		25.7689	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.7689	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1296	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3796	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3227	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4114	0.4034	0.3953	0.3549	0.3469	0.3065	0.3065	0.2985	0.3227	0.3469	0.3630	0.3791	(22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5602	0.5470	0.5470	0.5445	0.5521	0.5602	0.5659	0.5719	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.1500	1.3258	25.3883			(27)
Ground floor			47.5100	0.1300	6.1763			(28a)
External Wall	138.2700	23.4300	114.8400	0.1800	20.6712			(29a)
Main Roof	46.2700		46.2700	0.1300	6.0151			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5481			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0900	(36)
Total fabric heat loss (33) + (36) =	75.6381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6511	44.4001	44.1540	42.9985	42.7823	41.7758	41.7758	41.5894	42.1635	42.7823	43.2196	43.6769	(38)
Heat transfer coeff	120.2891	120.0381	119.7921	118.6365	118.4203	117.4139	117.4139	117.2275	117.8015	118.4203	118.8577	119.3150	(39)
Average = Sum(39)m / 12 =												118.6355	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2827	1.2800	1.2774	1.2651	1.2627	1.2520	1.2520	1.2500	1.2561	1.2627	1.2674	1.2723	(40)
HLP (average)												1.2650	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6740 (42)
Average daily hot water use (litres/day)	97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7866	47.2209	46.8033	43.3661	44.8117	46.8033	47.2209	50.7866	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (64)
								Total per year (kWh/year) = Sum(64)m =				2112.3818 (64)
Heat gains from water heating, kWh/month												
	65.7360	57.8578	60.5266	53.5046	51.7123	45.3684	43.1972	48.4147	48.9576	55.9941	59.5913	64.0638 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0285	19.5656	15.9118	12.0462	9.0047	7.6022	8.2144	10.6774	14.3312	18.1967	21.2382	22.6408	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	245.8627	248.4140	241.9848	228.2979	211.0207	194.7825	183.9343	181.3831	187.8122	201.4991	218.7764	235.0146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	(71)
Water heating gains (Table 5)													
	88.3549	86.0979	81.3530	74.3119	69.5058	63.0117	58.0607	65.0735	67.9966	75.2609	82.7658	86.1073	(72)
Total internal gains													
	422.3563	420.1875	405.3597	380.7662	355.6413	331.5064	316.3196	323.2441	336.2501	361.0668	388.8905	409.8728	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9400	10.6334	0.6300	0.7000	0.7700	3.0547	(74)
Northeast	6.2500	11.2829	0.6300	0.7000	0.7700	21.5513	(75)
Southeast	5.1800	36.7938	0.6300	0.7000	0.7700	58.2474	(77)
Southwest	1.2700	36.7938	0.6300	0.7000	0.7700	14.2807	(79)
West	0.9400	19.6403	0.6300	0.7000	0.7700	5.6422	(80)
Northwest	4.5700	11.2829	0.6300	0.7000	0.7700	15.7583	(81)

Solar gains	118.5347	216.3622	333.9611	476.5990	590.6041	611.1585	578.9017	490.1510	382.8251	249.3970	144.6207	99.7244 (83)
Total gains	540.8910	636.5497	739.3208	857.3652	946.2454	942.6649	895.2212	813.3950	719.0752	610.4638	533.5113	509.5971 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1404	54.2536	54.3650	54.8946	54.9948	55.4662	55.4662	55.5544	55.2837	54.9948	54.7924	54.5824	
alpha	4.6094	4.6169	4.6243	4.6596	4.6663	4.6977	4.6977	4.7036	4.6856	4.6663	4.6528	4.6388	
util living area													
	0.9983	0.9960	0.9888	0.9614	0.8798	0.7203	0.5578	0.6272	0.8706	0.9806	0.9965	0.9987	(86)
MIT	19.5637	19.7296	20.0155	20.4005	20.7362	20.9288	20.9830	20.9714	20.8164	20.3789	19.9014	19.5349	(87)
Th 2	19.8544	19.8565	19.8586	19.8683	19.8701	19.8786	19.8786	19.8802	19.8753	19.8701	19.8665	19.8626	(88)
util rest of house													
	0.9977	0.9946	0.9847	0.9461	0.8325	0.6229	0.4253	0.4916	0.8006	0.9702	0.9950	0.9982	(89)
MIT 2	17.9477	18.1912	18.6082	19.1642	19.6118	19.8317	19.8726	19.8686	19.7247	19.1436	18.4497	17.9111	(90)
Living area fraction										fLA = Living area / (4) =		0.1913	(91)
MIT	18.2568	18.4855	18.8774	19.4007	19.8269	20.0415	20.0850	20.0795	19.9336	19.3799	18.7274	18.2218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2568	18.4855	18.8774	19.4007	19.8269	20.0415	20.0850	20.0795	19.9336	19.3799	18.7274	18.2218	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9920	0.9795	0.9378	0.8304	0.6383	0.4507	0.5173	0.8049	0.9638	0.9926	0.9972	(94)
Useful gains	538.9066	631.4818	724.1795	804.0643	785.7743	601.7408	403.5060	420.8048	578.8053	588.3770	529.5851	508.1679	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1678.8512	1630.7798	1482.7147	1245.7674	962.3921	638.9132	409.1871	431.3414	687.2019	1039.7203	1382.0058	1673.0068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	848.1188	671.5283	564.3502	318.0263	131.4037	0.0000	0.0000	0.0000	0.0000	335.7994	613.7429	866.6402	(98)
Space heating												4349.6096	(98)
Space heating per m2											(98) / (4) =	46.3810	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4656.9696	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	848.1188	671.5283	564.3502	318.0263	131.4037	0.0000	0.0000	0.0000	0.0000	335.7994	613.7429	866.6402	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	908.0501	718.9810	604.2293	340.4992	140.6892	0.0000	0.0000	0.0000	0.0000	359.5283	657.1123	927.8803	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1955	88.0049	87.5753	86.5690	84.4531	80.3000	80.3000	80.3000	80.3000	86.5857	87.7749	88.2734	(217)
Fuel for water heating, kWh/month													
	238.5001	210.7027	222.2502	199.4160	197.9072	183.3206	175.6351	195.7920	197.9543	209.0467	218.1241	232.5922	(219)
Water heating fuel used												2481.2411	(219)
Annual totals kWh/year													
Space heating fuel - main system												4656.9696	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												389.0310	(232)
Total delivered energy for all uses												7602.2418	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4656.9696	0.2160	1005.9054	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2481.2411	0.2160	535.9481	(264)
Space and water heating			1541.8535	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.0310	0.5190	201.9071	(268)
Total CO2, kg/m2/year			1782.6856	(272)
Emissions per m2 for space and water heating			16.4412	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1530	(272b)
Emissions per m2 for pumps and fans			0.4151	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4412 * 1.00) + 2.1530 + 0.4151, rounded to 2 d.p.			19.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 134 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 134	**Prop Type Ref**	As
Property	L361-R - Det SG, Plot 134, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	19.01
Environmental	94 A	**% DER<TER**	56.44		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.61	**TFEE**	60.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.33 m	47.51 m²	2.31 m
1st Storey:	27.74 m	46.27 m²	2.63 m

7.0 Living Area	17.94	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	138.27	112.77

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.27	46.27
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	47.51

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
D1	Half Glazed Door	[1] External Wall	North East							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.20	100
D2 W14	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	South West							2.14	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.20	100

W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00	1.41	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.19	0.065	No
Independently assessed	E3 Sill	14.56	0.004	No
Independently assessed	E4 Jamb	44.55	0.005	No
Independently assessed	E5 Ground floor (normal)	28.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	27.74	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.57	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.17	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.023	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 134 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 134	**Prop Type Ref**	As
Property	L361-R - Det SG, Plot 134, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	19.01
Environmental	94 A	**% DER<TER**	56.44		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.61	**TFEE**	60.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.78	m^2	
DER	8.28	$kgCO_2/yr/m^2$	
TER	19.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.28	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.44	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.61	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.78	m^2	
DER	20.07	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.31	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.31	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 135 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 135	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 135, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.36
Environmental	95 A	**% DER<TER**	58.94		
CO_2 Emissions (t/year)	0.29	**DFEE**	43.50	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.41 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 5.74 m², No overhang
Windows facing South: 1.04 m², No overhang
Windows facing South West: 6.92 m², No overhang
Windows facing North West: 5.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2160	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4410	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4780	0.4686	0.4592	0.4124	0.4030	0.3561	0.3561	0.3468	0.3749	0.4030	0.4217	0.4405	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7280	0.7186	0.7092	0.6624	0.6530	0.6061	0.6061	0.5968	0.6249	0.6530	0.6717	0.6905	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2200	1.2357	26.2224			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			47.5100	0.1200	5.7012			(28a)
External Wall	138.2700	25.5000	112.7700	0.2100	23.6817			(29a)
Main Roof	46.2700		46.2700	0.0700	3.2389			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4626			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3203	(36)
Total fabric heat loss					(33) + (36) =		70.7830	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5990	54.8832	54.1674	50.5885	49.8727	46.2937	46.2937	45.5779	47.7253	49.8727	51.3043	52.7358	(38)
Heat transfer coeff	126.3820	125.6662	124.9504	121.3714	120.6556	117.0767	117.0767	116.3609	118.5083	120.6556	122.0872	123.5188	(39)
Average = Sum(39)m / 12 =												121.1925	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3476	1.3400	1.3324	1.2942	1.2866	1.2484	1.2484	1.2408	1.2637	1.2866	1.3018	1.3171	(40)
HLP (average)												1.2923	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6740 (42)
Average daily hot water use (litres/day) 97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8122   10.6595   11.7785   11.3594   11.7095   11.2990   11.6551   11.6904   11.3319   11.7500   11.4057   11.8016 (61)
Total heat required for water heating calculated for each month
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1675.5748 (64)
Heat gains from water heating, kWh/month
               55.9494   49.0158   50.7746   44.5392   42.9389   37.3516   34.9080   39.6365   39.9853   46.2350   50.1140   54.2745 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9147   19.4644   15.8296   11.9840    8.9582    7.5629    8.1719   10.6222   14.2571   18.1027   21.1285   22.5238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              245.8627  248.4140  241.9848  228.2979  211.0207  194.7825  183.9343  181.3831  187.8122  201.4991  218.7764  235.0146 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 (71)
Water heating gains (Table 5)
               75.2007   72.9402   68.2455   61.8600   57.7136   51.8773   46.9194   53.2748   55.5352   62.1438   69.6028   72.9496 (72)
Total internal gains
              409.0883  406.9287  392.1700  368.2520  343.8025  320.3327  305.1358  311.3902  323.7146  347.8557  375.6178  396.5981 (73)
```

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.4100	11.2829	0.7200	0.7000	0.7700	5.5565	(75)
East	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(76)
Southeast	5.7400	36.7938	0.7200	0.7000	0.7700	73.7651	(77)
South	1.0400	46.7521	0.7200	0.7000	0.7700	16.9824	(78)
Southwest	6.9200	36.7938	0.7200	0.7000	0.7700	88.9293	(79)
Northwest	5.0700	11.2829	0.7200	0.7000	0.7700	19.9799	(81)

```
Solar gains   212.3474  370.8776  531.2434  697.1871  815.7877  825.0513  789.1406  698.4599  588.4276  416.3688  256.0272  180.6280 (83)
Total gains   621.4357  777.8064  923.4134 1065.4391 1159.5902 1145.3840 1094.2764 1009.8501  912.1421  764.2245  631.6450  577.2261 (84)
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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           44.7283   44.9831   45.2408   46.5748   46.8511   48.2833   48.2833   48.5803   47.7001   46.8511   46.3017   45.7651
alpha          3.9819    3.9989    4.0161    4.1050    4.1234    4.2189    4.2189    4.2387    4.1800    4.1234    4.0868    4.0510
util living area
               0.9946    0.9864    0.9661    0.9087    0.7914    0.6118    0.4602    0.5125    0.7605    0.9451    0.9889    0.9959 (86)

MIT           19.3957   19.6479   20.0085   20.4564   20.7776   20.9468   20.9873   20.9806   20.8645   20.4206   19.8368   19.3777 (87)
Th 2          19.8037   19.8096   19.8156   19.8454   19.8514   19.8815   19.8815   19.8875   19.8694   19.8514   19.8394   19.8275 (88)
util rest of house
               0.9929    0.9824    0.9559    0.8816    0.7336    0.5206    0.3483    0.3968    0.6770    0.9228    0.9849    0.9947 (89)
MIT 2         17.6903   18.0602   18.5821   19.2261   19.6396   19.8461   19.8766   19.8793   19.7634   19.1965   18.3569   17.6796 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.1913 (91)
MIT           18.0166   18.3639   18.8550   19.4615   19.8573   20.0567   20.0891   20.0899   19.9741   19.4306   18.6400   18.0044 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.0166   18.3639   18.8550   19.4615   19.8573   20.0567   20.0891   20.0899   19.9741   19.4306   18.6400   18.0044 (93)
```

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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9891    0.9753    0.9448    0.8706    0.7339    0.5357    0.3696    0.4186    0.6857    0.9122    0.9789    0.9917 (94)
Useful gains 614.6878  758.6274  872.4288  927.6227  851.0243  613.5883  404.4596  422.7123  625.4187  697.1008  618.2881  572.4610 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1733.5250 1691.9601 1543.7572 1281.8636  984.2278  638.8516  408.4899  429.3639  696.1253 1065.4659 1408.8868 1705.1079 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              832.4149  627.1995  499.4683  255.0535   99.1034    0.0000    0.0000    0.0000    0.0000  274.0636  569.2310  842.6893 (98)
Space heating                                                                                                               3999.2236 (98)
Space heating per m2                                                                                          (98) / (4) =     42.6447 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4286.4133	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	832.4149	627.1995	499.4683	255.0535	99.1034	0.0000	0.0000	0.0000	0.0000	274.0636	569.2310	842.6893	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	892.1917	672.2396	535.3358	273.3692	106.2202	0.0000	0.0000	0.0000	0.0000	293.7445	610.1083	903.2040	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6649	89.5819	89.4180	89.0099	88.2077	86.7000	86.7000	86.7000	86.7000	89.0384	89.5104	89.6866	(217)
Fuel for water heating, kWh/month													
	190.9327	167.5124	174.0457	153.6581	149.6977	132.8019	124.4273	140.8397	141.9472	159.4458	171.5429	185.2670	(219)
Water heating fuel used												1892.1185	(219)
Annual totals kWh/year													
Space heating fuel - main system												4286.4133	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.0205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =											-1671.3992	-1671.3992	(233)
Total delivered energy for all uses												4969.1530	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4286.4133	0.2160	925.8653	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1892.1185	0.2160	408.6976	(264)
Space and water heating			1334.5629	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.0205	0.5190	200.8636	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			706.8953	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5400	ZC1
Total Floor Area	TFA	93.7800	
Assumed number of occupants	N	2.6740	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5356	ZC2
CO2 emissions from cooking, equation (L16)		1.9533	ZC3
Total CO2 emissions		25.0289	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.0289	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1296	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3796	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3227	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4114	0.4034	0.3953	0.3549	0.3469	0.3065	0.3065	0.2985	0.3227	0.3469	0.3630	0.3791	(22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5602	0.5470	0.5470	0.5445	0.5521	0.5602	0.5659	0.5719	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.1500	1.3258	25.3883			(27)
Ground floor			47.5100	0.1300	6.1763			(28a)
External Wall	138.2700	23.4300	114.8400	0.1800	20.6712			(29a)
Main Roof	46.2700		46.2700	0.1300	6.0151			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5481			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0900	(36)
Total fabric heat loss (33) + (36) =	75.6381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6511	44.4001	44.1540	42.9985	42.7823	41.7758	41.7758	41.5894	42.1635	42.7823	43.2196	43.6769	(38)
Heat transfer coeff	120.2891	120.0381	119.7921	118.6365	118.4203	117.4139	117.4139	117.2275	117.8015	118.4203	118.8577	119.3150	(39)
Average = Sum(39)m / 12 =												118.6355	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2827	1.2800	1.2774	1.2651	1.2627	1.2520	1.2520	1.2500	1.2561	1.2627	1.2674	1.2723	(40)
HLP (average)												1.2650	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6740 (42)
Average daily hot water use (litres/day)	97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7866	47.2209	46.8033	43.3661	44.8117	46.8033	47.2209	50.7866	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (64)
								Total per year (kWh/year) = Sum(64)m =				2112.3818 (64)
Heat gains from water heating, kWh/month												
	65.7360	57.8578	60.5266	53.5046	51.7123	45.3684	43.1972	48.4147	48.9576	55.9941	59.5913	64.0638 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0285	19.5656	15.9118	12.0462	9.0047	7.6022	8.2144	10.6774	14.3312	18.1967	21.2382	22.6408	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	245.8627	248.4140	241.9848	228.2979	211.0207	194.7825	183.9343	181.3831	187.8122	201.4991	218.7764	235.0146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	(71)
Water heating gains (Table 5)													
	88.3549	86.0979	81.3530	74.3119	69.5058	63.0117	58.0607	65.0735	67.9966	75.2609	82.7658	86.1073	(72)
Total internal gains													
	422.3563	420.1875	405.3597	380.7662	355.6413	331.5064	316.3196	323.2441	336.2501	361.0668	388.8905	409.8728	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.2700	11.2829	0.6300	0.7000	0.7700	4.3792	(75)
East	0.9400	19.6403	0.6300	0.7000	0.7700	5.6422	(76)
Southeast	5.1800	36.7938	0.6300	0.7000	0.7700	58.2474	(77)
South	0.9400	46.7521	0.6300	0.7000	0.7700	13.4308	(78)
Southwest	6.2500	36.7938	0.6300	0.7000	0.7700	70.2792	(79)
Northwest	4.5700	11.2829	0.6300	0.7000	0.7700	15.7583	(81)

Solar gains	167.7371	292.9524	419.5954	550.6175	644.2442	651.5426	623.1910	551.6072	464.7460	328.8778	202.2387	142.6826 (83)
Total gains	590.0934	713.1399	824.9551	931.3837	999.8855	983.0490	939.5105	874.8513	800.9962	689.9447	591.1292	552.5554 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1404	54.2536	54.3650	54.8946	54.9948	55.4662	55.4662	55.5544	55.2837	54.9948	54.7924	54.5824	
alpha	4.6094	4.6169	4.6243	4.6596	4.6663	4.6977	4.6977	4.7036	4.6856	4.6663	4.6528	4.6388	
util living area													
	0.9975	0.9937	0.9830	0.9488	0.8608	0.6994	0.5345	0.5905	0.8301	0.9694	0.9946	0.9982	(86)
MIT	19.6113	19.8026	20.0936	20.4587	20.7639	20.9371	20.9858	20.9777	20.8547	20.4478	19.9566	19.5766	(87)
Th 2	19.8544	19.8565	19.8586	19.8683	19.8701	19.8786	19.8786	19.8802	19.8753	19.8701	19.8665	19.8626	(88)
util rest of house													
	0.9966	0.9915	0.9768	0.9295	0.8097	0.6017	0.4061	0.4594	0.7509	0.9542	0.9924	0.9975	(89)
MIT 2	18.0171	18.2972	18.7198	19.2427	19.6432	19.8379	19.8736	19.8714	19.7619	19.2385	18.5298	17.9721	(90)
Living area fraction									fLA = Living area / (4) =			0.1913	(91)
MIT	18.3221	18.5851	18.9826	19.4753	19.8576	20.0482	20.0864	20.0830	19.9709	19.4699	18.8027	18.2791	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3221	18.5851	18.9826	19.4753	19.8576	20.0482	20.0864	20.0830	19.9709	19.4699	18.8027	18.2791	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9879	0.9703	0.9211	0.8090	0.6177	0.4307	0.4843	0.7587	0.9468	0.9892	0.9961	(94)
Useful gains	587.0544	704.4946	800.4580	857.8936	808.9477	607.1993	404.6457	423.7174	607.7495	653.2449	584.7366	550.4179	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1686.7006	1642.7397	1495.3157	1254.6177	966.0230	639.6925	409.3496	431.7529	691.6037	1050.3713	1390.9612	1679.8414	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	818.1368	630.5007	516.9742	285.6414	116.8640	0.0000	0.0000	0.0000	0.0000	295.4621	580.4817	840.2911	(98)
Space heating												4084.3520	(98)
Space heating per m2											(98) / (4) =	43.5525	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4372.9679	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	818.1368	630.5007	516.9742	285.6414	116.8640	0.0000	0.0000	0.0000	0.0000	295.4621	580.4817	840.2911	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	875.9495	675.0543	553.5055	305.8259	125.1221	0.0000	0.0000	0.0000	0.0000	316.3406	621.5008	899.6692	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1328	87.8878	87.3935	86.3105	84.1696	80.3000	80.3000	80.3000	80.3000	86.2775	87.6652	88.2211	(217)
Fuel for water heating, kWh/month													
	238.6696	210.9834	222.7125	200.0132	198.5737	183.3206	175.6351	195.7920	197.9543	209.7934	218.3970	232.7301	(219)
Water heating fuel used												2484.5750	(219)
Annual totals kWh/year													
Space heating fuel - main system												4372.9679	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												389.0310	(232)
Total delivered energy for all uses												7321.5739	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4372.9679	0.2160	944.5611	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.5750	0.2160	536.6682	(264)
Space and water heating			1481.2293	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.0310	0.5190	201.9071	(268)
Total CO2, kg/m2/year			1722.0614	(272)
Emissions per m2 for space and water heating			15.7947	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1530	(272b)
Emissions per m2 for pumps and fans			0.4151	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7947 * 1.00) + 2.1530 + 0.4151, rounded to 2 d.p.			18.3600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 135 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 135	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 135, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.36
Environmental	95 A	**% DER<TER**	58.94		
CO_2 Emissions (t/year)	0.29	**DFEE**	43.50	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.33 m	47.51 m²	2.31 m
1st Storey:	27.74 m	46.27 m²	2.63 m

7.0 Living Area	17.94	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	138.27	112.77

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.27	46.27
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	47.51

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.04	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.20	100
D2 W14	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North East							2.14	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.20	100

W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	1.41	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.19	0.065	No
Independently assessed	E3 Sill	14.56	0.004	No
Independently assessed	E4 Jamb	44.55	0.005	No
Independently assessed	E5 Ground floor (normal)	28.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	27.74	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.57	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.17	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.023	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 135 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 135	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 135, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.36
Environmental	95 A	**% DER<TER**	58.94		
CO_2 Emissions (t/year)	0.29	**DFEE**	43.50	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.78	m^2	
DER	7.54	$kgCO_2/yr/m^2$	
TER	18.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.54	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.94	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	43.50	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.78	m^2	
DER	19.28	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.77	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.77	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.03	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.52	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.52	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 136 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 136	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 136, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.30	**TER**	16.58
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.51	**TFEE**	55.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.58 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.30 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.16 m², No overhang
Windows facing East: 7.51 m², No overhang
Windows facing South East: 1.07 m², No overhang
Windows facing South: 6.76 m², No overhang
Windows facing South West: 1.07 m², No overhang
Windows facing West: 0.48 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m = 1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    9.1600            10.6334           0.7200           0.7000           0.7700           34.0197 (74)
East                                     7.5100            19.6403           0.7200           0.7000           0.7700           51.5171 (76)
Southeast                                1.0700            36.7938           0.7200           0.7000           0.7700           13.7506 (77)
South                                    6.7600            46.7521           0.7200           0.7000           0.7700          110.3853 (78)
Southwest                                1.0700            36.7938           0.7200           0.7000           0.7700           13.7506 (79)
West                                     0.4800            19.6403           0.7200           0.7000           0.7700            3.2927 (80)
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Solar gains   226.7161  399.8605  581.4292  774.6628  914.8196  928.3010  886.6646  779.4491  648.1510  451.3796  274.0935  192.3518 (83)
Total gains   696.8743  867.7445 1032.2569 1197.6837 1309.0634 1295.2066 1236.0543 1135.4233 1018.6196  849.8902  704.8674  647.8432 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9964    0.9908    0.9759    0.9299    0.8254    0.6508    0.4945    0.5517    0.8014    0.9607    0.9926    0.9973 (86)

MIT           19.3784   19.6111   19.9601   20.4093   20.7486   20.9372   20.9848   20.9764   20.8410   20.3762   19.8066   19.3635 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9954    0.9883    0.9690    0.9095    0.7768    0.5669    0.3873    0.4415    0.7303    0.9453    0.9901    0.9966 (89)
MIT 2         17.7536   18.0959   18.6042   19.2573   19.7075   19.9426   19.9816   19.9822   19.8417   19.2268   18.4000   17.7457 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1191 (91)
MIT           17.9472   18.2765   18.7658   19.3946   19.8316   20.0611   20.1012   20.1007   19.9608   19.3638   18.5676   17.9384 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  17.9472   18.2765   18.7658   19.3946   19.8316   20.0611   20.1012   20.1007   19.9608   19.3638   18.5676   17.9384 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9924    0.9825    0.9586    0.8959    0.7699    0.5733    0.3997    0.4538    0.7290    0.9334    0.9852    0.9943 (94)
Useful gains 691.6126  852.5359  989.5448 1072.9871 1007.8507  742.5411  494.0020  515.2077  742.5433  793.2732  694.4132  644.1731 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            2100.0996 2047.0755 1866.6825 1552.5566 1196.0652  780.0760  500.1112  525.4647  847.1206 1289.0596 1706.2479 2067.4562 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
            1047.9143  802.7306  652.5905  345.2900  140.0316    0.0000    0.0000    0.0000    0.0000  368.8651  728.5210 1058.9226 (98)
Space heating                                                                                                       5144.8657 (98)
Space heating per m2                                                                                 (98) / (4) =   40.1692 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5514.3255	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1047.9143	802.7306	652.5905	345.2900	140.0316	0.0000	0.0000	0.0000	0.0000	368.8651	728.5210	1058.9226	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1123.1665	860.3758	699.4539	370.0858	150.0874	0.0000	0.0000	0.0000	0.0000	395.3538	780.8371	1134.9653	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7548	89.6895	89.5561	89.2131	88.4740	86.7000	86.7000	86.7000	86.7000	89.2349	89.6263	89.7732	(217)
Fuel for water heating, kWh/month													
	200.0772	175.4824	182.2227	160.7109	156.4107	139.1090	130.2717	147.5475	148.7340	166.7674	179.6587	194.1277	(219)
Water heating fuel used												1981.1199	(219)
Annual totals kWh/year													
Space heating fuel - main system												5514.3255	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 908 * 1.00) =											-2353.1582	-2353.1582	(233)
Total delivered energy for all uses												5684.8591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5514.3255	0.2160	1191.0943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.1199	0.2160	427.9219	(264)
Space and water heating			1619.0162	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2353.1582	0.5190	-1221.2891	(269)
Total CO2, kg/year			679.3219	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.3000	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.4373	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.4373	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019 (64)
Heat gains from water heating, kWh/month												
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.1600	10.6334	0.6300	0.7000	0.7700	29.7673	(74)
East	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774	(76)
Southeast	1.0700	36.7938	0.6300	0.7000	0.7700	12.0318	(77)
South	6.7600	46.7521	0.6300	0.7000	0.7700	96.5871	(78)
Southwest	1.0700	36.7938	0.6300	0.7000	0.7700	12.0318	(79)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(80)

Solar gains	198.3766	349.8779	508.7506	677.8300	800.4671	812.2634	775.8315	682.0179	567.1322	394.9572	239.8318	168.3078	(83)
Total gains	681.6830	830.9140	972.7381	1114.0212	1207.3199	1191.0862	1137.1461	1050.6082	950.7816	806.6377	683.7632	636.9512	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9988	0.9967	0.9899	0.9645	0.8888	0.7334	0.5652	0.6273	0.8672	0.9815	0.9973	0.9992	(86)
MIT	19.6216	19.7991	20.0792	20.4408	20.7521	20.9340	20.9854	20.9762	20.8407	20.4254	19.9529	19.5915	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9984	0.9955	0.9861	0.9504	0.8449	0.6403	0.4379	0.4980	0.7985	0.9718	0.9962	0.9989	(89)
MIT 2	18.0741	18.3348	18.7435	19.2672	19.6845	19.8947	19.9338	19.9309	19.8048	19.2542	18.5671	18.0357	(90)
Living area fraction									fLA = Living area / (4) =			0.1191	(91)
MIT	18.2585	18.5093	18.9026	19.4070	19.8117	20.0186	20.0591	20.0554	19.9282	19.3938	18.7322	18.2211	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2585	18.5093	18.9026	19.4070	19.8117	20.0186	20.0591	20.0554	19.9282	19.3938	18.7322	18.2211	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9932	0.9810	0.9414	0.8391	0.6479	0.4529	0.5128	0.7979	0.9648	0.9942	0.9981	(94)
Useful gains	679.9079	825.2511	954.2632	1048.7494	1013.0718	771.7012	514.9797	538.7861	758.6718	778.2790	679.7724	635.7479	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2156.4086	2097.8798	1907.7721	1599.8690	1232.7924	816.1657	521.0279	549.6775	880.9020	1336.4459	1774.6580	2147.7286	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1098.5165	855.2065	709.4107	396.8061	163.4722	0.0000	0.0000	0.0000	0.0000	415.2762	788.3177	1124.9136	(98)
Space heating												5551.9193	(98)
Space heating per m2											(98) / (4) =	43.3473	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5944.2391	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1098.5165	855.2065	709.4107	396.8061	163.4722	0.0000	0.0000	0.0000	0.0000	415.2762	788.3177	1124.9136	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1176.1419	915.6386	759.5403	424.8459	175.0237	0.0000	0.0000	0.0000	0.0000	444.6212	844.0232	1204.4043	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5507	88.3560	87.9450	86.9694	84.8672	80.3000	80.3000	80.3000	80.3000	86.9902	88.1656	88.6225	(217)
Fuel for water heating, kWh/month													
	246.9862	218.1423	230.0927	208.4710	207.2733	192.9379	184.8492	206.0635	207.8622	216.1259	225.6154	240.8136	(219)
Water heating fuel used												2585.2331	(219)
Annual totals kWh/year													
Space heating fuel - main system												5944.2391	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												9072.0440	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5944.2391	0.2160	1283.9556	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.2331	0.2160	558.4104	(264)
Space and water heating			1842.3660	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2123.9608	(272)
Emissions per m2 for space and water heating			14.3845	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3845 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.5800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 136 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 136	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 136, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.30	**TER**	16.58
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.51	**TFEE**	55.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	0.48	100
W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	2.05	100
D2	Half Glazed Door	[1] External Wall	West			2.14	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00	1.07	100
W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value: 0.021 W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 136 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 136	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 136, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.30	**TER**	16.58
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.51	**TFEE**	55.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.30	$kgCO_2/yr/m^2$	
TER	16.58	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.30	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.04	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.51	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.05	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.05	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.37	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.51	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.51	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 137 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 137	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 137, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 122 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.27 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.68 m², No overhang
Windows facing East: 0.96 m², No overhang
Windows facing South: 5.77 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900	(1b)	x 2.3100	(2b) =	114.7839	(1b) - (3b)
First floor	41.0200	(1c)	x 2.6300	(2c) =	107.8826	(1c) - (3c)
Second floor	31.5300	(1d)	x 2.3400	(2d) =	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3599	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3824	0.3748	0.3365	0.3289	0.2906	0.2906	0.2830	0.3059	0.3289	0.3442	0.3595	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6401	0.6324	0.6248	0.5865	0.5789	0.5406	0.5406	0.5330	0.5559	0.5789	0.5942	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Opening Type 3 (Uw = 1.30)			1.4000	1.2357	1.7300			(27a)
Ground floor			49.6900	0.1200	5.9628			(28a)
External Wall	109.4500	14.2900	95.1600	0.2100	19.9836			(29a)
Knee wall	10.6500		10.6500	0.1500	1.5975			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1900	1.0830			(29a)
Main Roof	17.5600		17.5600	0.0700	1.2292			(30)
Lower roof	9.7100		9.7100	0.2700	2.6217			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1600	1.5184			(30)
Dormer roof	2.0400		2.0400	0.1600	0.3264			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8073			(33)
Party Wall			61.1900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							177.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1848	(36)
Total fabric heat loss					(33) + (36) =		62.9921	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.6170	61.8687	61.1205	57.3793	56.6311	52.8899	52.8899	52.1416	54.3863	56.6311	58.1275	59.6240	(38)
Heat transfer coeff	125.6090	124.8608	124.1126	120.3714	119.6231	115.8820	115.8820	115.1337	117.3784	119.6231	121.1196	122.6161	(39)
Average = Sum(39)m / 12 =												120.1843	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0276	1.0214	1.0153	0.9847	0.9786	0.9480	0.9480	0.9419	0.9602	0.9786	0.9908	1.0031	(40)
HLP (average)												0.9832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716	(42)
Average daily hot water use (litres/day)	102.3998	(43)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)
Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8282	10.6735	11.7940	11.3832	11.7324	11.3178	11.6726	11.7114	11.3531	11.7640	11.4200	11.8172	(61)
Total heat required for water heating calculated for each month													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(64)
								Total per year (kWh/year) = Sum(64)m =				1749.6145	(64)
Heat gains from water heating, kWh/month													
	58.4984	51.2452	53.0754	46.5476	44.8660	39.0144	36.4488	41.4048	41.7747	48.3177	52.3872	56.7431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	78.6268	76.2577	71.3379	64.6495	60.3038	54.1867	48.9903	55.6516	58.0205	64.9432	72.7600	76.2676	(72)
Total internal gains													
	464.1294	461.5825	444.4305	416.7329	388.2305	361.2818	344.1610	350.9999	365.6011	393.5330	425.5066	449.8456	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.7200	0.7000	0.7700	24.8092	(74)
East	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(76)
South	5.7700	46.7521	0.7200	0.7000	0.7700	94.2194	(78)
North	1.4000	26.0000	0.7200	0.7000	1.0000	16.5110	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	142.1250	248.8933	359.3031	477.7592	565.6694	575.2297	548.8859	481.0699	399.8980	280.0707	171.4550	120.8477	(83)
Total gains	606.2544	710.4758	803.7336	894.4921	953.8999	936.5116	893.0469	832.0699	765.4991	673.6037	596.9616	570.6934	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.8479	48.1347	48.4249	49.9299	50.2422	51.8643	51.8643	52.2013	51.2030	50.2422	49.6215	49.0159	
alpha	4.1899	4.2090	4.2283	4.3287	4.3495	4.4576	4.4576	4.4801	4.4135	4.3495	4.3081	4.2677	
util living area													
	0.9961	0.9918	0.9814	0.9495	0.8698	0.7110	0.5498	0.6031	0.8375	0.9670	0.9926	0.9970	(86)
MIT	19.4633	19.6550	19.9570	20.3688	20.7056	20.9205	20.9802	20.9708	20.8235	20.3829	19.8675	19.4570	(87)
Th 2	20.0604	20.0655	20.0706	20.0961	20.1012	20.1269	20.1269	20.1321	20.1166	20.1012	20.0910	20.0808	(88)
util rest of house													
	0.9951	0.9898	0.9766	0.9357	0.8336	0.6384	0.4499	0.5031	0.7810	0.9554	0.9904	0.9962	(89)
MIT 2	17.9867	18.2694	18.7115	19.3185	19.7813	20.0615	20.1163	20.1150	19.9506	19.3495	18.5977	17.9911	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9852	0.9689	0.9252	0.8279	0.6488	0.4703	0.5230	0.7824	0.9464	0.9862	0.9941	(94)
Useful gains	601.6506	699.9796	778.7590	827.5784	789.7215	607.6217	420.0417	435.1355	598.9004	637.4963	588.7117	567.3110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1758.4122	1705.9138	1548.3051	1280.8373	990.1028	653.9477	428.6548	448.5710	708.4096	1072.7906	1425.1338	1729.0319	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating			4374.9940 (98)
Space heating per m2		(98) / (4) =	35.7902 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)			0.0000 (201)
Fraction of space heat from main system(s)			1.0000 (202)
Efficiency of main space heating system 1 (in %)			93.3000 (206)
Efficiency of secondary/supplementary heating system, %			0.0000 (208)
Space heating requirement			4689.1682 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	922.4336	724.5314	613.6574	349.7818	159.7896	0.0000	0.0000	0.0000	0.0000	347.1157	645.4704	926.3883	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating			
Water heating requirement			173.5879 (64)
Efficiency of water heater			86.7000 (216)
(217)m			89.6772 (217)
Fuel for water heating, kWh/month			
Water heating fuel used			1974.5183 (219)
Annual totals kWh/year			
Space heating fuel - main system			4689.1682 (211)
Space heating fuel - secondary			0.0000 (215)

Electricity for pumps and fans:			
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			75.0000 (231)
Electricity for lighting (calculated in Appendix L)			500.2757 (232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =		-1399.0639	-1399.0639 (233)
Total delivered energy for all uses			5839.8983 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.1682	0.2160	1012.8603	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.5183	0.2160	426.4959	(264)
Space and water heating			1439.3563	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			1011.8102	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2800	ZC1
Total Floor Area	TFA	122.2400	
Assumed number of occupants	N	2.8716	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9662	ZC2
CO2 emissions from cooking, equation (L16)		1.5373	ZC3
Total CO2 emissions		23.7835	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.7835	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900 (1b)	x	2.3100 (2b)	=	114.7839	(1b) - (3b)
First floor	41.0200 (1c)	x	2.6300 (2c)	=	107.8826	(1c) - (3c)
Second floor	31.5300 (1d)	x	2.3400 (2d)	=	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3849	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3272	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3517	0.3108	0.3108	0.3027	0.3272	0.3517	0.3681	0.3845	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5677	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
TER Room Window (Uw = 1.70)			1.4000	1.5918	2.2285			(27a)
Ground floor			49.6900	0.1300	6.4597			(28a)
External Wall	109.4500	14.2900	95.1600	0.1800	17.1288			(29a)
Knee wall	10.6500		10.6500	0.1800	1.9170			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1800	1.0260			(29a)
Main Roof	17.5600		17.5600	0.1300	2.2828			(30)
Lower roof	9.7100		9.7100	0.1300	1.2623			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1300	1.2337			(30)
Dormer roof	2.0400		2.0400	0.1300	0.2652			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.1238			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8820	(36)
Total fabric heat loss (33) + (36) =	69.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.4262	57.0956	56.7716	55.2498	54.9651	53.6396	53.6396	53.3941	54.1501	54.9651	55.5411	56.1433	(38)
Heat transfer coeff	126.4320	126.1014	125.7774	124.2556	123.9708	122.6454	122.6454	122.3999	123.1559	123.9708	124.5468	125.1490	(39)
Average = Sum(39)m / 12 =												124.2542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0343	1.0316	1.0289	1.0165	1.0142	1.0033	1.0033	1.0013	1.0075	1.0142	1.0189	1.0238	(40)
HLP (average)												1.0165	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716 (42)
Average daily hot water use (litres/day)	102.3998 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0509	45.4487	46.9636	49.0509	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
								Total per year (kWh/year) = Sum(64)m =				2199.4693	(64)
Heat gains from water heating, kWh/month													
	68.2810	60.0836	62.8666	56.0306	54.1957	47.5471	45.2716	50.7397	51.2652	58.1164	61.8610	66.5285	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	91.7756	89.4101	84.4981	77.8203	72.8436	66.0376	60.8489	68.1985	71.2017	78.1135	85.9180	89.4200	(72)
Total internal gains													
	477.2781	474.7350	457.5907	429.9037	400.7703	373.1328	356.0196	363.5468	378.7823	406.7033	438.6646	462.9981	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.6300	0.7000	0.7700	21.7080	(74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(76)
South	5.7700	46.7521	0.6300	0.7000	0.7700	82.4420	(78)
North	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472	(82)

Solar gains	124.3594	217.7816	314.3902	418.0393	494.9607	503.3260	480.2752	420.9362	349.9108	245.0619	150.0231	105.7418	(83)
Total gains	601.6375	692.5166	771.9810	847.9429	895.7310	876.4588	836.2947	784.4830	728.6931	651.7652	588.6877	568.7399	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1420	67.3180	67.4914	68.3180	68.4749	69.2149	69.2149	69.3537	68.9280	68.4749	68.1582	67.8302	
alpha	5.4761	5.4879	5.4994	5.5545	5.5650	5.6143	5.6143	5.6236	5.5952	5.5650	5.5439	5.5220	
util living area													
	0.9993	0.9982	0.9949	0.9815	0.9323	0.7983	0.6246	0.6824	0.9054	0.9888	0.9983	0.9995	(86)
MIT	19.8147	19.9486	20.1706	20.4714	20.7496	20.9327	20.9863	20.9781	20.8501	20.4920	20.1000	19.7937	(87)
Th 2	20.0549	20.0571	20.0593	20.0696	20.0716	20.0806	20.0806	20.0822	20.0771	20.0716	20.0676	20.0635	(88)
util rest of house													
	0.9990	0.9976	0.9930	0.9738	0.9026	0.7182	0.5046	0.5634	0.8526	0.9828	0.9976	0.9993	(89)
MIT 2	18.4560	18.6534	18.9789	19.4212	19.8070	20.0312	20.0750	20.0722	19.9445	19.4558	18.8828	18.4315	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9905	0.9691	0.9001	0.7318	0.5301	0.5884	0.8567	0.9793	0.9966	0.9989	(94)
Useful gains	600.7138	690.0582	764.6846	821.7344	806.2468	641.4252	443.3322	461.6269	624.2758	638.2465	586.6783	568.0995	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1826.1163	1768.8775	1601.2761	1334.9265	1029.7494	689.5037	449.8345	472.9311	743.3761	1125.0406	1499.5803	1817.1266	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating												4743.6146	(98)
Space heating per m2											(98) / (4) =	38.8057	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5078.8165	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	976.1236	776.1954	666.4069	395.6084	178.0363	0.0000	0.0000	0.0000	0.0000	387.7675	703.7359	994.9423	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2578	88.0792	87.7001	86.8132	84.9205	80.3000	80.3000	80.3000	80.3000	86.6819	87.8395	88.3304	(217)
Fuel for water heating, kWh/month													
	247.0040	218.1253	230.0070	208.2047	206.2693	192.1240	184.0694	205.1942	207.2444	216.2276	225.7346	240.8339	(219)
Water heating fuel used												2581.0385	(219)
Annual totals kWh/year													
Space heating fuel - main system												5078.8165	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.2757	(232)
Total delivered energy for all uses												8235.1307	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5078.8165	0.2160	1097.0244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.0385	0.2160	557.5043	(264)
Space and water heating			1654.5287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Total CO2, kg/m2/year			1953.0968	(272)
Emissions per m2 for space and water heating			13.5351	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1240	(272b)
Emissions per m2 for pumps and fans			0.3184	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5351 * 1.00) + 2.1240 + 0.3184, rounded to 2 d.p.			15.9800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 137 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 137	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 137, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.95 m	49.69 m²	2.31 m
1st Storey:	18.15 m	41.02 m²	2.63 m
2nd Storey:	17.10 m	31.53 m²	2.34 m

7.0 Living Area	25.86	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	177.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	109.45	95.16
Knee wall	Cavity Wall	0.15	10.65	10.65
Dormer wall	Cavity Wall	0.19	6.96	5.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	61.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	17.56	17.56
Lower roof	External Plane Roof	0.27	9.71	9.71
Sloping roof	External Slope Roof	0.13	16.58	15.18
Sheltered ceiling	External Plane Roof	0.16	9.49	9.49
Dormer roof	External Flat Roof	0.16	2.04	2.04

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	49.69

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Opening Type 3	Manufacturer	Roof Window	Double Low-E Hard 0.15			0.72		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[3] Dormer wall	South	Dark-coloured curtain or roller blind	0.00					1.26	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
RL1	Roof Window	[3] Sloping roof	North	None						0.54	
RL2	Roof Window	[3] Sloping roof	North	None						0.43	
RL3	Roof Window	[3] Sloping roof	North	None						0.43	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.19	0.065	No
Independently assessed	E3 Sill	8.36	0.004	No
Independently assessed	E4 Jamb	26.55	0.005	No
Independently assessed	E5 Ground floor (normal)	19.95	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.10	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.82	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	5.93	0.060	No
Independently assessed	E16 Corner (normal)	14.56	0.037	No
Independently assessed	E18 Party wall between dwellings	14.56	0.030	No
Independently assessed	P1 Party wall - Ground floor	10.31	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	14.92	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	3.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	5.93	0.009	No
Independently assessed	R1 Head of roof window	1.65	0.007	No
Independently assessed	R2 Sill of roof window	1.65	0.007	No
Independently assessed	R3 Jamb of roof window	5.07	0.007	No
Independently assessed	R6 Flat ceiling	9.64	-0.025	No
Independently assessed	R8 Roof to wall (rafter)	8.46	0.021	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 137 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 137	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 137, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	122.24	m^2	
DER	8.28	$kgCO_2/yr/m^2$	
TER	15.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.28	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.18	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	122.24	m^2	
DER	16.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 138 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 138	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 138, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 122 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.27 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.68 m², No overhang
Windows facing South: 5.77 m², No overhang
Windows facing West: 0.96 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900	(1b)	x 2.3100	(2b) =	114.7839	(1b) - (3b)
First floor	41.0200	(1c)	x 2.6300	(2c) =	107.8826	(1c) - (3c)
Second floor	31.5300	(1d)	x 2.3400	(2d) =	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3599	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3824	0.3748	0.3365	0.3289	0.2906	0.2906	0.2830	0.3059	0.3289	0.3442	0.3595	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6401	0.6324	0.6248	0.5865	0.5789	0.5406	0.5406	0.5330	0.5559	0.5789	0.5942	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Opening Type 3 (Uw = 1.30)			1.4000	1.2357	1.7300			(27a)
Ground floor			49.6900	0.1200	5.9628			(28a)
External Wall	109.4500	14.2900	95.1600	0.2100	19.9836			(29a)
Knee wall	10.6500		10.6500	0.1500	1.5975			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1900	1.0830			(29a)
Main Roof	17.5600		17.5600	0.0700	1.2292			(30)
Lower roof	9.7100		9.7100	0.2700	2.6217			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1600	1.5184			(30)
Dormer roof	2.0400		2.0400	0.1600	0.3264			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8073			(33)
Party Wall			61.1900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							177.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1848	(36)
Total fabric heat loss					(33) + (36) =		62.9921	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.6170	61.8687	61.1205	57.3793	56.6311	52.8899	52.8899	52.1416	54.3863	56.6311	58.1275	59.6240	(38)
Heat transfer coeff	125.6090	124.8608	124.1126	120.3714	119.6231	115.8820	115.8820	115.1337	117.3784	119.6231	121.1196	122.6161	(39)
Average = Sum(39)m / 12 =												120.1843	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0276	1.0214	1.0153	0.9847	0.9786	0.9480	0.9480	0.9419	0.9602	0.9786	0.9908	1.0031	(40)
HLP (average)												0.9832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716	(42)
Average daily hot water use (litres/day)	102.3998	(43)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)
Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8282	10.6735	11.7940	11.3832	11.7324	11.3178	11.6726	11.7114	11.3531	11.7640	11.4200	11.8172	(61)
Total heat required for water heating calculated for each month													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(64)
								Total per year (kWh/year) = Sum(64)m =				1749.6145	(64)
Heat gains from water heating, kWh/month													
	58.4984	51.2452	53.0754	46.5476	44.8660	39.0144	36.4488	41.4048	41.7747	48.3177	52.3872	56.7431	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	78.6268	76.2577	71.3379	64.6495	60.3038	54.1867	48.9903	55.6516	58.0205	64.9432	72.7600	76.2676	(72)
Total internal gains													
	464.1294	461.5825	444.4305	416.7329	388.2305	361.2818	344.1610	350.9999	365.6011	393.5330	425.5066	449.8456	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.7200	0.7000	0.7700	24.8092	(74)
South	5.7700	46.7521	0.7200	0.7000	0.7700	94.2194	(78)
West	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(80)
North	1.4000	26.0000	0.7200	0.7000	1.0000	16.5110	(82)

Solar gains	142.1250	248.8933	359.3031	477.7592	565.6694	575.2297	548.8859	481.0699	399.8980	280.0707	171.4550	120.8477	(83)
Total gains	606.2544	710.4758	803.7336	894.4921	953.8999	936.5116	893.0469	832.0699	765.4991	673.6037	596.9616	570.6934	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.8479	48.1347	48.4249	49.9299	50.2422	51.8643	51.8643	52.2013	51.2030	50.2422	49.6215	49.0159	
alpha	4.1899	4.2090	4.2283	4.3287	4.3495	4.4576	4.4576	4.4801	4.4135	4.3495	4.3081	4.2677	
util living area													
	0.9961	0.9918	0.9814	0.9495	0.8698	0.7110	0.5498	0.6031	0.8375	0.9670	0.9926	0.9970	(86)
MIT	19.4633	19.6550	19.9570	20.3688	20.7056	20.9205	20.9802	20.9708	20.8235	20.3829	19.8675	19.4570	(87)
Th 2	20.0604	20.0655	20.0706	20.0961	20.1012	20.1269	20.1269	20.1321	20.1166	20.1012	20.0910	20.0808	(88)
util rest of house													
	0.9951	0.9898	0.9766	0.9357	0.8336	0.6384	0.4499	0.5031	0.7810	0.9554	0.9904	0.9962	(89)
MIT 2	17.9867	18.2694	18.7115	19.3185	19.7813	20.0615	20.1163	20.1150	19.9506	19.3495	18.5977	17.9911	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9852	0.9689	0.9252	0.8279	0.6488	0.4703	0.5230	0.7824	0.9464	0.9862	0.9941	(94)
Useful gains	601.6506	699.9796	778.7590	827.5784	789.7215	607.6217	420.0417	435.1355	598.9004	637.4963	588.7117	567.3110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1758.4122	1705.9138	1548.3051	1280.8373	990.1028	653.9477	428.6548	448.5710	708.4096	1072.7906	1425.1338	1729.0319	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating			4374.9940 (98)
Space heating per m2		(98) / (4) =	35.7902 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)			0.0000 (201)
Fraction of space heat from main system(s)			1.0000 (202)
Efficiency of main space heating system 1 (in %)			93.3000 (206)
Efficiency of secondary/supplementary heating system, %			0.0000 (208)
Space heating requirement			4689.1682 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	922.4336	724.5314	613.6574	349.7818	159.7896	0.0000	0.0000	0.0000	0.0000	347.1157	645.4704	926.3883	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating			
Water heating requirement			173.5879 (64)
Efficiency of water heater			86.7000 (216)
(217)m			89.6772 (217)
Fuel for water heating, kWh/month			
Water heating fuel used			1974.5183 (219)
Annual totals kWh/year			
Space heating fuel - main system			4689.1682 (211)
Space heating fuel - secondary			0.0000 (215)

Electricity for pumps and fans:			
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			75.0000 (231)
Electricity for lighting (calculated in Appendix L)			500.2757 (232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =		-1399.0639	-1399.0639 (233)
Total delivered energy for all uses			5839.8983 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.1682	0.2160	1012.8603	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.5183	0.2160	426.4959	(264)
Space and water heating			1439.3563	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			1011.8102	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2800	ZC1
Total Floor Area	TFA	122.2400	
Assumed number of occupants	N	2.8716	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9662	ZC2
CO2 emissions from cooking, equation (L16)		1.5373	ZC3
Total CO2 emissions		23.7835	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.7835	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900 (1b)	x	2.3100 (2b)	=	114.7839	(1b) - (3b)
First floor	41.0200 (1c)	x	2.6300 (2c)	=	107.8826	(1c) - (3c)
Second floor	31.5300 (1d)	x	2.3400 (2d)	=	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3849	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3272	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3517	0.3108	0.3108	0.3027	0.3272	0.3517	0.3681	0.3845	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5677	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
TER Room Window (Uw = 1.70)			1.4000	1.5918	2.2285			(27a)
Ground floor			49.6900	0.1300	6.4597			(28a)
External Wall	109.4500	14.2900	95.1600	0.1800	17.1288			(29a)
Knee wall	10.6500		10.6500	0.1800	1.9170			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1800	1.0260			(29a)
Main Roof	17.5600		17.5600	0.1300	2.2828			(30)
Lower roof	9.7100		9.7100	0.1300	1.2623			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1300	1.2337			(30)
Dormer roof	2.0400		2.0400	0.1300	0.2652			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.1238			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8820	(36)
Total fabric heat loss (33) + (36) =	69.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.4262	57.0956	56.7716	55.2498	54.9651	53.6396	53.6396	53.3941	54.1501	54.9651	55.5411	56.1433	(38)
Heat transfer coeff	126.4320	126.1014	125.7774	124.2556	123.9708	122.6454	122.6454	122.3999	123.1559	123.9708	124.5468	125.1490	(39)
Average = Sum(39)m / 12 =												124.2542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0343	1.0316	1.0289	1.0165	1.0142	1.0033	1.0033	1.0013	1.0075	1.0142	1.0189	1.0238	(40)
HLP (average)												1.0165	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716 (42)
Average daily hot water use (litres/day)	102.3998 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0509	45.4487	46.9636	49.0509	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
									Total per year (kWh/year) = Sum(64)m =			2199.4693	(64)
Heat gains from water heating, kWh/month													
	68.2810	60.0836	62.8666	56.0306	54.1957	47.5471	45.2716	50.7397	51.2652	58.1164	61.8610	66.5285	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	91.7756	89.4101	84.4981	77.8203	72.8436	66.0376	60.8489	68.1985	71.2017	78.1135	85.9180	89.4200	(72)
Total internal gains													
	477.2781	474.7350	457.5907	429.9037	400.7703	373.1328	356.0196	363.5468	378.7823	406.7033	438.6646	462.9981	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.6300	0.7000	0.7700	21.7080	(74)
South	5.7700	46.7521	0.6300	0.7000	0.7700	82.4420	(78)
West	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(80)
North	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472	(82)

Solar gains	124.3594	217.7816	314.3902	418.0393	494.9607	503.3260	480.2752	420.9362	349.9108	245.0619	150.0231	105.7418	(83)
Total gains	601.6375	692.5166	771.9810	847.9429	895.7310	876.4588	836.2947	784.4830	728.6931	651.7652	588.6877	568.7399	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1420	67.3180	67.4914	68.3180	68.4749	69.2149	69.2149	69.3537	68.9280	68.4749	68.1582	67.8302	
alpha	5.4761	5.4879	5.4994	5.5545	5.5650	5.6143	5.6143	5.6236	5.5952	5.5650	5.5439	5.5220	
util living area													
	0.9993	0.9982	0.9949	0.9815	0.9323	0.7983	0.6246	0.6824	0.9054	0.9888	0.9983	0.9995	(86)
MIT	19.8147	19.9486	20.1706	20.4714	20.7496	20.9327	20.9863	20.9781	20.8501	20.4920	20.1000	19.7937	(87)
Th 2	20.0549	20.0571	20.0593	20.0696	20.0716	20.0806	20.0806	20.0822	20.0771	20.0716	20.0676	20.0635	(88)
util rest of house													
	0.9990	0.9976	0.9930	0.9738	0.9026	0.7182	0.5046	0.5634	0.8526	0.9828	0.9976	0.9993	(89)
MIT 2	18.4560	18.6534	18.9789	19.4212	19.8070	20.0312	20.0750	20.0722	19.9445	19.4558	18.8828	18.4315	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9905	0.9691	0.9001	0.7318	0.5301	0.5884	0.8567	0.9793	0.9966	0.9989	(94)
Useful gains	600.7138	690.0582	764.6846	821.7344	806.2468	641.4252	443.3322	461.6269	624.2758	638.2465	586.6783	568.0995	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1826.1163	1768.8775	1601.2761	1334.9265	1029.7494	689.5037	449.8345	472.9311	743.3761	1125.0406	1499.5803	1817.1266	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating												4743.6146	(98)
Space heating per m2											(98) / (4) =	38.8057	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5078.8165	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	976.1236	776.1954	666.4069	395.6084	178.0363	0.0000	0.0000	0.0000	0.0000	387.7675	703.7359	994.9423	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2578	88.0792	87.7001	86.8132	84.9205	80.3000	80.3000	80.3000	80.3000	86.6819	87.8395	88.3304	(217)
Fuel for water heating, kWh/month													
	247.0040	218.1253	230.0070	208.2047	206.2693	192.1240	184.0694	205.1942	207.2444	216.2276	225.7346	240.8339	(219)
Water heating fuel used												2581.0385	(219)
Annual totals kWh/year													
Space heating fuel - main system												5078.8165	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.2757	(232)
Total delivered energy for all uses												8235.1307	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5078.8165	0.2160	1097.0244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.0385	0.2160	557.5043	(264)
Space and water heating			1654.5287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Total CO2, kg/m2/year			1953.0968	(272)
Emissions per m2 for space and water heating			13.5351	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1240	(272b)
Emissions per m2 for pumps and fans			0.3184	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5351 * 1.00) + 2.1240 + 0.3184, rounded to 2 d.p.			15.9800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 138 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 138	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 138, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.95 m	49.69 m²	2.31 m
1st Storey:	18.15 m	41.02 m²	2.63 m
2nd Storey:	17.10 m	31.53 m²	2.34 m

7.0 Living Area	25.86	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	177.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	109.45	95.16
Knee wall	Cavity Wall	0.15	10.65	10.65
Dormer wall	Cavity Wall	0.19	6.96	5.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	61.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	17.56	17.56
Lower roof	External Plane Roof	0.27	9.71	9.71
Sloping roof	External Slope Roof	0.13	16.58	15.18
Sheltered ceiling	External Plane Roof	0.16	9.49	9.49
Dormer roof	External Flat Roof	0.16	2.04	2.04

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	49.69

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Opening Type 3	Manufacturer	Roof Window	Double Low-E Hard 0.15			0.72		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[3] Dormer wall	South	Dark-coloured curtain or roller blind	0.00					1.26	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
RL1	Roof Window	[3] Sloping roof	North	None						0.54	
RL2	Roof Window	[3] Sloping roof	North	None						0.43	
RL3	Roof Window	[3] Sloping roof	North	None						0.43	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.19	0.065	No
Independently assessed	E3 Sill	8.36	0.004	No
Independently assessed	E4 Jamb	26.55	0.005	No
Independently assessed	E5 Ground floor (normal)	19.95	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.10	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.82	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	5.93	0.060	No
Independently assessed	E16 Corner (normal)	14.56	0.037	No
Independently assessed	E18 Party wall between dwellings	14.56	0.030	No
Independently assessed	P1 Party wall - Ground floor	10.31	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	14.92	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	3.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	5.93	0.009	No
Independently assessed	R1 Head of roof window	1.65	0.007	No
Independently assessed	R2 Sill of roof window	1.65	0.007	No
Independently assessed	R3 Jamb of roof window	5.07	0.007	No
Independently assessed	R6 Flat ceiling	9.64	-0.025	No
Independently assessed	R8 Roof to wall (rafter)	8.46	0.021	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 138 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 138	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 138, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	122.24	m^2	
DER	8.28	$kgCO_2/yr/m^2$	
TER	15.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.28	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.18	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	122.24	m^2	
DER	16.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 139 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 139	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 139, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 122 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.27 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.68 m², No overhang
Windows facing East: 0.96 m², No overhang
Windows facing South: 5.77 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900	(1b)	x 2.3100	(2b) =	114.7839	(1b) - (3b)
First floor	41.0200	(1c)	x 2.6300	(2c) =	107.8826	(1c) - (3c)
Second floor	31.5300	(1d)	x 2.3400	(2d) =	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3599	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3824	0.3748	0.3365	0.3289	0.2906	0.2906	0.2830	0.3059	0.3289	0.3442	0.3595	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6401	0.6324	0.6248	0.5865	0.5789	0.5406	0.5406	0.5330	0.5559	0.5789	0.5942	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Opening Type 3 (Uw = 1.30)			1.4000	1.2357	1.7300			(27a)
Ground floor			49.6900	0.1200	5.9628			(28a)
External Wall	109.4500	14.2900	95.1600	0.2100	19.9836			(29a)
Knee wall	10.6500		10.6500	0.1500	1.5975			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1900	1.0830			(29a)
Main Roof	17.5600		17.5600	0.0700	1.2292			(30)
Lower roof	9.7100		9.7100	0.2700	2.6217			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1600	1.5184			(30)
Dormer roof	2.0400		2.0400	0.1600	0.3264			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8073			(33)
Party Wall			61.1900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							177.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1848	(36)
Total fabric heat loss					(33) + (36) =		62.9921	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.6170	61.8687	61.1205	57.3793	56.6311	52.8899	52.8899	52.1416	54.3863	56.6311	58.1275	59.6240	(38)
Heat transfer coeff	125.6090	124.8608	124.1126	120.3714	119.6231	115.8820	115.8820	115.1337	117.3784	119.6231	121.1196	122.6161	(39)
Average = Sum(39)m / 12 =												120.1843	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0276	1.0214	1.0153	0.9847	0.9786	0.9480	0.9480	0.9419	0.9602	0.9786	0.9908	1.0031	(40)
HLP (average)												0.9832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716	(42)
Average daily hot water use (litres/day)	102.3998	(43)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)
Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8282	10.6735	11.7940	11.3832	11.7324	11.3178	11.6726	11.7114	11.3531	11.7640	11.4200	11.8172	(61)
Total heat required for water heating calculated for each month													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(64)
								Total per year (kWh/year) = Sum(64)m =				1749.6145	(64)
Heat gains from water heating, kWh/month													
	58.4984	51.2452	53.0754	46.5476	44.8660	39.0144	36.4488	41.4048	41.7747	48.3177	52.3872	56.7431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	78.6268	76.2577	71.3379	64.6495	60.3038	54.1867	48.9903	55.6516	58.0205	64.9432	72.7600	76.2676	(72)
Total internal gains													
	464.1294	461.5825	444.4305	416.7329	388.2305	361.2818	344.1610	350.9999	365.6011	393.5330	425.5066	449.8456	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.7200	0.7000	0.7700	24.8092	(74)
East	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(76)
South	5.7700	46.7521	0.7200	0.7000	0.7700	94.2194	(78)
North	1.4000	26.0000	0.7200	0.7000	1.0000	16.5110	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	142.1250	248.8933	359.3031	477.7592	565.6694	575.2297	548.8859	481.0699	399.8980	280.0707	171.4550	120.8477	(83)
Total gains	606.2544	710.4758	803.7336	894.4921	953.8999	936.5116	893.0469	832.0699	765.4991	673.6037	596.9616	570.6934	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.8479	48.1347	48.4249	49.9299	50.2422	51.8643	51.8643	52.2013	51.2030	50.2422	49.6215	49.0159	
alpha	4.1899	4.2090	4.2283	4.3287	4.3495	4.4576	4.4576	4.4801	4.4135	4.3495	4.3081	4.2677	
util living area													
	0.9961	0.9918	0.9814	0.9495	0.8698	0.7110	0.5498	0.6031	0.8375	0.9670	0.9926	0.9970	(86)
MIT	19.4633	19.6550	19.9570	20.3688	20.7056	20.9205	20.9802	20.9708	20.8235	20.3829	19.8675	19.4570	(87)
Th 2	20.0604	20.0655	20.0706	20.0961	20.1012	20.1269	20.1269	20.1321	20.1166	20.1012	20.0910	20.0808	(88)
util rest of house													
	0.9951	0.9898	0.9766	0.9357	0.8336	0.6384	0.4499	0.5031	0.7810	0.9554	0.9904	0.9962	(89)
MIT 2	17.9867	18.2694	18.7115	19.3185	19.7813	20.0615	20.1163	20.1150	19.9506	19.3495	18.5977	17.9911	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9852	0.9689	0.9252	0.8279	0.6488	0.4703	0.5230	0.7824	0.9464	0.9862	0.9941	(94)
Useful gains	601.6506	699.9796	778.7590	827.5784	789.7215	607.6217	420.0417	435.1355	598.9004	637.4963	588.7117	567.3110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1758.4122	1705.9138	1548.3051	1280.8373	990.1028	653.9477	428.6548	448.5710	708.4096	1072.7906	1425.1338	1729.0319	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating			4374.9940 (98)
Space heating per m2		(98) / (4) =	35.7902 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)			0.0000 (201)
Fraction of space heat from main system(s)			1.0000 (202)
Efficiency of main space heating system 1 (in %)			93.3000 (206)
Efficiency of secondary/supplementary heating system, %			0.0000 (208)
Space heating requirement			4689.1682 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	922.4336	724.5314	613.6574	349.7818	159.7896	0.0000	0.0000	0.0000	0.0000	347.1157	645.4704	926.3883	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating			
Water heating requirement			173.5879 (64)
Efficiency of water heater			86.7000 (216)
(217)m			89.6772 (217)
Fuel for water heating, kWh/month			
Water heating fuel used			1974.5183 (219)
Annual totals kWh/year			
Space heating fuel - main system			4689.1682 (211)
Space heating fuel - secondary			0.0000 (215)

Electricity for pumps and fans:			
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			75.0000 (231)
Electricity for lighting (calculated in Appendix L)			500.2757 (232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =		-1399.0639	-1399.0639 (233)
Total delivered energy for all uses			5839.8983 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.1682	0.2160	1012.8603	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.5183	0.2160	426.4959	(264)
Space and water heating			1439.3563	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			1011.8102	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2800	ZC1
Total Floor Area	TFA	122.2400	
Assumed number of occupants	N	2.8716	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9662	ZC2
CO2 emissions from cooking, equation (L16)		1.5373	ZC3
Total CO2 emissions		23.7835	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.7835	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900 (1b)	x	2.3100 (2b)	=	114.7839	(1b) - (3b)
First floor	41.0200 (1c)	x	2.6300 (2c)	=	107.8826	(1c) - (3c)
Second floor	31.5300 (1d)	x	2.3400 (2d)	=	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3849	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3272	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3517	0.3108	0.3108	0.3027	0.3272	0.3517	0.3681	0.3845	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5677	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
TER Room Window (Uw = 1.70)			1.4000	1.5918	2.2285			(27a)
Ground floor			49.6900	0.1300	6.4597			(28a)
External Wall	109.4500	14.2900	95.1600	0.1800	17.1288			(29a)
Knee wall	10.6500		10.6500	0.1800	1.9170			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1800	1.0260			(29a)
Main Roof	17.5600		17.5600	0.1300	2.2828			(30)
Lower roof	9.7100		9.7100	0.1300	1.2623			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1300	1.2337			(30)
Dormer roof	2.0400		2.0400	0.1300	0.2652			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.1238			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8820	(36)
Total fabric heat loss (33) + (36) =	69.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.4262	57.0956	56.7716	55.2498	54.9651	53.6396	53.6396	53.3941	54.1501	54.9651	55.5411	56.1433	(38)
Heat transfer coeff	126.4320	126.1014	125.7774	124.2556	123.9708	122.6454	122.6454	122.3999	123.1559	123.9708	124.5468	125.1490	(39)
Average = Sum(39)m / 12 =												124.2542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0343	1.0316	1.0289	1.0165	1.0142	1.0033	1.0033	1.0013	1.0075	1.0142	1.0189	1.0238	(40)
HLP (average)												1.0165	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716 (42)
Average daily hot water use (litres/day)	102.3998 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0509	45.4487	46.9636	49.0509	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
								Total per year (kWh/year) = Sum(64)m =				2199.4693	(64)
Heat gains from water heating, kWh/month													
	68.2810	60.0836	62.8666	56.0306	54.1957	47.5471	45.2716	50.7397	51.2652	58.1164	61.8610	66.5285	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	91.7756	89.4101	84.4981	77.8203	72.8436	66.0376	60.8489	68.1985	71.2017	78.1135	85.9180	89.4200	(72)
Total internal gains													
	477.2781	474.7350	457.5907	429.9037	400.7703	373.1328	356.0196	363.5468	378.7823	406.7033	438.6646	462.9981	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.6300	0.7000	0.7700	21.7080	(74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(76)
South	5.7700	46.7521	0.6300	0.7000	0.7700	82.4420	(78)
North	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472	(82)

Solar gains	124.3594	217.7816	314.3902	418.0393	494.9607	503.3260	480.2752	420.9362	349.9108	245.0619	150.0231	105.7418	(83)
Total gains	601.6375	692.5166	771.9810	847.9429	895.7310	876.4588	836.2947	784.4830	728.6931	651.7652	588.6877	568.7399	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1420	67.3180	67.4914	68.3180	68.4749	69.2149	69.2149	69.3537	68.9280	68.4749	68.1582	67.8302	
alpha	5.4761	5.4879	5.4994	5.5545	5.5650	5.6143	5.6143	5.6236	5.5952	5.5650	5.5439	5.5220	
util living area													
	0.9993	0.9982	0.9949	0.9815	0.9323	0.7983	0.6246	0.6824	0.9054	0.9888	0.9983	0.9995	(86)
MIT	19.8147	19.9486	20.1706	20.4714	20.7496	20.9327	20.9863	20.9781	20.8501	20.4920	20.1000	19.7937	(87)
Th 2	20.0549	20.0571	20.0593	20.0696	20.0716	20.0806	20.0806	20.0822	20.0771	20.0716	20.0676	20.0635	(88)
util rest of house													
	0.9990	0.9976	0.9930	0.9738	0.9026	0.7182	0.5046	0.5634	0.8526	0.9828	0.9976	0.9993	(89)
MIT 2	18.4560	18.6534	18.9789	19.4212	19.8070	20.0312	20.0750	20.0722	19.9445	19.4558	18.8828	18.4315	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9905	0.9691	0.9001	0.7318	0.5301	0.5884	0.8567	0.9793	0.9966	0.9989	(94)
Useful gains	600.7138	690.0582	764.6846	821.7344	806.2468	641.4252	443.3322	461.6269	624.2758	638.2465	586.6783	568.0995	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1826.1163	1768.8775	1601.2761	1334.9265	1029.7494	689.5037	449.8345	472.9311	743.3761	1125.0406	1499.5803	1817.1266	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating												4743.6146	(98)
Space heating per m2											(98) / (4) =	38.8057	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5078.8165	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	976.1236	776.1954	666.4069	395.6084	178.0363	0.0000	0.0000	0.0000	0.0000	387.7675	703.7359	994.9423	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2578	88.0792	87.7001	86.8132	84.9205	80.3000	80.3000	80.3000	80.3000	86.6819	87.8395	88.3304	(217)
Fuel for water heating, kWh/month													
	247.0040	218.1253	230.0070	208.2047	206.2693	192.1240	184.0694	205.1942	207.2444	216.2276	225.7346	240.8339	(219)
Water heating fuel used												2581.0385	(219)
Annual totals kWh/year													
Space heating fuel - main system												5078.8165	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.2757	(232)
Total delivered energy for all uses												8235.1307	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5078.8165	0.2160	1097.0244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.0385	0.2160	557.5043	(264)
Space and water heating			1654.5287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Total CO2, kg/m2/year			1953.0968	(272)
Emissions per m2 for space and water heating			13.5351	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1240	(272b)
Emissions per m2 for pumps and fans			0.3184	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5351 * 1.00) + 2.1240 + 0.3184, rounded to 2 d.p.			15.9800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 139 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 139	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 139, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.95 m	49.69 m²	2.31 m
1st Storey:	18.15 m	41.02 m²	2.63 m
2nd Storey:	17.10 m	31.53 m²	2.34 m

7.0 Living Area	25.86	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	177.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	109.45	95.16
Knee wall	Cavity Wall	0.15	10.65	10.65
Dormer wall	Cavity Wall	0.19	6.96	5.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	61.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	17.56	17.56
Lower roof	External Plane Roof	0.27	9.71	9.71
Sloping roof	External Slope Roof	0.13	16.58	15.18
Sheltered ceiling	External Plane Roof	0.16	9.49	9.49
Dormer roof	External Flat Roof	0.16	2.04	2.04

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	49.69

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Opening Type 3	Manufacturer	Roof Window	Double Low-E Hard 0.15			0.72		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[3] Dormer wall	South	Dark-coloured curtain or roller blind	0.00					1.26	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
RL1	Roof Window	[3] Sloping roof	North	None						0.54	
RL2	Roof Window	[3] Sloping roof	North	None						0.43	
RL3	Roof Window	[3] Sloping roof	North	None						0.43	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.19	0.065	No
Independently assessed	E3 Sill	8.36	0.004	No
Independently assessed	E4 Jamb	26.55	0.005	No
Independently assessed	E5 Ground floor (normal)	19.95	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.10	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.82	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	5.93	0.060	No
Independently assessed	E16 Corner (normal)	14.56	0.037	No
Independently assessed	E18 Party wall between dwellings	14.56	0.030	No
Independently assessed	P1 Party wall - Ground floor	10.31	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	14.92	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	3.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	5.93	0.009	No
Independently assessed	R1 Head of roof window	1.65	0.007	No
Independently assessed	R2 Sill of roof window	1.65	0.007	No
Independently assessed	R3 Jamb of roof window	5.07	0.007	No
Independently assessed	R6 Flat ceiling	9.64	-0.025	No
Independently assessed	R8 Roof to wall (rafter)	8.46	0.021	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 139 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 139	**Prop Type Ref**	Opp
Property	L368-R - Semi SG, Plot 139, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	122.24	m^2	
DER	8.28	$kgCO_2/yr/m^2$	
TER	15.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.28	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.18	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	122.24	m^2	
DER	16.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 140 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 140	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 140, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 122 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.27 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.68 m², No overhang
Windows facing South: 5.77 m², No overhang
Windows facing West: 0.96 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900	(1b)	x 2.3100	(2b) =	114.7839	(1b) - (3b)
First floor	41.0200	(1c)	x 2.6300	(2c) =	107.8826	(1c) - (3c)
Second floor	31.5300	(1d)	x 2.3400	(2d) =	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3599	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3824	0.3748	0.3365	0.3289	0.2906	0.2906	0.2830	0.3059	0.3289	0.3442	0.3595	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6401	0.6324	0.6248	0.5865	0.5789	0.5406	0.5406	0.5330	0.5559	0.5789	0.5942	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Opening Type 3 (Uw = 1.30)			1.4000	1.2357	1.7300			(27a)
Ground floor			49.6900	0.1200	5.9628			(28a)
External Wall	109.4500	14.2900	95.1600	0.2100	19.9836			(29a)
Knee wall	10.6500		10.6500	0.1500	1.5975			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1900	1.0830			(29a)
Main Roof	17.5600		17.5600	0.0700	1.2292			(30)
Lower roof	9.7100		9.7100	0.2700	2.6217			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1600	1.5184			(30)
Dormer roof	2.0400		2.0400	0.1600	0.3264			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8073			(33)
Party Wall			61.1900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							177.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1848	(36)
Total fabric heat loss					(33) + (36) =		62.9921	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.6170	61.8687	61.1205	57.3793	56.6311	52.8899	52.8899	52.1416	54.3863	56.6311	58.1275	59.6240	(38)
Heat transfer coeff	125.6090	124.8608	124.1126	120.3714	119.6231	115.8820	115.8820	115.1337	117.3784	119.6231	121.1196	122.6161	(39)
Average = Sum(39)m / 12 =												120.1843	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0276	1.0214	1.0153	0.9847	0.9786	0.9480	0.9480	0.9419	0.9602	0.9786	0.9908	1.0031	(40)
HLP (average)												0.9832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716	(42)
Average daily hot water use (litres/day)	102.3998	(43)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)
Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8282	10.6735	11.7940	11.3832	11.7324	11.3178	11.6726	11.7114	11.3531	11.7640	11.4200	11.8172	(61)
Total heat required for water heating calculated for each month													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.8697	156.7691	162.5516	142.8173	137.8465	120.1447	112.5167	127.4314	128.4553	148.2353	160.3891	173.5879	(64)
								Total per year (kWh/year) = Sum(64)m =				1749.6145	(64)
Heat gains from water heating, kWh/month													
	58.4984	51.2452	53.0754	46.5476	44.8660	39.0144	36.4488	41.4048	41.7747	48.3177	52.3872	56.7431	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	78.6268	76.2577	71.3379	64.6495	60.3038	54.1867	48.9903	55.6516	58.0205	64.9432	72.7600	76.2676	(72)
Total internal gains													
	464.1294	461.5825	444.4305	416.7329	388.2305	361.2818	344.1610	350.9999	365.6011	393.5330	425.5066	449.8456	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.7200	0.7000	0.7700	24.8092	(74)
South	5.7700	46.7521	0.7200	0.7000	0.7700	94.2194	(78)
West	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(80)
North	1.4000	26.0000	0.7200	0.7000	1.0000	16.5110	(82)

Solar gains	142.1250	248.8933	359.3031	477.7592	565.6694	575.2297	548.8859	481.0699	399.8980	280.0707	171.4550	120.8477	(83)
Total gains	606.2544	710.4758	803.7336	894.4921	953.8999	936.5116	893.0469	832.0699	765.4991	673.6037	596.9616	570.6934	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.8479	48.1347	48.4249	49.9299	50.2422	51.8643	51.8643	52.2013	51.2030	50.2422	49.6215	49.0159	
alpha	4.1899	4.2090	4.2283	4.3287	4.3495	4.4576	4.4576	4.4801	4.4135	4.3495	4.3081	4.2677	
util living area													
	0.9961	0.9918	0.9814	0.9495	0.8698	0.7110	0.5498	0.6031	0.8375	0.9670	0.9926	0.9970	(86)
MIT	19.4633	19.6550	19.9570	20.3688	20.7056	20.9205	20.9802	20.9708	20.8235	20.3829	19.8675	19.4570	(87)
Th 2	20.0604	20.0655	20.0706	20.0961	20.1012	20.1269	20.1269	20.1321	20.1166	20.1012	20.0910	20.0808	(88)
util rest of house													
	0.9951	0.9898	0.9766	0.9357	0.8336	0.6384	0.4499	0.5031	0.7810	0.9554	0.9904	0.9962	(89)
MIT 2	17.9867	18.2694	18.7115	19.3185	19.7813	20.0615	20.1163	20.1150	19.9506	19.3495	18.5977	17.9911	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2991	18.5625	18.9750	19.5407	19.9769	20.2432	20.2991	20.2961	20.1353	19.5681	18.8663	18.3012	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9852	0.9689	0.9252	0.8279	0.6488	0.4703	0.5230	0.7824	0.9464	0.9862	0.9941	(94)
Useful gains	601.6506	699.9796	778.7590	827.5784	789.7215	607.6217	420.0417	435.1355	598.9004	637.4963	588.7117	567.3110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1758.4122	1705.9138	1548.3051	1280.8373	990.1028	653.9477	428.6548	448.5710	708.4096	1072.7906	1425.1338	1729.0319	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating			4374.9940 (98)
Space heating per m2		(98) / (4) =	35.7902 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)			0.0000 (201)
Fraction of space heat from main system(s)			1.0000 (202)
Efficiency of main space heating system 1 (in %)			93.3000 (206)
Efficiency of secondary/supplementary heating system, %			0.0000 (208)
Space heating requirement			4689.1682 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.6306	675.9878	572.5423	326.3464	149.0837	0.0000	0.0000	0.0000	0.0000	323.8590	602.2239	864.3203	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	922.4336	724.5314	613.6574	349.7818	159.7896	0.0000	0.0000	0.0000	0.0000	347.1157	645.4704	926.3883	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating			
Water heating requirement			173.5879 (64)
Efficiency of water heater			86.7000 (216)
(217)m			89.6772 (217)
Fuel for water heating, kWh/month			
Water heating fuel used			1974.5183 (219)
Annual totals kWh/year			
Space heating fuel - main system			4689.1682 (211)
Space heating fuel - secondary			0.0000 (215)

Electricity for pumps and fans:			
central heating pump			30.0000 (230c)
main heating flue fan			45.0000 (230e)
Total electricity for the above, kWh/year			75.0000 (231)
Electricity for lighting (calculated in Appendix L)			500.2757 (232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =		-1399.0639	-1399.0639 (233)
Total delivered energy for all uses			5839.8983 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4689.1682	0.2160	1012.8603	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.5183	0.2160	426.4959	(264)
Space and water heating			1439.3563	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			1011.8102	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2800	ZC1
Total Floor Area	TFA	122.2400	
Assumed number of occupants	N	2.8716	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9662	ZC2
CO2 emissions from cooking, equation (L16)		1.5373	ZC3
Total CO2 emissions		23.7835	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.7835	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6900 (1b)	x	2.3100 (2b)	=	114.7839	(1b) - (3b)
First floor	41.0200 (1c)	x	2.6300 (2c)	=	107.8826	(1c) - (3c)
Second floor	31.5300 (1d)	x	2.3400 (2d)	=	73.7802	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.4467	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1349	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3849	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3272	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3517	0.3108	0.3108	0.3027	0.3272	0.3517	0.3681	0.3845	(22b)
Effective ac	0.5870	0.5836	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5677	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
TER Room Window (Uw = 1.70)			1.4000	1.5918	2.2285			(27a)
Ground floor			49.6900	0.1300	6.4597			(28a)
External Wall	109.4500	14.2900	95.1600	0.1800	17.1288			(29a)
Knee wall	10.6500		10.6500	0.1800	1.9170			(29a)
Dormer wall	6.9600	1.2600	5.7000	0.1800	1.0260			(29a)
Main Roof	17.5600		17.5600	0.1300	2.2828			(30)
Lower roof	9.7100		9.7100	0.1300	1.2623			(30)
Sloping roof	16.5800	1.4000	15.1800	0.1300	1.9734			(30)
Sheltered ceiling	9.4900		9.4900	0.1300	1.2337			(30)
Dormer roof	2.0400		2.0400	0.1300	0.2652			(30)
Total net area of external elements Aum(A, m2)			232.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.1238			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8820	(36)
Total fabric heat loss (33) + (36) =	69.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.4262	57.0956	56.7716	55.2498	54.9651	53.6396	53.6396	53.3941	54.1501	54.9651	55.5411	56.1433	(38)
Heat transfer coeff	126.4320	126.1014	125.7774	124.2556	123.9708	122.6454	122.6454	122.3999	123.1559	123.9708	124.5468	125.1490	(39)
Average = Sum(39)m / 12 =												124.2542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0343	1.0316	1.0289	1.0165	1.0142	1.0033	1.0033	1.0013	1.0075	1.0142	1.0189	1.0238	(40)
HLP (average)												1.0165	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8716 (42)
Average daily hot water use (litres/day)	102.3998 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6397	108.5438	104.4478	100.3518	96.2558	92.1598	92.1598	96.2558	100.3518	104.4478	108.5438	112.6397	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	167.0415	146.0955	150.7575	131.4341	126.1141	108.8269	100.8441	115.7201	117.1022	136.4713	148.9691	161.7708	(45)
Energy content (annual)										Total = Sum(45)m =		1611.1471	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0562	21.9143	22.6136	19.7151	18.9171	16.3240	15.1266	17.3580	17.5653	20.4707	22.3454	24.2656	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0509	45.4487	46.9636	49.0509	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
									Total per year (kWh/year) = Sum(64)m =			2199.4693	(64)
Heat gains from water heating, kWh/month													
	68.2810	60.0836	62.8666	56.0306	54.1957	47.5471	45.2716	50.7397	51.2652	58.1164	61.8610	66.5285	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	143.5785	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3277	25.1604	20.4618	15.4909	11.5796	9.7760	10.5633	13.7306	18.4292	23.4001	27.3114	29.1150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.1013	291.0909	283.5572	267.5190	247.2735	228.2456	215.5338	212.5442	220.0779	236.1162	256.3617	275.3895	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	37.3578	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	-114.8628	(71)
Water heating gains (Table 5)													
	91.7756	89.4101	84.4981	77.8203	72.8436	66.0376	60.8489	68.1985	71.2017	78.1135	85.9180	89.4200	(72)
Total internal gains													
	477.2781	474.7350	457.5907	429.9037	400.7703	373.1328	356.0196	363.5468	378.7823	406.7033	438.6646	462.9981	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6800	10.6334	0.6300	0.7000	0.7700	21.7080	(74)
South	5.7700	46.7521	0.6300	0.7000	0.7700	82.4420	(78)
West	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(80)
North	1.4000	26.0000	0.6300	0.7000	1.0000	14.4472	(82)

Solar gains	124.3594	217.7816	314.3902	418.0393	494.9607	503.3260	480.2752	420.9362	349.9108	245.0619	150.0231	105.7418	(83)
Total gains	601.6375	692.5166	771.9810	847.9429	895.7310	876.4588	836.2947	784.4830	728.6931	651.7652	588.6877	568.7399	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1420	67.3180	67.4914	68.3180	68.4749	69.2149	69.2149	69.3537	68.9280	68.4749	68.1582	67.8302	
alpha	5.4761	5.4879	5.4994	5.5545	5.5650	5.6143	5.6143	5.6236	5.5952	5.5650	5.5439	5.5220	
util living area													
	0.9993	0.9982	0.9949	0.9815	0.9323	0.7983	0.6246	0.6824	0.9054	0.9888	0.9983	0.9995	(86)
MIT	19.8147	19.9486	20.1706	20.4714	20.7496	20.9327	20.9863	20.9781	20.8501	20.4920	20.1000	19.7937	(87)
Th 2	20.0549	20.0571	20.0593	20.0696	20.0716	20.0806	20.0806	20.0822	20.0771	20.0716	20.0676	20.0635	(88)
util rest of house													
	0.9990	0.9976	0.9930	0.9738	0.9026	0.7182	0.5046	0.5634	0.8526	0.9828	0.9976	0.9993	(89)
MIT 2	18.4560	18.6534	18.9789	19.4212	19.8070	20.0312	20.0750	20.0722	19.9445	19.4558	18.8828	18.4315	(90)
Living area fraction									fLA = Living area / (4) =			0.2116	(91)
MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7435	18.9274	19.2310	19.6434	20.0064	20.2219	20.2678	20.2638	20.1361	19.6750	19.1403	18.7197	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9905	0.9691	0.9001	0.7318	0.5301	0.5884	0.8567	0.9793	0.9966	0.9989	(94)
Useful gains	600.7138	690.0582	764.6846	821.7344	806.2468	641.4252	443.3322	461.6269	624.2758	638.2465	586.6783	568.0995	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1826.1163	1768.8775	1601.2761	1334.9265	1029.7494	689.5037	449.8345	472.9311	743.3761	1125.0406	1499.5803	1817.1266	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating												4743.6146	(98)
Space heating per m2											(98) / (4) =	38.8057	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5078.8165	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.6994	724.9665	622.4241	369.4983	166.2859	0.0000	0.0000	0.0000	0.0000	362.1749	657.2894	929.2761	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	976.1236	776.1954	666.4069	395.6084	178.0363	0.0000	0.0000	0.0000	0.0000	387.7675	703.7359	994.9423	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.0004	192.1229	201.7164	180.7491	175.1650	154.2756	147.8077	164.7710	166.4172	187.4302	198.2841	212.7297	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2578	88.0792	87.7001	86.8132	84.9205	80.3000	80.3000	80.3000	80.3000	86.6819	87.8395	88.3304	(217)
Fuel for water heating, kWh/month													
	247.0040	218.1253	230.0070	208.2047	206.2693	192.1240	184.0694	205.1942	207.2444	216.2276	225.7346	240.8339	(219)
Water heating fuel used												2581.0385	(219)
Annual totals kWh/year													
Space heating fuel - main system												5078.8165	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.2757	(232)
Total delivered energy for all uses												8235.1307	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5078.8165	0.2160	1097.0244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.0385	0.2160	557.5043	(264)
Space and water heating			1654.5287	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.2757	0.5190	259.6431	(268)
Total CO2, kg/m2/year			1953.0968	(272)
Emissions per m2 for space and water heating			13.5351	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1240	(272b)
Emissions per m2 for pumps and fans			0.3184	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5351 * 1.00) + 2.1240 + 0.3184, rounded to 2 d.p.			15.9800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 140 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 140	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 140, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.95 m	49.69 m²	2.31 m
1st Storey:	18.15 m	41.02 m²	2.63 m
2nd Storey:	17.10 m	31.53 m²	2.34 m

7.0 Living Area	25.86	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	177.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	109.45	95.16
Knee wall	Cavity Wall	0.15	10.65	10.65
Dormer wall	Cavity Wall	0.19	6.96	5.70

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	61.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	17.56	17.56
Lower roof	External Plane Roof	0.27	9.71	9.71
Sloping roof	External Slope Roof	0.13	16.58	15.18
Sheltered ceiling	External Plane Roof	0.16	9.49	9.49
Dormer roof	External Flat Roof	0.16	2.04	2.04

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	49.69

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Opening Type 3	Manufacturer	Roof Window	Double Low-E Hard 0.15			0.72		0.70	1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[3] Dormer wall	South	Dark-coloured curtain or roller blind	0.00					1.26	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
RL1	Roof Window	[3] Sloping roof	North	None						0.54	
RL2	Roof Window	[3] Sloping roof	North	None						0.43	
RL3	Roof Window	[3] Sloping roof	North	None						0.43	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.19	0.065	No
Independently assessed	E3 Sill	8.36	0.004	No
Independently assessed	E4 Jamb	26.55	0.005	No
Independently assessed	E5 Ground floor (normal)	19.95	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.10	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.82	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	5.93	0.060	No
Independently assessed	E16 Corner (normal)	14.56	0.037	No
Independently assessed	E18 Party wall between dwellings	14.56	0.030	No
Independently assessed	P1 Party wall - Ground floor	10.31	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	14.92	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	3.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	5.93	0.009	No
Independently assessed	R1 Head of roof window	1.65	0.007	No
Independently assessed	R2 Sill of roof window	1.65	0.007	No
Independently assessed	R3 Jamb of roof window	5.07	0.007	No
Independently assessed	R6 Flat ceiling	9.64	-0.025	No
Independently assessed	R8 Roof to wall (rafter)	8.46	0.021	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 140 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 140	**Prop Type Ref**	As
Property	L368-R - Semi SG, Plot 140, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.28	**TER**	15.98
Environmental	93 A	**% DER<TER**	48.18		
CO_2 Emissions (t/year)	0.57	**DFEE**	37.96	**TFEE**	49.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	122.24	m^2	
DER	8.28	$kgCO_2/yr/m^2$	
TER	15.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.28	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.18	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	122.24	m^2	
DER	16.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.97	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.54	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.69	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 141 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 141	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 141, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 10.34 m², No overhang
Windows facing South: 8.19 m², No overhang
Windows facing West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8318 10.6767 11.7973 11.3860 11.7376 11.3222 11.6766 11.7162 11.3556 11.7670 11.4232 11.8206 (61)
Total heat required for water heating calculated for each month
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (64)
Total per year (kWh/year) = Sum(64)m = 1766.1786 (64)
Heat gains from water heating, kWh/month
59.0688 51.7440 53.5902 46.9965 45.2973 39.3865 36.7936 41.8005 42.1746 48.7837 52.8959 57.2955 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
29.6036 26.2936 21.3834 16.1886 12.1012 10.2163 11.0391 14.3491 19.2593 24.4541 28.5415 30.4264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
308.6376 311.8403 303.7696 286.5881 264.8995 244.5153 230.8973 227.6947 235.7653 252.9469 274.6354 295.0197 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 (71)
Water heating gains (Table 5)
79.3935 77.0001 72.0298 65.2729 60.8835 54.7035 49.4538 56.1835 58.5759 65.5695 73.4666 77.0101 (72)
Total internal gains
487.3714 484.8707 466.9195 437.7862 407.6209 379.1718 361.1270 367.9639 383.3372 412.7072 446.3802 472.1928 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3400	10.6334	0.7200	0.7000	0.7700	38.4022	(74)
South	8.1900	46.7521	0.7200	0.7000	0.7700	133.7360	(78)
West	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(80)

Solar gains	177.0773	302.0756	419.6160	538.8443	626.8669	634.2046	606.3818	537.8300	459.8895	335.0633	212.0553	151.6359	(83)
Total gains	664.4487	786.9462	886.5355	976.6305	1034.4877	1013.3764	967.5088	905.7939	843.2267	747.7704	658.4355	623.8286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area	0.9977	0.9949	0.9883	0.9679	0.9115	0.7787	0.6195	0.6718	0.8817	0.9783	0.9955	0.9982	(86)
MIT	19.3910	19.5773	19.8689	20.2746	20.6286	20.8856	20.9689	20.9560	20.7764	20.3167	19.8007	19.3884	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house	0.9970	0.9935	0.9848	0.9574	0.8802	0.7030	0.5028	0.5581	0.8288	0.9694	0.9940	0.9978	(89)
MIT 2	17.8136	18.0893	18.5177	19.1219	19.6173	19.9580	20.0357	20.0326	19.8300	19.1916	18.4352	17.8247	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.1308	18.3885	18.7893	19.3536	19.8206	20.1445	20.2233	20.2182	20.0203	19.4178	18.7097	18.1391	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1308	18.3885	18.7893	19.3536	19.8206	20.1445	20.2233	20.2182	20.0203	19.4178	18.7097	18.1391	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9901	0.9789	0.9481	0.8724	0.7113	0.5253	0.5791	0.8275	0.9617	0.9910	0.9964	(94)
Useful gains	661.2683	779.1820	867.8016	925.9379	902.4540	720.8344	508.1890	524.5090	697.7438	719.1660	652.4992	621.5573	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2174.1852	2107.3803	1908.1850	1572.7809	1213.9508	802.1334	524.1914	548.7065	867.9026	1318.1754	1757.9137	2137.4872	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1125.6101	892.5492	774.0452	465.7269	231.7536	0.0000	0.0000	0.0000	0.0000	445.6630	795.8984	1127.8518	(98)
Space heating												5859.0984	(98)
Space heating per m2											(98) / (4) =	42.0550	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6279.8482	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1125.6101	892.5492	774.0452	465.7269	231.7536	0.0000	0.0000	0.0000	0.0000	445.6630	795.8984	1127.8518	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1206.4417	956.6444	829.6305	499.1714	248.3962	0.0000	0.0000	0.0000	0.0000	477.6667	853.0530	1208.8444	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7846	89.7388	89.6489	89.4223	88.9149	86.7000	86.7000	86.7000	86.7000	89.3672	89.6706	89.7985	(217)
Fuel for water heating, kWh/month													
	201.1327	176.3678	183.0482	161.2213	156.4922	139.8673	130.9744	148.3539	149.5485	167.4412	180.5719	195.1593	(219)
Water heating fuel used												1990.1787	(219)
Annual totals kWh/year													
Space heating fuel - main system												6279.8482	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6415.1554	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6279.8482	0.2160	1356.4472	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.1787	0.2160	429.8786	(264)
Space and water heating			1786.3258	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			823.6475	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.3939	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3939	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3400	10.6334	0.6300	0.7000	0.7700	33.6019	(74)
South	8.1900	46.7521	0.6300	0.7000	0.7700	117.0190	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	154.9426	264.3161	367.1640	471.4888	548.5085	554.9291	530.5841	470.6012	402.4033	293.1804	185.5484	132.6814	(83)
Total gains	655.4615	762.3381	847.2427	922.4448	968.8365	946.1121	903.7301	851.2794	798.9209	719.0569	645.0855	618.0255	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9994	0.9985	0.9959	0.9864	0.9516	0.8469	0.6865	0.7405	0.9284	0.9911	0.9986	0.9996	(86)
MIT	19.6994	19.8376	20.0637	20.3705	20.6697	20.8924	20.9735	20.9607	20.7981	20.4135	20.0009	19.6767	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9992	0.9979	0.9943	0.9804	0.9276	0.7709	0.5546	0.6141	0.8826	0.9862	0.9980	0.9994	(89)
MIT 2	18.2462	18.4497	18.7813	19.2333	19.6551	19.9383	20.0098	20.0037	19.8333	19.2995	18.6958	18.2185	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.5384	18.7287	19.0392	19.4619	19.8591	20.1301	20.2036	20.1961	20.0273	19.5235	18.9582	18.5117	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5384	18.7287	19.0392	19.4619	19.8591	20.1301	20.2036	20.1961	20.0273	19.5235	18.9582	18.5117	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9969	0.9921	0.9758	0.9229	0.7807	0.5811	0.6389	0.8832	0.9827	0.9971	0.9990	(94)
Useful gains	654.5877	759.9602	840.5428	900.1476	894.1341	738.6429	525.1321	543.8646	705.5735	706.6009	643.1875	617.4216	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2189.5798	2121.7821	1919.6483	1600.0565	1233.6046	828.4192	539.8226	567.6765	891.0985	1349.1781	1800.0593	2181.5592	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1142.0342	915.1443	802.8545	503.9344	252.5661	0.0000	0.0000	0.0000	0.0000	478.0775	832.9476	1163.7184	(98)
Space heating												6091.2770	(98)
Space heating per m2											(98) / (4) =	43.7215	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6521.7098	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1142.0342	915.1443	802.8545	503.9344	252.5661	0.0000	0.0000	0.0000	0.0000	478.0775	832.9476	1163.7184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1222.7347	979.8119	859.5873	539.5444	270.4133	0.0000	0.0000	0.0000	0.0000	511.8602	891.8069	1245.9512	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6019	88.4571	88.1598	87.4794	85.9463	80.3000	80.3000	80.3000	80.3000	87.2913	88.2524	88.6651	(217)
Fuel for water heating, kWh/month													
	247.9779	218.8869	230.5612	208.1597	205.8973	194.0940	185.9568	207.2983	208.7397	216.3212	226.4093	241.7958	(219)
Water heating fuel used												2592.0982	(219)
Annual totals kWh/year													
Space heating fuel - main system												6521.7098	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9711.6165	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6521.7098	0.2160	1408.6893	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2592.0982	0.2160	559.8932	(264)
Space and water heating			1968.5825	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2278.8452	(272)
Emissions per m2 for space and water heating			14.1299	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1299 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.3600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 141 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 141	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 141, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 141 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 141	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 141, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	16.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.87	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.29	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.29	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 142 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 142	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 142, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.51 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.05 m², No overhang
Windows facing South: 6.92 m², No overhang
Windows facing South West: 1.07 m², No overhang
Windows facing West: 6.75 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8268	10.6723	11.7927	11.3819	11.7303	11.3161	11.6710	11.7094	11.3519	11.7628	11.4187	11.8158 (61)

Total heat required for water heating calculated for each month

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (64)

Total per year (kWh/year) = Sum(64)m = 1742.9413 (64)

Heat gains from water heating, kWh/month

	58.2686	51.0442	52.8680	46.3668	44.6923	38.8645	36.3099	41.2453	41.6136	48.1300	52.1823	56.5205 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)

Water heating gains (Table 5)

	78.3179	75.9586	71.0591	64.3983	60.0703	53.9785	48.8036	55.4373	57.7967	64.6908	72.4754	75.9684	(72)

Total internal gains

	454.4556	452.2051	435.7469	408.9569	381.3228	354.9930	338.0709	344.5956	358.5138	385.5371	416.6277	440.3588	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
South	6.9200	46.7521	0.7200	0.7000	0.7700	112.9980	(78)
Southwest	1.0700	36.7938	0.7200	0.7000	0.7700	13.7506	(79)
West	6.7500	19.6403	0.7200	0.7000	0.7700	46.3036	(80)
Northwest	1.0700	11.2829	0.7200	0.7000	0.7700	4.2167	(81)

Solar gains	210.8801	371.8796	541.5663	724.4140	859.0494	873.5053	833.5725	730.1601	604.5209	419.9234	254.9158	178.9497	(83)
Total gains	665.3357	824.0846	977.3131	1133.3708	1240.3722	1228.4983	1171.6434	1074.7558	963.0347	805.4605	671.5435	619.3084	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3274	47.5916	47.8587	49.2408	49.5269	51.0084	51.0084	51.3155	50.4053	49.5269	48.9580	48.4021	
alpha	4.1552	4.1728	4.1906	4.2827	4.3018	4.4006	4.4006	4.4210	4.3604	4.3018	4.2639	4.2268	
util living area	0.9967	0.9915	0.9775	0.9328	0.8284	0.6518	0.4947	0.5528	0.8052	0.9627	0.9931	0.9976	(86)
MIT	19.4173	19.6429	19.9833	20.4246	20.7583	20.9414	20.9861	20.9781	20.8470	20.3918	19.8360	19.4034	(87)
Th 2	19.8894	19.8948	19.9003	19.9278	19.9333	19.9610	19.9610	19.9665	19.9499	19.9333	19.9223	19.9113	(88)
util rest of house	0.9957	0.9891	0.9707	0.9121	0.7781	0.5648	0.3841	0.4389	0.7314	0.9472	0.9907	0.9968	(89)
MIT 2	17.7824	18.1145	18.6105	19.2526	19.6933	19.9197	19.9552	19.9564	19.8224	19.2227	18.4158	17.7765	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.1965	18.5016	18.9583	19.5494	19.9630	20.1785	20.2163	20.2152	20.0819	19.5189	18.7755	18.1886	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1965	18.5016	18.9583	19.5494	19.9630	20.1785	20.2163	20.2152	20.0819	19.5189	18.7755	18.1886	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9845	0.9628	0.9032	0.7797	0.5840	0.4120	0.4674	0.7419	0.9393	0.9869	0.9951	(94)
Useful gains	660.9389	811.3346	940.9205	1023.6657	967.0664	717.4969	482.7360	502.3244	714.4993	756.5726	662.7409	616.2477	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2024.7198	1970.7588	1795.0160	1491.3267	1150.4588	754.1318	488.8753	512.6769	818.3399	1241.7671	1644.4603	1992.8804	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1014.6530	779.1331	635.4471	336.7159	136.4439	0.0000	0.0000	0.0000	0.0000	360.9847	706.8380	1024.2147	(98)
Space heating												4994.4304	(98)
Space heating per m2											(98) / (4) =	42.4516	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5353.0872	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1014.6530	779.1331	635.4471	336.7159	136.4439	0.0000	0.0000	0.0000	0.0000	360.9847	706.8380	1024.2147	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1087.5166	835.0837	681.0794	360.8959	146.2421	0.0000	0.0000	0.0000	0.0000	386.9075	757.5970	1097.7650	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7434	89.6783	89.5449	89.1999	88.4576	86.7000	86.7000	86.7000	86.7000	89.2244	89.6140	89.7616	(217)
Fuel for water heating, kWh/month													
	198.5419	174.1384	180.8338	159.4991	155.2420	138.0547	129.2947	146.4262	147.6013	165.5044	178.2896	192.6416	(219)
Water heating fuel used												1966.0678	(219)
Annual totals kWh/year													
Space heating fuel - main system												5353.0872	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =										-2098.5959		-2098.5959	(233)
Total delivered energy for all uses												5740.7710	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5353.0872	0.2160	1156.2668	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0678	0.2160	424.6706	(264)
Space and water heating			1580.9375	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			761.7562	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4700	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.2735	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.2735	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
								Total per year (kWh/year) = Sum(64)m =				2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
South	6.9200	46.7521	0.6300	0.7000	0.7700	98.8732	(78)
Southwest	1.0700	36.7938	0.6300	0.7000	0.7700	12.0318	(79)
West	6.7500	19.6403	0.6300	0.7000	0.7700	40.5157	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	184.5201	325.3946	473.8705	633.8622	751.6682	764.3172	729.3760	638.8901	528.9558	367.4330	223.0513	156.5810 (83)
Total gains	652.1249	790.7526	922.7780	1055.9796	1145.4635	1131.0965	1079.2407	995.9652	900.6405	766.1408	652.8375	610.0927 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9986	0.9962	0.9888	0.9620	0.8843	0.7285	0.5620	0.6241	0.8631	0.9797	0.9968	0.9990	(86)
MIT	19.5955	19.7751	20.0594	20.4281	20.7454	20.9313	20.9843	20.9746	20.8356	20.4141	19.9338	19.5653	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9981	0.9948	0.9846	0.9470	0.8389	0.6334	0.4323	0.4923	0.7924	0.9691	0.9955	0.9986	(89)
MIT 2	18.0162	18.2799	18.6947	19.2279	19.6520	19.8662	19.9064	19.9033	19.7744	19.2174	18.5197	17.9780	(90)
Living area fraction										fLA = Living area / (4) =		0.2533	(91)
MIT	18.4162	18.6586	19.0404	19.5319	19.9289	20.1359	20.1794	20.1747	20.0432	19.5205	18.8779	18.3801	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4162	18.6586	19.0404	19.5319	19.9289	20.1359	20.1794	20.1747	20.0432	19.5205	18.8779	18.3801	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9926	0.9801	0.9405	0.8401	0.6546	0.4654	0.5257	0.8027	0.9640	0.9936	0.9978	(94)
Useful gains	650.1946	784.8931	904.4333	993.1642	962.3317	740.4678	502.2457	523.6137	722.8994	738.5447	648.6481	608.7650	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2062.5565	2005.7791	1824.1421	1530.4491	1182.2155	788.0326	509.5243	536.3962	849.0203	1281.5777	1698.8256	2053.7988	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1050.7973	820.4354	684.2633	386.8452	163.5935	0.0000	0.0000	0.0000	0.0000	404.0166	756.1278	1075.1052	(98)
Space heating												5341.1841	(98)
Space heating per m2											(98) / (4) =	45.3989	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5718.6126	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1050.7973	820.4354	684.2633	386.8452	163.5935	0.0000	0.0000	0.0000	0.0000	404.0166	756.1278	1075.1052	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1125.0506	878.4105	732.6160	414.1811	175.1537	0.0000	0.0000	0.0000	0.0000	432.5659	809.5587	1151.0762	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4926	88.2981	87.8891	86.9258	84.8900	80.3000	80.3000	80.3000	80.3000	86.9417	88.1034	88.5648	(217)
Fuel for water heating, kWh/month													
	245.5689	216.9009	228.8037	207.2747	205.4911	191.3303	183.3090	204.3466	206.6034	214.9330	224.3599	239.4422	(219)
Water heating fuel used												2568.3638	(219)
Annual totals kWh/year													
Space heating fuel - main system												5718.6126	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												8807.1882	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5718.6126	0.2160	1235.2203	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2568.3638	0.2160	554.7666	(264)
Space and water heating			1789.9869	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2059.9768	(272)
Emissions per m2 for space and water heating			15.2145	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2145 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.5100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 142 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 142	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 142, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 142 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 142	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 142, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	6.47	$kgCO_2/yr/m^2$	
TER	17.51	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.47	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.05	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	17.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 143 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 143	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 143, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.87	**TER**	16.79
Environmental	96 A	**% DER<TER**	65.04		
CO_2 Emissions (t/year)	0.14	**DFEE**	37.20	**TFEE**	48.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.80		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.87 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.03 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 5.90 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.8900	1.2357	17.1644			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.2100	17.3796			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.6840			(33)
Party Wall			44.7700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	207.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6523 (36)
Total fabric heat loss (33) + (36) =	52.3363 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	106.6133	105.9458	105.2783	101.9408	101.2733	97.9359	97.9359	97.2684	99.2709	101.2733	102.6083	103.9433	(39)
Average = Sum(39)m / 12 =												101.7740	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0669	1.0602	1.0266	1.0199	0.9863	0.9863	0.9795	0.9997	1.0199	1.0333	1.0468	(40)
HLP (average)												1.0249	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.8169   10.6637   11.7839   11.3667   11.7162   11.3045   11.6603   11.6966   11.3384   11.7548   11.4100   11.8062 (61)
Total heat required for water heating calculated for each month
   173.4880  152.0622  157.6945  138.5751  133.7757  116.6326  109.2622  123.6962  124.6756  143.8385  155.5896  168.3760 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   173.4880  152.0622  157.6945  138.5751  133.7757  116.6326  109.2622  123.6962  124.6756  143.8385  155.5896  168.3760 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m =   1697.6662 (64)
Heat gains from water heating, kWh/month
    56.7099   49.6809   51.4612   45.1385   43.5138   37.8477   35.3677   40.1640   40.5192   46.8565   50.7922   55.0110 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m    136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    24.4117   21.6822   17.6332   13.3494    9.9789    8.4246    9.1031   11.8325   15.8815   20.1653   23.5358   25.0901 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   255.1911  257.8392  251.1661  236.9599  219.0271  202.1728  190.9131  188.2650  194.9381  209.1443  227.0771  243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648 (69)
Pumps, fans  3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
    76.2229   73.9299   69.1683   62.6923   58.4863   52.5663   47.5372   53.9839   56.2767   62.9792   70.5448   73.9395 (72)
Total internal gains
   422.8200  420.4456  404.9619  379.9959  354.4866  330.1579  314.5477  321.0757  334.0906  359.2830  388.1520  409.9553 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area      Solar flux          g              FF          Access          Gains
                                     m2         Table 6a     Specific data  Specific data    factor           W
                                                   W/m2     or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                7.0300       19.6403          0.7200         0.7000       0.7700      48.2244 (76)
South                               0.9600       46.7521          0.7200         0.7000       0.7700      15.6760 (78)
West                                5.9000       19.6403          0.7200         0.7000       0.7700      40.4728 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains  104.3732  199.1837  318.4502  453.7066  549.2529  559.8965  533.9717  462.7356  366.4979  233.5758  129.1763   86.4857 (83)
Total gains  527.1931  619.6293  723.4120  833.7025  903.7395  890.0544  848.5194  783.8113  700.5885  592.8588  517.3283  496.4411 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau         53.5557   53.8931   54.2348   56.0104   56.3796   58.3009   58.3009   58.7010   57.5169   56.3796   55.6461   54.9314
alpha        4.5704    4.5929    4.6157    4.7340    4.7586    4.8867    4.8867    4.9134    4.8345    4.7586    4.7097    4.6621
util living area
             0.9973    0.9939    0.9830    0.9433    0.8430    0.6612    0.4986    0.5547    0.8191    0.9705    0.9946    0.9980 (86)

MIT         19.6041   19.7857   20.0902   20.4975   20.7974   20.9566   20.9911   20.9856   20.8744   20.4622   19.9769   19.6004 (87)
Th 2        20.0224   20.0279   20.0335   20.0612   20.0668   20.0948   20.0948   20.1004   20.0836   20.0668   20.0557   20.0445 (88)
util rest of house
             0.9965    0.9922    0.9780    0.9263    0.7987    0.5830    0.4005    0.4537    0.7539    0.9587    0.9928    0.9974 (89)
MIT 2       18.1471   18.4158   18.8613   19.4595   19.8599   20.0629   20.0908   20.0933   19.9746   19.4233   18.7148   18.1569 (90)
Living area fraction                                                                 fLA = Living area / (4) =     0.1233 (91)
MIT         18.3267   18.5846   19.0127   19.5875   19.9754   20.1731   20.2017   20.2033   20.0855   19.5513   18.8704   18.3348 (92)
Temperature adjustment                                                                                          0.0000
adjusted MIT 18.3267  18.5846   19.0127   19.5875   19.9754   20.1731   20.2017   20.2033   20.0855   19.5513   18.8704   18.3348 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation  0.9945    0.9884    0.9706    0.9157    0.7938    0.5902    0.4124    0.4657    0.7541    0.9498    0.9894    0.9958 (94)
Useful gains 524.2755  612.4160  702.1701  763.3996  717.3778  525.3040  349.8969  364.9972  528.2854  563.0888  511.8306  494.3476 (95)
Ext temp.    4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
          1495.4364 1449.8286 1317.3197 1089.4911  838.0819  545.8052  352.7394  369.9376  594.1873  906.5311 1207.7407 1469.2192 (97)
Month fracti 1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   722.5437  562.7413  457.6714  234.7859   89.8039    0.0000    0.0000    0.0000    0.0000  255.5211  501.0553  725.3045 (98)
Space heating                                                                                                  3549.4269 (98)
Space heating per m2                                                                                 (98) / (4) =     35.7445 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3804.3161	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	722.5437	562.7413	457.6714	234.7859	89.8039	0.0000	0.0000	0.0000	0.0000	255.5211	501.0553	725.3045	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	774.4306	603.1525	490.5374	251.6462	96.2528	0.0000	0.0000	0.0000	0.0000	273.8704	537.0367	777.3896	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5798	89.5093	89.3493	88.9295	88.1109	86.7000	86.7000	86.7000	86.7000	88.9694	89.4202	89.5991	(217)
Fuel for water heating, kWh/month													
	193.6686	169.8841	176.4922	155.8258	151.8265	134.5243	126.0233	142.6715	143.8012	161.6718	173.9982	187.9216	(219)
Water heating fuel used												1918.3092	(219)
Annual totals kWh/year													
Space heating fuel - main system												3804.3161	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												4463.8742	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3804.3161	0.2160	821.7323	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1918.3092	0.2160	414.3548	(264)
Space and water heating			1236.0871	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			582.7952	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.8700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.8700	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		22.9576	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9576	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.1800	14.8968			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0614	(36)
Total fabric heat loss (33) + (36) =	58.8500	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	105.9085	105.6526	105.4019	104.2239	104.0035	102.9776	102.9776	102.7876	103.3728	104.0035	104.4494	104.9155	(39)
Average = Sum(39)m / 12 =												104.2229	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0666	1.0640	1.0614	1.0496	1.0474	1.0370	1.0370	1.0351	1.0410	1.0474	1.0519	1.0566	(40)
HLP (average)												1.0496	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330	(42)
Average daily hot water use (litres/day)	99.1076	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.9725	433.6018	418.1255	392.6802	366.5019	341.5062	325.9030	333.0976	346.7848	372.4565	401.3135	423.1115	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.0300	19.6403	0.6300	0.7000	0.7700	42.1963	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137	(80)

Solar gains	91.3265	174.2857	278.6439	396.9933	480.5963	489.9094	467.2252	404.8936	320.6856	204.3788	113.0293	75.6750	(83)
Total gains	527.2990	607.8875	696.7694	789.6735	847.0982	831.4156	793.1282	737.9913	667.4704	576.8353	514.3428	498.7865	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1112	65.2689	65.4242	66.1636	66.3038	66.9644	66.9644	67.0882	66.7084	66.3038	66.0208	65.7275	
alpha	5.3407	5.3513	5.3616	5.4109	5.4203	5.4643	5.4643	5.4725	5.4472	5.4203	5.4014	5.3818	
util living area	0.9989	0.9974	0.9919	0.9688	0.8944	0.7333	0.5595	0.6194	0.8715	0.9843	0.9976	0.9992	(86)
MIT	19.8073	19.9482	20.1952	20.5220	20.7980	20.9523	20.9910	20.9848	20.8730	20.5047	20.0960	19.7836	(87)
Th 2	20.0282	20.0304	20.0324	20.0422	20.0440	20.0526	20.0526	20.0542	20.0493	20.0440	20.0403	20.0365	(88)
util rest of house	0.9985	0.9965	0.9889	0.9566	0.8543	0.6475	0.4452	0.5027	0.8083	0.9762	0.9966	0.9989	(89)
MIT 2	18.4258	18.6332	18.9944	19.4695	19.8405	20.0198	20.0491	20.0476	19.9426	19.4524	18.8570	18.3972	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.5961	18.7953	19.1424	19.5993	19.9586	20.1347	20.1652	20.1631	20.0573	19.5821	19.0097	18.5681	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5961	18.7953	19.1424	19.5993	19.9586	20.1347	20.1652	20.1631	20.0573	19.5821	19.0097	18.5681	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9947	0.9850	0.9494	0.8500	0.6555	0.4592	0.5167	0.8090	0.9706	0.9950	0.9983	(94)
Useful gains	526.0684	604.6949	686.3218	749.6802	720.0609	545.0103	364.1847	381.3544	539.9540	559.8936	511.7763	497.9180	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1514.0752	1468.0729	1332.5296	1115.1200	858.9187	569.9553	367.1358	386.8030	615.8254	934.1712	1243.9617	1507.4367	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	735.0771	580.1900	480.7786	263.1166	103.3102	0.0000	0.0000	0.0000	0.0000	278.4625	527.1735	751.0819	(98)
Space heating												3719.1905	(98)
Space heating per m2											(98) / (4) =	37.4541	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3982.0026	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	735.0771	580.1900	480.7786	263.1166	103.3102	0.0000	0.0000	0.0000	0.0000	278.4625	527.1735	751.0819	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	787.0204	621.1885	514.7523	281.7095	110.6105	0.0000	0.0000	0.0000	0.0000	298.1397	564.4256	804.1562	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9189	87.7065	87.2131	86.0740	83.8471	80.3000	80.3000	80.3000	80.3000	86.1046	87.4469	88.0037	(217)
Fuel for water heating, kWh/month													
	241.8477	213.6968	225.7338	203.4364	202.1936	185.9471	178.1515	198.5972	200.7905	212.5817	221.2712	235.8181	(219)
Water heating fuel used												2520.0656	(219)
Annual totals kWh/year													
Space heating fuel - main system												3982.0026	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Total delivered energy for all uses												7008.1858	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3982.0026	0.2160	860.1126	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2520.0656	0.2160	544.3342	(264)
Space and water heating			1404.4467	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Total CO2, kg/m2/year			1667.1217	(272)
Emissions per m2 for space and water heating			14.1435	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2533	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1435 * 1.00) + 2.2533 + 0.3920, rounded to 2 d.p.			16.7900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 143 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 143	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 143, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.87	**TER**	16.79
Environmental	96 A	**% DER<TER**	65.04		
CO_2 Emissions (t/year)	0.14	**DFEE**	37.20	**TFEE**	48.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.80		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.02 m	49.65 m²	2.31 m
1st Storey:	20.02 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	207.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	98.79	82.76

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	44.77

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.065	No
Independently assessed	E3 Sill	8.97	0.004	No
Independently assessed	E4 Jamb	26.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.02	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.02	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.95	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.07	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.07	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.07	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.07	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 143 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 143	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 143, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.87	**TER**	16.79
Environmental	96 A	**% DER<TER**	65.04		
CO_2 Emissions (t/year)	0.14	**DFEE**	37.20	**TFEE**	48.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.80		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	5.87	$kgCO_2/yr/m^2$	
TER	16.79	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.87	$kgCO_2/yr/m^2$	
Reduction DER/TER	65.04	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.20	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	17.27	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.36	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.36	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.05	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.14	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.14	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 144 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 144	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 144, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.02	**TER**	16.93
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.16	**DFEE**	37.83	**TFEE**	49.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.02 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 7.03 m², No overhang
Windows facing West: 5.90 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.8900	1.2357	17.1644			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.2100	17.3796			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.6840			(33)
Party Wall			44.7700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	207.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6523 (36)
Total fabric heat loss (33) + (36) =	52.3363 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	106.6133	105.9458	105.2783	101.9408	101.2733	97.9359	97.9359	97.2684	99.2709	101.2733	102.6083	103.9433	(39)
Average = Sum(39)m / 12 =												101.7740	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0669	1.0602	1.0266	1.0199	0.9863	0.9863	0.9795	0.9997	1.0199	1.0333	1.0468	(40)
HLP (average)												1.0249	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8169   10.6637   11.7839   11.3667   11.7162   11.3045   11.6603   11.6966   11.3384   11.7548   11.4100   11.8062 (61)
Total heat required for water heating calculated for each month
              173.4880  152.0622  157.6945  138.5751  133.7757  116.6326  109.2622  123.6962  124.6756  143.8385  155.5896  168.3760 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              173.4880  152.0622  157.6945  138.5751  133.7757  116.6326  109.2622  123.6962  124.6756  143.8385  155.5896  168.3760 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1697.6662 (64)
Heat gains from water heating, kWh/month
               56.7099   49.6809   51.4612   45.1385   43.5138   37.8477   35.3677   40.1640   40.5192   46.8565   50.7922   55.0110 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475  136.6475 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               24.4117   21.6822   17.6332   13.3494    9.9789    8.4246    9.1031   11.8325   15.8815   20.1653   23.5358   25.0901 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              255.1911  257.8392  251.1661  236.9599  219.0271  202.1728  190.9131  188.2650  194.9381  209.1443  227.0771  243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648   36.6648 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
               76.2229   73.9299   69.1683   62.6923   58.4863   52.5663   47.5372   53.9839   56.2767   62.9792   70.5448   73.9395 (72)
Total internal gains
              422.8200  420.4456  404.9619  379.9959  354.4866  330.1579  314.5477  321.0757  334.0906  359.2830  388.1520  409.9553 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                Area        Solar flux          g              FF          Access          Gains
                                     m2          Table 6a      Specific data  Specific data    factor           W
                                                    W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                              0.9600          10.6334          0.7200         0.7000       0.7700       3.5654 (74)
East                               7.0300          19.6403          0.7200         0.7000       0.7700      48.2244 (76)
West                               5.9000          19.6403          0.7200         0.7000       0.7700      40.4728 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    92.2625  180.3241  297.3250  435.3422  535.7888  549.6489  522.7943  447.4297  346.2561  213.9955  114.9933   75.9125 (83)
Total gains   515.0825  600.7697  702.2869  815.3381  890.2753  879.8068  837.3420  768.5054  680.3467  573.2785  503.1453  485.8678 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           53.5557   53.8931   54.2348   56.0104   56.3796   58.3009   58.3009   58.7010   57.5169   56.3796   55.6461   54.9314
alpha          4.5704    4.5929    4.6157    4.7340    4.7586    4.8867    4.8867    4.9134    4.8345    4.7586    4.7097    4.6621
util living area
               0.9975    0.9946    0.9848    0.9473    0.8488    0.6672    0.5047    0.5644    0.8314    0.9740    0.9952    0.9981 (86)

MIT           19.5908   19.7653   20.0685   20.4818   20.7904   20.9549   20.9906   20.9845   20.8651   20.4430   19.9614   19.5887 (87)
Th 2          20.0224   20.0279   20.0335   20.0612   20.0668   20.0948   20.0948   20.1004   20.0836   20.0668   20.0557   20.0445 (88)
util rest of house
               0.9968    0.9931    0.9803    0.9313    0.8053    0.5889    0.4057    0.4623    0.7680    0.9633    0.9936    0.9976 (89)
MIT 2         18.1277   18.3861   18.8301   19.4383   19.8519   20.0615   20.0905   20.0927   19.9652   19.3967   18.6923   18.1398 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.1233 (91)
MIT           18.3081   18.5561   18.9828   19.5669   19.9676   20.1717   20.2015   20.2026   20.0761   19.5257   18.8488   18.3184 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3081   18.5561   18.9828   19.5669   19.9676   20.1717   20.2015   20.2026   20.0761   19.5257   18.8488   18.3184 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9949    0.9896    0.9734    0.9208    0.8001    0.5959    0.4176    0.4743    0.7674    0.9548    0.9904    0.9961 (94)
Useful gains 512.4740  594.5213  683.6012  750.7533  712.2720  524.3070  349.7093  364.5234  522.0864  547.3828  498.3280  483.9858 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1493.4485 1446.8091 1314.1659 1087.3948  837.2835  545.6657  352.7136  369.8728  593.2541  903.9350 1205.5204 1467.5107 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              729.8450  572.7374  469.1402  242.3819   93.0086    0.0000    0.0000    0.0000    0.0000  265.2748  509.1786  731.7425 (98)
Space heating                                                                                                         3613.3089 (98)
Space heating per m2                                                                                  (98) / (4) =     36.3878 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3872.7855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	729.8450	572.7374	469.1402	242.3819	93.0086	0.0000	0.0000	0.0000	0.0000	265.2748	509.1786	731.7425	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	782.2562	613.8664	502.8298	259.7876	99.6876	0.0000	0.0000	0.0000	0.0000	284.3246	545.7434	784.2899	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5856	89.5202	89.3665	88.9564	88.1411	86.7000	86.7000	86.7000	86.7000	89.0007	89.4309	89.6040	(217)
Fuel for water heating, kWh/month													
	193.6561	169.8636	176.4582	155.7786	151.7745	134.5243	126.0233	142.6715	143.8012	161.6150	173.9775	187.9112	(219)
Water heating fuel used												1918.0551	(219)
Annual totals kWh/year													
Space heating fuel - main system												3872.7855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												4532.0895	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3872.7855	0.2160	836.5217	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1918.0551	0.2160	414.2999	(264)
Space and water heating			1250.8216	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			597.5297	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.0200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.0200	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		23.1076	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.1076	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.1800	14.8968			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0614	(36)
Total fabric heat loss (33) + (36) =	58.8500	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	105.9085	105.6526	105.4019	104.2239	104.0035	102.9776	102.9776	102.7876	103.3728	104.0035	104.4494	104.9155	(39)
Average = Sum(39)m / 12 =												104.2229	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0666	1.0640	1.0614	1.0496	1.0474	1.0370	1.0370	1.0351	1.0410	1.0474	1.0519	1.0566	(40)
HLP (average)												1.0496	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330	(42)
Average daily hot water use (litres/day)	99.1076	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.9725	433.6018	418.1255	392.6802	366.5019	341.5062	325.9030	333.0976	346.7848	372.4565	401.3135	423.1115	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	7.0300	19.6403	0.6300	0.7000	0.7700	42.1963	(76)
West	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137	(80)

Solar gains	80.7297	157.7836	260.1594	380.9244	468.8152	480.9428	457.4450	391.5010	302.9741	187.2460	100.6191	66.4234	(83)
Total gains	516.7022	591.3853	678.2849	773.6046	835.3171	822.4489	783.3480	724.5986	649.7588	559.7025	501.9326	489.5349	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1112	65.2689	65.4242	66.1636	66.3038	66.9644	66.9644	67.0882	66.7084	66.3038	66.0208	65.7275	
alpha	5.3407	5.3513	5.3616	5.4109	5.4203	5.4643	5.4643	5.4725	5.4472	5.4203	5.4014	5.3818	
util living area	0.9990	0.9977	0.9928	0.9713	0.8990	0.7390	0.5658	0.6291	0.8814	0.9862	0.9979	0.9993	(86)
MIT	19.7971	19.9325	20.1782	20.5089	20.7915	20.9505	20.9905	20.9836	20.8644	20.4895	20.0842	19.7748	(87)
Th 2	20.0282	20.0304	20.0324	20.0422	20.0440	20.0526	20.0526	20.0542	20.0493	20.0440	20.0403	20.0365	(88)
util rest of house	0.9987	0.9969	0.9902	0.9600	0.8599	0.6533	0.4505	0.5114	0.8208	0.9790	0.9970	0.9990	(89)
MIT 2	18.4110	18.6104	18.9698	19.4515	19.8330	20.0184	20.0489	20.0470	19.9338	19.4311	18.8398	18.3843	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.5819	18.7734	19.1188	19.5818	19.9511	20.1333	20.1650	20.1625	20.0485	19.5615	18.9932	18.5557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5819	18.7734	19.1188	19.5818	19.9511	20.1333	20.1650	20.1625	20.0485	19.5615	18.9932	18.5557	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9953	0.9866	0.9529	0.8554	0.6612	0.4647	0.5256	0.8207	0.9738	0.9955	0.9984	(94)
Useful gains	515.6035	588.6346	669.1723	737.1422	714.5260	543.8182	363.9860	380.8309	533.2535	545.0547	499.6866	488.7539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1512.5706	1465.7591	1330.0417	1113.3029	858.1461	569.8033	367.1107	386.7373	614.9157	932.0300	1242.2365	1506.1302	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	741.7435	589.4276	491.6868	270.8357	106.8533	0.0000	0.0000	0.0000	0.0000	287.9096	534.6359	756.9280	(98)
Space heating												3780.0205	(98)
Space heating per m2											(98) / (4) =	38.0667	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4047.1311	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	741.7435	589.4276	491.6868	270.8357	106.8533	0.0000	0.0000	0.0000	0.0000	287.9096	534.6359	756.9280	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	794.1579	631.0788	526.4313	289.9740	114.4040	0.0000	0.0000	0.0000	0.0000	308.2544	572.4153	810.4154	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9358	87.7375	87.2619	86.1454	83.9251	80.3000	80.3000	80.3000	80.3000	86.1867	87.4761	88.0178	(217)
Fuel for water heating, kWh/month													
	241.8014	213.6211	225.6077	203.2679	202.0057	185.9471	178.1515	198.5972	200.7905	212.3791	221.1971	235.7803	(219)
Water heating fuel used												2519.1465	(219)
Annual totals kWh/year													
Space heating fuel - main system												4047.1311	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Total delivered energy for all uses												7072.3951	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4047.1311	0.2160	874.1803	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2519.1465	0.2160	544.1356	(264)
Space and water heating			1418.3160	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Total CO2, kg/m2/year			1680.9910	(272)
Emissions per m2 for space and water heating			14.2831	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2533	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2831 * 1.00) + 2.2533 + 0.3920, rounded to 2 d.p.			16.9300	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 144 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 144	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 144, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.02	**TER**	16.93
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.16	**DFEE**	37.83	**TFEE**	49.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.02 m	49.65 m²	2.31 m
1st Storey:	20.02 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	207.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	98.79	82.76

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	44.77

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.065	No
Independently assessed	E3 Sill	8.97	0.004	No
Independently assessed	E4 Jamb	26.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.02	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.02	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.95	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.07	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.07	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.07	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.07	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 144 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 144	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 144, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.02	**TER**	16.93
Environmental	96 A	**% DER<TER**	64.44		
CO_2 Emissions (t/year)	0.16	**DFEE**	37.83	**TFEE**	49.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	6.02	$kgCO_2/yr/m^2$	
TER	16.93	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.02	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.44	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	17.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.52	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.52	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.29	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.29	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 145 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 145	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 145, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.85 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.49 m², No overhang
Windows facing South: 7.85 m², No overhang
Windows facing West: 2.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area        Solar flux          g              FF          Access          Gains
                                     m2          Table 6a      Specific data  Specific data    factor           W
                                                    W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                              3.4900          10.6334          0.7200         0.7000       0.7700       12.9617 (74)
South                              7.8500          46.7521          0.7200         0.7000       0.7700      128.1841 (78)
West                               2.4400          19.6403          0.7200         0.7000       0.7700       16.7379 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   157.8837  267.4459  363.4307  448.4913  502.4075  499.2596  481.1038  440.5021  392.6700  294.7701  188.8020  135.3328 (83)
Total gains   532.8743  640.3119  722.7259  785.9213  817.6411  793.1247  761.1083  726.5197  689.9420  614.1193  533.4983  499.0343 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
               0.9923    0.9829    0.9630    0.9130    0.8119    0.6396    0.4803    0.5189    0.7494    0.9336    0.9846    0.9941 (86)

MIT           19.5928   19.8212   20.1291   20.5069   20.7867   20.9483   20.9885   20.9840   20.8915   20.5218   20.0012   19.5757 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
               0.9903    0.9785    0.9532    0.8898    0.7632    0.5591    0.3801    0.4178    0.6758    0.9109    0.9799    0.9925 (89)
MIT 2         18.0975   18.4320   18.8777   19.4254   19.7940   19.9980   20.0307   20.0335   19.9351   19.4598   18.7139   18.0871 (90)
Living area fraction                                                                    fLA = Living area / (4) =     0.2505 (91)
MIT           18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (92)
Temperature adjustment                                                                                               0.0000
adjusted MIT  18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9861    0.9715    0.9436    0.8813    0.7650    0.5767    0.4050    0.4428    0.6881    0.9030    0.9736    0.9891 (94)
Useful gains  525.4491  622.0886  681.9387  692.6454  625.5231  457.3878  308.2592  321.6788  474.7562  554.5323  519.4161  493.5950 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1300.7953 1266.6469 1151.4532  951.0093  730.4665  478.5906  311.6934  326.7117  522.2582  799.0409 1057.7404 1278.7207 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              576.8576  433.1432  349.3188  186.0219   78.0779    0.0000    0.0000    0.0000    0.0000  181.9144  387.5935  584.1336 (98)
Space heating                                                                                                       2777.0609 (98)
Space heating per m2                                                                                 (98) / (4) =     34.5750 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2976.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	576.8576	433.1432	349.3188	186.0219	78.0779	0.0000	0.0000	0.0000	0.0000	181.9144	387.5935	584.1336	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	618.2825	464.2478	374.4039	199.3804	83.6848	0.0000	0.0000	0.0000	0.0000	194.9780	415.4271	626.0810	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4805	89.3784	89.1956	88.7802	88.0427	86.7000	86.7000	86.7000	86.7000	88.7276	89.2834	89.5070	(217)
Fuel for water heating, kWh/month													
	182.4271	160.0967	166.4065	146.9856	143.1385	126.8093	118.8742	134.4666	135.4969	152.6577	164.0203	177.0232	(219)
Water heating fuel used												1808.4027	(219)
Annual totals kWh/year													
Space heating fuel - main system												2976.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4163.1006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2976.4855	0.2160	642.9209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.4027	0.2160	390.6150	(264)
Space and water heating			1033.5358	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			710.8281	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.3083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.3083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4900	10.6334	0.6300	0.7000	0.7700	11.3415	(74)
South	7.8500	46.7521	0.6300	0.7000	0.7700	112.1611	(78)
West	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(80)

Solar gains	138.1482	234.0151	318.0019	392.4299	439.6066	436.8521	420.9658	385.4394	343.5862	257.9238	165.2017	118.4162	(83)
Total gains	526.2986	619.7731	689.5637	741.5029	765.8559	741.1074	711.3667	682.4786	652.5098	589.5483	522.7949	495.2809	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9970	0.9929	0.9827	0.9532	0.8772	0.7220	0.5497	0.5921	0.8209	0.9647	0.9935	0.9978	(86)
MIT	19.7851	19.9602	20.2111	20.5210	20.7844	20.9439	20.9885	20.9835	20.8882	20.5453	20.1046	19.7542	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9960	0.9905	0.9766	0.9358	0.8316	0.6308	0.4284	0.4704	0.7445	0.9482	0.9909	0.9971	(89)
MIT 2	18.3339	18.5906	18.9549	19.4018	19.7512	19.9355	19.9689	19.9682	19.8818	19.4442	18.8101	18.2956	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9873	0.9714	0.9300	0.8339	0.6513	0.4590	0.5010	0.7582	0.9431	0.9879	0.9957	(94)
Useful gains	523.3027	611.8719	669.8240	689.6275	638.6747	482.6989	326.5138	341.9065	494.7539	556.0205	516.4866	493.1518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1351.1878	1313.6617	1192.3152	994.7667	764.9592	508.9909	330.1220	347.4884	551.8474	839.5234	1112.8567	1343.6095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating												3062.9918	(98)
Space heating per m2											(98) / (4) =	38.1349	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3279.4345	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	659.4716	504.9280	416.2028	235.2250	100.5950	0.0000	0.0000	0.0000	0.0000	225.8309	459.7286	677.4524	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6726	87.3912	86.8774	85.7877	83.7794	80.3000	80.3000	80.3000	80.3000	85.5661	87.1182	87.7726	(217)
Fuel for water heating, kWh/month													
	230.8589	203.3906	212.8663	191.1999	189.5527	174.1812	166.8789	186.0308	188.0853	200.9915	210.7320	225.1519	(219)
Water heating fuel used												2379.9201	(219)
Annual totals kWh/year													
Space heating fuel - main system												3279.4345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6091.1831	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3279.4345	0.2160	708.3578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.9201	0.2160	514.0627	(264)
Space and water heating			1222.4206	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1446.5396	(272)
Emissions per m2 for space and water heating			15.2194	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2194 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 145 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 145	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 145, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 145 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 145	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 145, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.85	$kgCO_2/yr/m^2$	
TER	18.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.85	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.86	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.30	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 146 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 146	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 146, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.85 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.49 m², No overhang
Windows facing East: 2.44 m², No overhang
Windows facing South: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)
```

---

6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                         m2          Table 6a      Specific data  Specific data      factor           W
                                                       W/m2      or Table 6b    or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  3.4900          10.6334          0.7200         0.7000          0.7700         12.9617 (74)
East                                   2.4400          19.6403          0.7200         0.7000          0.7700         16.7379 (76)
South                                  7.8500          46.7521          0.7200         0.7000          0.7700        128.1841 (78)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   157.8837  267.4459  363.4307  448.4913  502.4075  499.2596  481.1038  440.5021  392.6700  294.7701  188.8020  135.3328 (83)
Total gains   532.8743  640.3119  722.7259  785.9213  817.6411  793.1247  761.1083  726.5197  689.9420  614.1193  533.4983  499.0343 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
               0.9923    0.9829    0.9630    0.9130    0.8119    0.6396    0.4803    0.5189    0.7494    0.9336    0.9846    0.9941 (86)

MIT           19.5928   19.8212   20.1291   20.5069   20.7867   20.9483   20.9885   20.9840   20.8915   20.5218   20.0012   19.5757 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
               0.9903    0.9785    0.9532    0.8898    0.7632    0.5591    0.3801    0.4178    0.6758    0.9109    0.9799    0.9925 (89)
MIT 2         18.0975   18.4320   18.8777   19.4254   19.7940   19.9980   20.0307   20.0335   19.9351   19.4598   18.7139   18.0871 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9861    0.9715    0.9436    0.8813    0.7650    0.5767    0.4050    0.4428    0.6881    0.9030    0.9736    0.9891 (94)
Useful gains  525.4491  622.0886  681.9387  692.6454  625.5231  457.3878  308.2592  321.6788  474.7562  554.5323  519.4161  493.5950 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1300.7953 1266.6469 1151.4532  951.0093  730.4665  478.5906  311.6934  326.7117  522.2582  799.0409 1057.7404 1278.7207 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              576.8576  433.1432  349.3188  186.0219   78.0779    0.0000    0.0000    0.0000    0.0000  181.9144  387.5935  584.1336 (98)
Space heating                                                                                                         2777.0609 (98)
Space heating per m2                                                                                  (98) / (4) =     34.5750 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2976.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	576.8576	433.1432	349.3188	186.0219	78.0779	0.0000	0.0000	0.0000	0.0000	181.9144	387.5935	584.1336	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	618.2825	464.2478	374.4039	199.3804	83.6848	0.0000	0.0000	0.0000	0.0000	194.9780	415.4271	626.0810	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4805	89.3784	89.1956	88.7802	88.0427	86.7000	86.7000	86.7000	86.7000	88.7276	89.2834	89.5070	(217)
Fuel for water heating, kWh/month													
	182.4271	160.0967	166.4065	146.9856	143.1385	126.8093	118.8742	134.4666	135.4969	152.6577	164.0203	177.0232	(219)
Water heating fuel used												1808.4027	(219)
Annual totals kWh/year													
Space heating fuel - main system												2976.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4163.1006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2976.4855	0.2160	642.9209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.4027	0.2160	390.6150	(264)
Space and water heating			1033.5358	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			710.8281	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.3083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.3083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4900	10.6334	0.6300	0.7000	0.7700	11.3415	(74)
East	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(76)
South	7.8500	46.7521	0.6300	0.7000	0.7700	112.1611	(78)

Solar gains	138.1482	234.0151	318.0019	392.4299	439.6066	436.8521	420.9658	385.4394	343.5862	257.9238	165.2017	118.4162	(83)
Total gains	526.2986	619.7731	689.5637	741.5029	765.8559	741.1074	711.3667	682.4786	652.5098	589.5483	522.7949	495.2809	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9970	0.9929	0.9827	0.9532	0.8772	0.7220	0.5497	0.5921	0.8209	0.9647	0.9935	0.9978	(86)
MIT	19.7851	19.9602	20.2111	20.5210	20.7844	20.9439	20.9885	20.9835	20.8882	20.5453	20.1046	19.7542	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9960	0.9905	0.9766	0.9358	0.8316	0.6308	0.4284	0.4704	0.7445	0.9482	0.9909	0.9971	(89)
MIT 2	18.3339	18.5906	18.9549	19.4018	19.7512	19.9355	19.9689	19.9682	19.8818	19.4442	18.8101	18.2956	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9873	0.9714	0.9300	0.8339	0.6513	0.4590	0.5010	0.7582	0.9431	0.9879	0.9957	(94)
Useful gains	523.3027	611.8719	669.8240	689.6275	638.6747	482.6989	326.5138	341.9065	494.7539	556.0205	516.4866	493.1518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1351.1878	1313.6617	1192.3152	994.7667	764.9592	508.9909	330.1220	347.4884	551.8474	839.5234	1112.8567	1343.6095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating												3062.9918	(98)
Space heating per m2											(98) / (4) =	38.1349	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3279.4345	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	659.4716	504.9280	416.2028	235.2250	100.5950	0.0000	0.0000	0.0000	0.0000	225.8309	459.7286	677.4524	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6726	87.3912	86.8774	85.7877	83.7794	80.3000	80.3000	80.3000	80.3000	85.5661	87.1182	87.7726	(217)
Fuel for water heating, kWh/month													
	230.8589	203.3906	212.8663	191.1999	189.5527	174.1812	166.8789	186.0308	188.0853	200.9915	210.7320	225.1519	(219)
Water heating fuel used												2379.9201	(219)
Annual totals kWh/year													
Space heating fuel - main system												3279.4345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6091.1831	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3279.4345	0.2160	708.3578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.9201	0.2160	514.0627	(264)
Space and water heating			1222.4206	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1446.5396	(272)
Emissions per m2 for space and water heating			15.2194	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2194 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 146 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 146	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 146, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 146 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 146	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 146, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.85	$kgCO_2/yr/m^2$	
TER	18.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.85	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.86	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.30	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 147 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 147	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 147, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.85 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.49 m², No overhang
Windows facing South: 7.85 m², No overhang
Windows facing West: 2.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area        Solar flux          g              FF          Access          Gains
                                     m2          Table 6a      Specific data  Specific data    factor           W
                                                    W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                              3.4900          10.6334          0.7200         0.7000       0.7700       12.9617 (74)
South                              7.8500          46.7521          0.7200         0.7000       0.7700      128.1841 (78)
West                               2.4400          19.6403          0.7200         0.7000       0.7700       16.7379 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   157.8837  267.4459  363.4307  448.4913  502.4075  499.2596  481.1038  440.5021  392.6700  294.7701  188.8020  135.3328 (83)
Total gains   532.8743  640.3119  722.7259  785.9213  817.6411  793.1247  761.1083  726.5197  689.9420  614.1193  533.4983  499.0343 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
               0.9923    0.9829    0.9630    0.9130    0.8119    0.6396    0.4803    0.5189    0.7494    0.9336    0.9846    0.9941 (86)

MIT           19.5928   19.8212   20.1291   20.5069   20.7867   20.9483   20.9885   20.9840   20.8915   20.5218   20.0012   19.5757 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
               0.9903    0.9785    0.9532    0.8898    0.7632    0.5591    0.3801    0.4178    0.6758    0.9109    0.9799    0.9925 (89)
MIT 2         18.0975   18.4320   18.8777   19.4254   19.7940   19.9980   20.0307   20.0335   19.9351   19.4598   18.7139   18.0871 (90)
Living area fraction                                                                    fLA = Living area / (4) =     0.2505 (91)
MIT           18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (92)
Temperature adjustment                                                                                               0.0000
adjusted MIT  18.4721   18.7800   19.1912   19.6963   20.0427   20.2361   20.2706   20.2716   20.1747   19.7259   19.0364   18.4600 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9861    0.9715    0.9436    0.8813    0.7650    0.5767    0.4050    0.4428    0.6881    0.9030    0.9736    0.9891 (94)
Useful gains  525.4491  622.0886  681.9387  692.6454  625.5231  457.3878  308.2592  321.6788  474.7562  554.5323  519.4161  493.5950 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1300.7953 1266.6469 1151.4532  951.0093  730.4665  478.5906  311.6934  326.7117  522.2582  799.0409 1057.7404 1278.7207 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              576.8576  433.1432  349.3188  186.0219   78.0779    0.0000    0.0000    0.0000    0.0000  181.9144  387.5935  584.1336 (98)
Space heating                                                                                                       2777.0609 (98)
Space heating per m2                                                                                 (98) / (4) =     34.5750 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2976.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	576.8576	433.1432	349.3188	186.0219	78.0779	0.0000	0.0000	0.0000	0.0000	181.9144	387.5935	584.1336	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	618.2825	464.2478	374.4039	199.3804	83.6848	0.0000	0.0000	0.0000	0.0000	194.9780	415.4271	626.0810	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4805	89.3784	89.1956	88.7802	88.0427	86.7000	86.7000	86.7000	86.7000	88.7276	89.2834	89.5070	(217)
Fuel for water heating, kWh/month													
	182.4271	160.0967	166.4065	146.9856	143.1385	126.8093	118.8742	134.4666	135.4969	152.6577	164.0203	177.0232	(219)
Water heating fuel used												1808.4027	(219)
Annual totals kWh/year													
Space heating fuel - main system												2976.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4163.1006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2976.4855	0.2160	642.9209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.4027	0.2160	390.6150	(264)
Space and water heating			1033.5358	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			710.8281	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.3083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.3083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.4900	10.6334	0.6300	0.7000	0.7700	11.3415	(74)
South	7.8500	46.7521	0.6300	0.7000	0.7700	112.1611	(78)
West	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(80)

Solar gains	138.1482	234.0151	318.0019	392.4299	439.6066	436.8521	420.9658	385.4394	343.5862	257.9238	165.2017	118.4162	(83)
Total gains	526.2986	619.7731	689.5637	741.5029	765.8559	741.1074	711.3667	682.4786	652.5098	589.5483	522.7949	495.2809	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9970	0.9929	0.9827	0.9532	0.8772	0.7220	0.5497	0.5921	0.8209	0.9647	0.9935	0.9978	(86)
MIT	19.7851	19.9602	20.2111	20.5210	20.7844	20.9439	20.9885	20.9835	20.8882	20.5453	20.1046	19.7542	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9960	0.9905	0.9766	0.9358	0.8316	0.6308	0.4284	0.4704	0.7445	0.9482	0.9909	0.9971	(89)
MIT 2	18.3339	18.5906	18.9549	19.4018	19.7512	19.9355	19.9689	19.9682	19.8818	19.4442	18.8101	18.2956	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6974	18.9337	19.2696	19.6822	20.0100	20.1881	20.2243	20.2225	20.1339	19.7200	19.1344	18.6610	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9873	0.9714	0.9300	0.8339	0.6513	0.4590	0.5010	0.7582	0.9431	0.9879	0.9957	(94)
Useful gains	523.3027	611.8719	669.8240	689.6275	638.6747	482.6989	326.5138	341.9065	494.7539	556.0205	516.4866	493.1518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1351.1878	1313.6617	1192.3152	994.7667	764.9592	508.9909	330.1220	347.4884	551.8474	839.5234	1112.8567	1343.6095	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating												3062.9918	(98)
Space heating per m2											(98) / (4) =	38.1349	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3279.4345	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.9465	471.6028	388.7335	219.7002	93.9557	0.0000	0.0000	0.0000	0.0000	210.9261	429.3865	632.7405	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	659.4716	504.9280	416.2028	235.2250	100.5950	0.0000	0.0000	0.0000	0.0000	225.8309	459.7286	677.4524	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6726	87.3912	86.8774	85.7877	83.7794	80.3000	80.3000	80.3000	80.3000	85.5661	87.1182	87.7726	(217)
Fuel for water heating, kWh/month													
	230.8589	203.3906	212.8663	191.1999	189.5527	174.1812	166.8789	186.0308	188.0853	200.9915	210.7320	225.1519	(219)
Water heating fuel used												2379.9201	(219)
Annual totals kWh/year													
Space heating fuel - main system												3279.4345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6091.1831	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3279.4345	0.2160	708.3578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.9201	0.2160	514.0627	(264)
Space and water heating			1222.4206	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1446.5396	(272)
Emissions per m2 for space and water heating			15.2194	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2194 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 147 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 147	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 147, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 147 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 147	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 147, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	8.85	**TER**	18.01
Environmental	94 A	**% DER<TER**	50.86		
CO_2 Emissions (t/year)	0.40	**DFEE**	37.30	**TFEE**	49.97
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.85	$kgCO_2/yr/m^2$	
TER	18.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.85	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.86	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.30	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 148 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 148	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 148, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.99 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.79 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.55 m², No overhang
Windows facing East: 7.88 m², No overhang
Windows facing South: 7.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1692.5948 (64)
Heat gains from water heating, kWh/month
               56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
               75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
              418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)
```

---

6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2         Table 6a     Specific data  Specific data      factor               W
                                                         W/m2     or Table 6b    or Table 6c     Table 6d
-----------------------------------------------------------------------------------------------------------------------------
North                                   4.5500          10.6334          0.7200          0.7000          0.7700      16.8985 (74)
East                                    7.8800          19.6403          0.7200          0.7000          0.7700      54.0552 (76)
South                                   7.4700          46.7521          0.7200          0.7000          0.7700     121.9790 (78)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains   192.9327  337.8074  483.4912  629.7309  729.7040  734.1687  703.8345  628.4027  534.3405  379.3859  232.8336  163.9408 (83)
Total gains   611.3037  753.9827  884.5462 1006.2726 1081.1498 1061.5659 1015.6896  946.5938  865.1910  734.9755  616.8677  569.5065 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha         4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
               0.9926    0.9824    0.9578    0.8923    0.7678    0.5863    0.4367    0.4833    0.7272    0.9310    0.9851    0.9944 (86)

MIT           19.5181   19.7680   20.1159   20.5321   20.8164   20.9586   20.9907   20.9860   20.8944   20.4987   19.9407   19.4962 (87)
Th 2          19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
               0.9908    0.9780    0.9473    0.8664    0.7167    0.5099    0.3454    0.3889    0.6543    0.9085    0.9807    0.9930 (89)
MIT 2         18.0046   18.3699   18.8721   19.4681   19.8359   20.0138   20.0399   20.0422   19.9458   19.4393   18.6400   17.9859 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1928 (91)
MIT           18.2964   18.6395   19.1119   19.6733   20.0249   20.1959   20.2232   20.2241   20.1287   19.6436   18.8908   18.2771 (92)
Temperature adjustment                                                                                                     0.0000
adjusted MIT  18.2964   18.6395   19.1119   19.6733   20.0249   20.1959   20.2232   20.2241   20.1287   19.6436   18.8908   18.2771 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9862    0.9701    0.9356    0.8560    0.7170    0.5225    0.3628    0.4067    0.6621    0.8978    0.9737    0.9894 (94)
Useful gains 602.8834  731.4298  827.5821  861.3439  775.2175  554.6708  368.4804  384.9516  572.8349  659.8632  600.6578  563.4525 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1544.0913 1507.5288 1376.2678 1143.4067  878.5748  573.8318  371.5392  389.8566  625.4243  954.4171 1258.4507 1519.3150 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             700.2587  521.5385  408.2221  203.0852   76.8979    0.0000    0.0000    0.0000    0.0000  219.1481  473.6109  711.1617 (98)
Space heating                                                                                                             3313.9230 (98)
Space heating per m2                                                                                    (98) / (4) =     33.8432 (99)
```

8c. Space cooling requirement

```
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3551.9004	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.2587	521.5385	408.2221	203.0852	76.8979	0.0000	0.0000	0.0000	0.0000	219.1481	473.6109	711.1617	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	750.5452	558.9909	437.5371	217.6690	82.4200	0.0000	0.0000	0.0000	0.0000	234.8854	507.6215	762.2312	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5634	89.4634	89.2694	88.8070	87.9827	86.7000	86.7000	86.7000	86.7000	88.8409	89.3843	89.5896	(217)
Fuel for water heating, kWh/month													
	193.1176	169.4578	176.1190	155.5742	151.5961	134.1289	125.6569	142.2510	143.3756	161.4226	173.5440	187.3735	(219)
Water heating fuel used												1913.6171	(219)
Annual totals kWh/year													
Space heating fuel - main system												3551.9004	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 853 * 1.00) =										-1658.2902		-1658.2902	(233)
Total delivered energy for all uses												4282.6024	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3551.9004	0.2160	767.2105	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1913.6171	0.2160	413.3413	(264)
Space and water heating			1180.5518	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1658.2902	0.5190	-860.6526	(269)
Total CO2, kg/year			566.6189	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.7900	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		22.9777	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9777	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.5500	10.6334	0.6300	0.7000	0.7700	14.7861	(74)
East	7.8800	19.6403	0.6300	0.7000	0.7700	47.2983	(76)
South	7.4700	46.7521	0.6300	0.7000	0.7700	106.7317	(78)

Solar gains	168.8161	295.5815	423.0548	551.0146	638.4910	642.3976	615.8552	549.8524	467.5480	331.9627	203.7294	143.4482	(83)
Total gains	600.3400	724.9132	837.2738	940.1872	1001.9009	981.0940	939.0165	880.0142	811.0392	700.7260	600.9253	562.1704	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9978	0.9940	0.9830	0.9466	0.8525	0.6823	0.5142	0.5669	0.8144	0.9683	0.9950	0.9984	(86)
MIT	19.7419	19.9272	20.2033	20.5421	20.8129	20.9557	20.9913	20.9860	20.8910	20.5256	20.0646	19.7084	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9971	0.9920	0.9771	0.9274	0.8022	0.5907	0.3985	0.4480	0.7368	0.9530	0.9929	0.9979	(89)
MIT 2	18.2692	18.5407	18.9416	19.4261	19.7787	19.9382	19.9638	19.9629	19.8789	19.4136	18.7491	18.2261	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.5531	18.8080	19.1848	19.6413	19.9781	20.1344	20.1619	20.1602	20.0741	19.6280	19.0027	18.5119	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5531	18.8080	19.1848	19.6413	19.9781	20.1344	20.1619	20.1602	20.0741	19.6280	19.0027	18.5119	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9889	0.9712	0.9202	0.8032	0.6065	0.4208	0.4709	0.7462	0.9466	0.9902	0.9967	(94)
Useful gains	597.6727	716.8661	813.1932	865.1503	804.7655	595.0341	395.1826	414.4211	605.1699	663.3183	595.0303	560.3316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1635.2153	1592.0618	1448.8612	1214.2091	933.9372	618.7085	398.1992	419.6506	670.2267	1018.5445	1348.1838	1627.7375	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	771.9317	588.1315	472.9371	251.3224	96.1037	0.0000	0.0000	0.0000	0.0000	264.2883	542.2706	794.1500	(98)
Space heating												3781.1353	(98)
Space heating per m2											(98) / (4) =	38.6145	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4048.3247	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	771.9317	588.1315	472.9371	251.3224	96.1037	0.0000	0.0000	0.0000	0.0000	264.2883	542.2706	794.1500	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	826.4794	629.6911	506.3566	269.0817	102.8948	0.0000	0.0000	0.0000	0.0000	282.9639	580.5895	850.2677	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0139	87.7380	87.1824	85.9683	83.6898	80.3000	80.3000	80.3000	80.3000	85.9809	87.5105	88.1084	(217)
Fuel for water heating, kWh/month													
	240.9912	213.0973	225.2705	203.0260	201.9166	185.3441	177.5738	197.9532	200.1393	212.3892	220.5760	234.9615	(219)
Water heating fuel used												2513.2387	(219)
Annual totals kWh/year													
Space heating fuel - main system												4048.3247	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												7036.9386	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4048.3247	0.2160	874.4381	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.2387	0.2160	542.8596	(264)
Space and water heating			1417.2977	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1664.0174	(272)
Emissions per m2 for space and water heating			14.4740	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4740 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			16.9900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 148 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 148	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 148, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 148 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 148	**Prop Type Ref**	As
Property	Type 3S - Semi SG, Plot 148, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.79	**TER**	16.99
Environmental	96 A	**% DER<TER**	65.93		
CO_2 Emissions (t/year)	0.17	**DFEE**	37.79	**TFEE**	50.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	5.79	$kgCO_2/yr/m^2$	
TER	16.99	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.79	$kgCO_2/yr/m^2$	
Reduction DER/TER	65.93	%	
CfSH ENE1 credits achieved	6.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.79	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	16.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.03	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.22	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.22	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 149 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 149	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 149, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing East: 3.49 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                       m2          Table 6a     Specific data     Specific data     factor           W
                                                     W/m2       or Table 6b       or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                 2.4400          10.6334          0.7200          0.7000          0.7700          9.0620 (74)
East                                  3.4900          19.6403          0.7200          0.7000          0.7700         23.9407 (76)
West                                  7.8500          19.6403          0.7200          0.7000          0.7700         53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    86.8521  169.4919  280.0362  412.7660  511.6058  526.7029  500.1875  425.4780  326.8497  201.1819  108.1742   71.5253 (83)
Total gains   461.8427  542.3579  639.3314  750.1960  826.8394  820.5679  780.1920  711.4956  624.1216  520.5311  452.8706  435.2268 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha           4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9955    0.9906    0.9754    0.9239    0.8073    0.6226    0.4694    0.5287    0.7944    0.9607    0.9916    0.9965 (86)

MIT            19.4960   19.6919   20.0274   20.4723   20.7919   20.9535   20.9895   20.9828   20.8613   20.4179   19.8935   19.4877 (87)
Th 2           19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9943    0.9881    0.9685    0.9028    0.7581    0.5429    0.3711    0.4262    0.7247    0.9457    0.9889    0.9956 (89)
MIT 2          17.9569   18.2456   18.7343   19.3798   19.7998   20.0022   20.0312   20.0328   19.9061   19.3204   18.5588   17.9591 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT            18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9832    0.9603    0.8940    0.7603    0.5606    0.3956    0.4515    0.7343    0.9376    0.9846    0.9933 (94)
Useful gains  457.8800  533.2649  613.9782  670.6461  628.6207  459.9766  308.6189  321.2092  458.3082  488.0386  445.8838  432.2903 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1288.8976 1250.9424 1139.3897  947.2366  730.9637  478.9648  311.7449  326.6449  519.7337  787.6117 1045.0449 1268.1402 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              618.2771  482.2793  390.9061  199.1452   76.1432    0.0000    0.0000    0.0000    0.0000  222.8824  431.3960  621.8723 (98)
Space heating                                                                                                         3042.9015 (98)
Space heating per m2                                                                                  (98) / (4) =     37.8847 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3261.4164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2771	482.2793	390.9061	199.1452	76.1432	0.0000	0.0000	0.0000	0.0000	222.8824	431.3960	621.8723	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6764	516.9124	418.9776	213.4460	81.6111	0.0000	0.0000	0.0000	0.0000	238.8878	462.3752	666.5298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5236	89.4502	89.2798	88.8397	88.0217	86.7000	86.7000	86.7000	86.7000	88.9046	89.3597	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3393	159.9683	166.2496	146.8871	143.1728	126.8093	118.8742	134.4666	135.4969	152.3537	163.8803	176.9481	(219)
Water heating fuel used												1807.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.4164	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4324.1122	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3261.4164	0.2160	704.4660	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.4463	0.2160	390.4084	(264)
Space and water heating			1094.8744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			708.3488	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.2783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.2783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	75.9956	148.3054	245.0317	361.1702	447.6551	460.8650	437.6640	372.2932	285.9935	176.0342	94.6525	62.5847	(83)
Total gains	464.1460	534.0634	616.5935	710.2432	773.9044	765.1203	728.0650	669.3324	594.9171	507.6587	452.2457	439.4493	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9963	0.9891	0.9600	0.8735	0.7056	0.5382	0.6021	0.8588	0.9804	0.9966	0.9987	(86)
MIT	19.7135	19.8631	20.1320	20.4918	20.7893	20.9495	20.9896	20.9822	20.8592	20.4622	20.0243	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9977	0.9950	0.9851	0.9447	0.8271	0.6142	0.4189	0.4791	0.7894	0.9703	0.9952	0.9983	(89)
MIT 2	18.2296	18.4497	18.8421	19.3625	19.7568	19.9397	19.9693	19.9676	19.8541	19.3304	18.6937	18.2013	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9929	0.9810	0.9388	0.8298	0.6350	0.4490	0.5100	0.8001	0.9656	0.9933	0.9974	(94)
Useful gains	462.5800	530.2900	604.8527	666.8002	642.1961	485.8866	326.9040	341.3760	476.0031	490.1916	449.1967	438.3133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.1684	1301.5015	1182.5697	991.3737	765.4586	509.4043	330.1730	347.4198	549.2871	829.7509	1102.9297	1335.5398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating												3318.7460	(98)
Space heating per m2											(98) / (4) =	41.3190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3553.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.6572	554.8759	460.1943	250.2066	98.1877	0.0000	0.0000	0.0000	0.0000	270.4841	503.9484	714.7072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7915	87.5866	87.1042	85.9419	83.7243	80.3000	80.3000	80.3000	80.3000	86.0179	87.3183	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5462	202.9369	212.3119	190.8567	189.6773	174.1812	166.8789	186.0308	188.0853	199.9358	210.2491	224.8887	(219)
Water heating fuel used												2376.5789	(219)
Annual totals kWh/year													
Space heating fuel - main system												3553.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6361.6687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.2613	0.2160	767.5044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.5789	0.2160	513.3410	(264)
Space and water heating			1280.8455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1504.9645	(272)
Emissions per m2 for space and water heating			15.9468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9468 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 149 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 149	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 149, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 149 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 149	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 149, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.82	$kgCO_2/yr/m^2$	
TER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.82	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.93	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 150 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 150	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 150, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 2.44 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                     3.4900           19.6403           0.7200           0.7000           0.7700           23.9407 (76)
South                                    2.4400           46.7521           0.7200           0.7000           0.7700           39.8432 (78)
West                                     7.8500           19.6403           0.7200           0.7000           0.7700           53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.6333  217.4268  333.7293  459.4422  545.8272  552.7488  528.5966  464.3804  378.2976  250.9485  144.2229   98.3990 (83)
Total gains   492.6239  590.2928  693.0245  796.8722  861.0607  846.6139  808.6011  750.3980  675.5696  570.2977  488.9192  462.1005 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9943    0.9872    0.9678    0.9095    0.7902    0.6071    0.4541    0.5040    0.7591    0.9472    0.9888    0.9956 (86)

MIT           19.5381   19.7557   20.0935   20.5171   20.8101   20.9579   20.9907   20.9857   20.8855   20.4748   19.9421   19.5249 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9927    0.9838    0.9590    0.8857    0.7393    0.5281    0.3584    0.4051    0.6862    0.9282    0.9853    0.9944 (89)
MIT 2         18.0182   18.3378   18.8278   19.4388   19.8202   20.0056   20.0318   20.0344   19.9295   19.3974   18.6289   18.0132 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9893    0.9780    0.9499    0.8774    0.7427    0.5459    0.3822    0.4296    0.6980    0.9199    0.9801    0.9917 (94)
Useful gains  487.3517  577.2789  658.2806  699.1442  639.4800  462.1516  309.0856  322.3433  471.5342  524.6284  479.1864  458.2461 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1294.0794 1258.7105 1147.2507  952.1204  732.6977  479.2780  311.8119  326.8063  521.7677  793.9105 1050.7841 1272.6141 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.2054  457.9220  363.7938  182.1429   69.3539    0.0000    0.0000    0.0000    0.0000  200.3459  411.5503  605.8898 (98)
Space heating                                                                                                         2891.2040 (98)
Space heating per m2                                                                                  (98) / (4) =     35.9961 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3098.8253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.2054	457.9220	363.7938	182.1429	69.3539	0.0000	0.0000	0.0000	0.0000	200.3459	411.5503	605.8898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	643.3070	490.8061	389.9183	195.2228	74.3343	0.0000	0.0000	0.0000	0.0000	214.7330	441.1043	649.3995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5054	89.4160	89.2264	88.7616	87.9446	86.7000	86.7000	86.7000	86.7000	88.8125	89.3266	89.5294	(217)
Fuel for water heating, kWh/month													
	182.3764	160.0293	166.3490	147.0163	143.2983	126.8093	118.8742	134.4666	135.4969	152.5117	163.9410	176.9790	(219)
Water heating fuel used												1808.1482	(219)
Annual totals kWh/year													
Space heating fuel - main system												3098.8253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4162.2229	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3098.8253	0.2160	669.3463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.1482	0.2160	390.5600	(264)
Space and water heating			1059.9063	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			673.3807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.8383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
South	2.4400	46.7521	0.6300	0.7000	0.7700	34.8628	(78)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	102.9291	190.2484	292.0132	402.0119	477.5988	483.6552	462.5220	406.3329	331.0104	219.5800	126.1950	86.0991	(83)
Total gains	491.0795	576.0064	663.5750	751.0849	803.8481	787.9105	752.9230	703.3721	639.9340	551.2044	483.7882	462.9638	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9978	0.9948	0.9852	0.9509	0.8595	0.6903	0.5220	0.5767	0.8293	0.9728	0.9954	0.9984	(86)
MIT	19.7446	19.9109	20.1832	20.5297	20.8068	20.9542	20.9909	20.9853	20.8824	20.5072	20.0603	19.7169	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9971	0.9930	0.9799	0.9330	0.8106	0.5990	0.4055	0.4571	0.7542	0.9594	0.9935	0.9978	(89)
MIT 2	18.2749	18.5190	18.9153	19.4135	19.7764	19.9432	19.9698	19.9690	19.8764	19.3925	18.7461	18.2411	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9904	0.9751	0.9272	0.8144	0.6201	0.4349	0.4872	0.7673	0.9544	0.9911	0.9968	(94)
Useful gains	488.9803	570.4956	647.0245	696.4335	654.6313	488.5754	327.4087	342.6570	491.0411	526.0650	479.4989	461.4677	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.0865	1307.4866	1188.8912	995.7770	767.2138	509.7518	330.2392	347.5855	551.3441	835.0772	1107.3942	1338.9447	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating												3170.2151	(98)
Space heating per m2											(98) / (4) =	39.4698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3394.2346	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	682.7484	530.2548	431.6369	230.7573	89.6803	0.0000	0.0000	0.0000	0.0000	246.1511	484.0306	698.9753	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7411	87.4935	86.9604	85.7396	83.5223	80.3000	80.3000	80.3000	80.3000	85.7828	87.2313	87.8329	(217)
Fuel for water heating, kWh/month													
	230.6787	203.1527	212.6630	191.3072	190.1361	174.1812	166.8789	186.0308	188.0853	200.4839	210.4588	224.9973	(219)
Water heating fuel used												2379.0539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3394.2346	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6205.1170	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3394.2346	0.2160	733.1547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.0539	0.2160	513.8756	(264)
Space and water heating			1247.0303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1471.1493	(272)
Emissions per m2 for space and water heating			15.5258	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5258 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 150 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 150	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 150, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 150 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 150	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 150, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.38	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.25	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.13	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 151 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 151	**Prop Type Ref**	As
Property	Type 4 - Det FG, Plot 151, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.27	**TER**	17.90
Environmental	95 A	**% DER<TER**	59.39		
CO_2 Emissions (t/year)	0.37	**DFEE**	45.02	**TFEE**	58.62
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 110 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.27 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.41 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 5.90 m², No overhang
Windows facing South: 2.88 m², No overhang
Windows facing West: 7.50 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.5400 (1b)	x	2.3900 (2b)	=	132.7406	(1b) - (3b)
First floor	54.3600 (1c)	x	2.6300 (2c)	=	142.9668	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	275.7074	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1088	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3338	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2837	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3618	0.3547	0.3476	0.3121	0.3050	0.2696	0.2696	0.2625	0.2837	0.3050	0.3192	0.3334	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6118	0.6047	0.5976	0.5621	0.5550	0.5196	0.5196	0.5125	0.5337	0.5550	0.5692	0.5834	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.7700	1.2357	28.1378			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			55.5400	0.1300	7.2202			(28a)
External Wall	154.7500	24.9100	129.8400	0.2100	27.2664			(29a)
Main Roof	54.3600		54.3600	0.0700	3.8052			(30)
Bay roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			265.8300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.8284			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							190.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7487	(36)
Total fabric heat loss					(33) + (36) =		75.5771	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.6607	55.0153	54.3700	51.1430	50.4976	47.2707	47.2707	46.6253	48.5614	50.4976	51.7884	53.0792	(38)
Heat transfer coeff	131.2379	130.5925	129.9471	126.7201	126.0747	122.8478	122.8478	122.2024	124.1386	126.0747	127.3655	128.6563	(39)
Average = Sum(39)m / 12 =												126.5588	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1942	1.1883	1.1824	1.1530	1.1472	1.1178	1.1178	1.1119	1.1296	1.1472	1.1589	1.1707	(40)
HLP (average)												1.1516	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8142	(42)
Average daily hot water use (litres/day)	101.0378	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.1416	107.1001	103.0586	99.0171	94.9756	90.9340	90.9340	94.9756	99.0171	103.0586	107.1001	111.1416	(44)
Energy conte	164.8198	144.1524	148.7524	129.6860	124.4368	107.3795	99.5029	114.1810	115.5447	134.6562	146.9877	159.6192	(45)
Energy content (annual)										Total = Sum(45)m =		1589.7185	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7230	21.6229	22.3129	19.4529	18.6655	16.1069	14.9254	17.1271	17.3317	20.1984	22.0482	23.9429	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8236   10.6694   11.7898   11.3769   11.7256   11.3123   11.6675   11.7052   11.3475   11.7602   11.4159   11.8126 (61)
Total heat required for water heating calculated for each month
              176.6434  154.8219  160.5422  141.0628  136.1624  118.6917  111.1703  125.8862  126.8921  146.4164  158.4036  171.4318 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              176.6434  154.8219  160.5422  141.0628  136.1624  118.6917  111.1703  125.8862  126.8921  146.4164  158.4036  171.4318 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1728.1249 (64)
Heat gains from water heating, kWh/month
               57.7585   50.5980   52.4076   45.9648   44.3066   38.5317   36.0016   40.8915   41.2555   47.7132   51.7274   56.0265 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112  140.7112 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               24.2876   21.5720   17.5435   13.2816    9.9281    8.3818    9.0568   11.7723   15.8008   20.0628   23.4162   24.9626 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              271.4123  274.2287  267.1314  252.0222  232.9495  215.0239  203.0484  200.2320  207.3293  222.4385  241.5112  259.4368 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711   37.0711 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 -112.5690 (71)
Water heating gains (Table 5)
               77.6324   75.2947   70.4404   63.8400   59.5519   53.5163   48.3892   54.9617   57.2993   64.1307   71.8436   75.3045 (72)
Total internal gains
              441.5456  439.3088  423.3287  397.3571  370.6429  345.1353  328.7078  335.1794  348.6427  374.8453  404.9844  427.9173 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  4.4100            10.6334            0.7200           0.7000            0.7700           16.3785 (74)
Northeast                              1.0400            11.2829            0.7200           0.7000            0.7700            4.0984 (75)
East                                   5.9000            19.6403            0.7200           0.7000            0.7700           40.4728 (76)
South                                  2.8800            46.7521            0.7200           0.7000            0.7700           47.0281 (78)
West                                   7.5000            19.6403            0.7200           0.7000            0.7700           51.4485 (80)
Northwest                              1.0400            11.2829            0.7200           0.7000            0.7700            4.0984 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   163.5247  304.8225  477.4911  677.5789  826.2962  846.9838  805.7052  692.6388  547.4803  354.0908  200.8781  136.5761 (83)
Total gains   605.0703  744.1312  900.8198 1074.9360 1196.9391 1192.1191 1134.4130 1027.8182  896.1231  728.9362  605.8625  564.4934 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           44.1967   44.4151   44.6357   45.7723   46.0067   47.2152   47.2152   47.4645   46.7242   46.0067   45.5404   45.0835
alpha          3.9464    3.9610    3.9757    4.0515    4.0671    4.1477    4.1477    4.1643    4.1149    4.0671    4.0360    4.0056
util living area
               0.9955    0.9894    0.9715    0.9150    0.7943    0.6143    0.4647    0.5259    0.7859    0.9570    0.9913    0.9966 (86)

MIT           19.3403   19.5713   19.9435   20.4206   20.7659   20.9427   20.9858   20.9770   20.8387   20.3525   19.7687   19.3215 (87)
Th 2          19.9247   19.9294   19.9341   19.9577   19.9625   19.9863   19.9863   19.9911   19.9768   19.9625   19.9530   19.9435 (88)
util rest of house
               0.9943    0.9866    0.9638    0.8922    0.7433    0.5325    0.3631    0.4198    0.7143    0.9410    0.9885    0.9957 (89)
MIT 2         17.7085   18.0478   18.5884   19.2752   19.7276   19.9444   19.9799   19.9796   19.8380   19.1983   18.3526   17.6934 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1935 (91)
MIT           18.0243   18.3426   18.8506   19.4968   19.9286   20.1376   20.1746   20.1727   20.0317   19.4216   18.6267   18.0085 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.0243   18.3426   18.8506   19.4968   19.9286   20.1376   20.1746   20.1727   20.0317   19.4216   18.6267   18.0085 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9910    0.9805    0.9532    0.8800    0.7415    0.5453    0.3824    0.4396    0.7187    0.9300    0.9833    0.9931 (94)
Useful gains 599.6204  729.6144  858.6602  945.9733  887.5248  650.0928  433.8349  451.8616  644.0158  677.8809  595.7483  560.5799 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1801.1490 1755.5074 1604.9305 1342.8331 1037.4157  680.2853  439.1277  461.0289  736.3517 1112.1868 1468.1037 1776.5509 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              893.9373  689.4001  555.2251  285.7390  111.5189    0.0000    0.0000    0.0000    0.0000  323.1236  628.0959  904.6824 (98)
Space heating                                                                                                              4391.7222 (98)
Space heating per m2                                                                                        (98) / (4) =     39.9611 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4707.0978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	893.9373	689.4001	555.2251	285.7390	111.5189	0.0000	0.0000	0.0000	0.0000	323.1236	628.0959	904.6824	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	958.1321	738.9068	595.0966	306.2583	119.5272	0.0000	0.0000	0.0000	0.0000	346.3275	673.2004	969.6489	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.6434	154.8219	160.5422	141.0628	136.1624	118.6917	111.1703	125.8862	126.8921	146.4164	158.4036	171.4318	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6856	89.6176	89.4668	89.0775	88.2847	86.7000	86.7000	86.7000	86.7000	89.1457	89.5511	89.7066	(217)
Fuel for water heating, kWh/month													
	196.9585	172.7584	179.4434	158.3596	154.2310	136.8993	128.2241	145.1974	146.3577	164.2438	176.8863	191.1028	(219)
Water heating fuel used												1950.6624	(219)
Annual totals kWh/year													
Space heating fuel - main system												4707.0978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.9262	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1068 * 1.00) =											-1734.5465	-1734.5465	(233)
Total delivered energy for all uses												5427.1399	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4707.0978	0.2160	1016.7331	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1950.6624	0.2160	421.3431	(264)
Space and water heating			1438.0762	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	428.9262	0.5190	222.6127	(268)
Energy saving/generation technologies				
PV Unit	-1734.5465	0.5190	-900.2296	(269)
Total CO2, kg/year			799.3843	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.2700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.2700	ZC1
Total Floor Area	TFA	109.9000	
Assumed number of occupants	N	2.8142	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.6345	ZC2
CO2 emissions from cooking, equation (L16)		1.6974	ZC3
Total CO2 emissions		23.6019	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.6019	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.5400	(1b)	x 2.3900	(2b) =	132.7406	(1b) - (3b)
First floor	54.3600	(1c)	x 2.6300	(2c) =	142.9668	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		275.7074	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1451	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3951	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3358	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4282	0.4198	0.4114	0.3694	0.3610	0.3190	0.3190	0.3106	0.3358	0.3610	0.3778	0.3946	(22b)
Effective ac	0.5917	0.5881	0.5846	0.5682	0.5652	0.5509	0.5509	0.5482	0.5564	0.5652	0.5714	0.5778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			22.7700	1.3258	30.1875			(27)
Ground floor			55.5400	0.1300	7.2202			(28a)
External Wall	154.7500	24.9100	129.8400	0.1800	23.3712			(29a)
Main Roof	54.3600		54.3600	0.1300	7.0668			(30)
Bay roof	1.1800		1.1800	0.1300	0.1534			(30)
Total net area of external elements Aum(A, m2)			265.8300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.5671			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.8147	(36)
Total fabric heat loss (33) + (36) =	83.3818	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.8317	53.5078	53.1904	51.6994	51.4204	50.1218	50.1218	49.8813	50.6220	51.4204	51.9848	52.5747	(38)
Heat transfer coeff	137.2135	136.8896	136.5722	135.0812	134.8022	133.5036	133.5036	133.2631	134.0038	134.8022	135.3666	135.9565	(39)
Average = Sum(39)m / 12 =												135.0799	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2485	1.2456	1.2427	1.2291	1.2266	1.2148	1.2148	1.2126	1.2193	1.2266	1.2317	1.2371	(40)
HLP (average)												1.2291	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8142 (42)
Average daily hot water use (litres/day)	101.0378 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.1416	107.1001	103.0586	99.0171	94.9756	90.9340	90.9340	94.9756	99.0171	103.0586	107.1001	111.1416	(44)
Energy conte	164.8198	144.1524	148.7524	129.6860	124.4368	107.3795	99.5029	114.1810	115.5447	134.6562	146.9877	159.6192	(45)
Energy content (annual)										Total = Sum(45)m =		1589.7185	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7230	21.6229	22.3129	19.4529	18.6655	16.1069	14.9254	17.1271	17.3317	20.1984	22.0482	23.9429	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.8303	48.3985	44.8442	46.3390	48.3985	48.8303	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	215.7787	190.1798	199.7113	178.5163	172.8353	152.2237	145.8419	162.5795	164.3750	185.6151	196.3028	210.5781 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	215.7787	190.1798	199.7113	178.5163	172.8353	152.2237	145.8419	162.5795	164.3750	185.6151	196.3028	210.5781 (64)
								Total per year (kWh/year) = Sum(64)m =				2174.5374 (64)
Heat gains from water heating, kWh/month												
	67.5423	59.4375	62.1999	55.3282	53.4749	46.9147	44.6694	50.0648	50.6262	57.5129	61.2022	65.8131 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	140.7112	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.2876	21.5720	17.5435	13.2816	9.9281	8.3818	9.0568	11.7723	15.8008	20.0628	23.4162	24.9626	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	271.4123	274.2287	267.1314	252.0222	232.9495	215.0239	203.0484	200.2320	207.3293	222.4385	241.5112	259.4368	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	37.0711	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	-112.5690	(71)
Water heating gains (Table 5)													
	90.7827	88.4487	83.6020	76.8447	71.8748	65.1593	60.0396	67.2914	70.3141	77.3023	85.0030	88.4585	(72)
Total internal gains													
	454.6959	452.4628	436.4903	410.3618	382.9658	356.7783	340.3582	347.5091	361.6576	388.0169	418.1438	441.0713	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.6300	0.7000	0.7700	14.3312	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137	(76)
South	2.8800	46.7521	0.6300	0.7000	0.7700	41.1496	(78)
West	7.5000	19.6403	0.6300	0.7000	0.7700	45.0174	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	143.0841	266.7197	417.8047	592.8815	723.0091	741.1109	704.9921	606.0590	479.0453	309.8295	175.7683	119.5040 (83)
Total gains	597.7800	719.1824	854.2950	1003.2433	1105.9750	1097.8892	1045.3502	953.5681	840.7029	697.8464	593.9122	560.5753 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6210	55.7525	55.8821	56.4989	56.6159	57.1666	57.1666	57.2697	56.9532	56.6159	56.3798	56.1352	
alpha	4.7081	4.7168	4.7255	4.7666	4.7744	4.8111	4.8111	4.8180	4.7969	4.7744	4.7587	4.7423	
util living area													
	0.9987	0.9966	0.9892	0.9599	0.8743	0.7109	0.5460	0.6133	0.8644	0.9817	0.9972	0.9990	(86)
MIT	19.5775	19.7508	20.0460	20.4343	20.7583	20.9376	20.9859	20.9762	20.8329	20.3958	19.9143	19.5497	(87)
Th 2	19.8814	19.8837	19.8860	19.8968	19.8988	19.9082	19.9082	19.9099	19.9046	19.8988	19.8947	19.8904	(88)
util rest of house													
	0.9982	0.9954	0.9852	0.9442	0.8265	0.6153	0.4186	0.4823	0.7938	0.9720	0.9960	0.9987	(89)
MIT 2	17.9863	18.2410	18.6717	19.2327	19.6629	19.8671	19.9032	19.9003	19.7680	19.1888	18.4882	17.9519	(90)
Living area fraction										fLA = Living area / (4) =		0.1935	(91)
MIT	18.2943	18.5333	18.9377	19.4653	19.8749	20.0743	20.1127	20.1085	19.9741	19.4224	18.7642	18.2612	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2943	18.5333	18.9377	19.4653	19.8749	20.0743	20.1127	20.1085	19.9741	19.4224	18.7642	18.2612	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9931	0.9803	0.9363	0.8253	0.6310	0.4433	0.5075	0.7992	0.9660	0.9940	0.9979	(94)
Useful gains	596.0855	714.2400	837.4656	939.3308	912.7929	692.7738	463.4424	483.9474	671.8749	674.1313	590.3671	559.3960	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1920.2007	1866.2505	1698.6461	1427.1714	1101.9975	730.8408	468.9614	494.2048	787.1586	1189.2762	1578.9447	1911.7058	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	985.1417	774.1511	640.7183	351.2452	140.7682	0.0000	0.0000	0.0000	0.0000	383.2678	711.7759	1006.1185	(98)
Space heating												4993.1867	(98)
Space heating per m2											(98) / (4) =	45.4339	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5346.0243	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	985.1417	774.1511	640.7183	351.2452	140.7682	0.0000	0.0000	0.0000	0.0000	383.2678	711.7759	1006.1185	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1054.7556	828.8555	685.9939	376.0656	150.7154	0.0000	0.0000	0.0000	0.0000	410.3510	762.0727	1077.2146	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.7787	190.1798	199.7113	178.5163	172.8353	152.2237	145.8419	162.5795	164.3750	185.6151	196.3028	210.5781	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4021	88.2119	87.7765	86.7243	84.5397	80.3000	80.3000	80.3000	80.3000	86.8363	88.0071	88.4740	(217)
Fuel for water heating, kWh/month													
	244.0876	215.5944	227.5226	205.8435	204.4427	189.5687	181.6212	202.4651	204.7011	213.7528	223.0534	238.0112	(219)
Water heating fuel used												2550.6644	(219)
Annual totals kWh/year													
Space heating fuel - main system												5346.0243	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.9262	(232)
Total delivered energy for all uses												8400.6149	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5346.0243	0.2160	1154.7413	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2550.6644	0.2160	550.9435	(264)
Space and water heating			1705.6848	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	428.9262	0.5190	222.6127	(268)
Total CO2, kg/m2/year			1967.2225	(272)
Emissions per m2 for space and water heating			15.5203	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0256	(272b)
Emissions per m2 for pumps and fans			0.3542	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5203 * 1.00) + 2.0256 + 0.3542, rounded to 2 d.p.			17.9000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 151 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 151	**Prop Type Ref**	As
Property	Type 4 - Det FG, Plot 151, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.27	**TER**	17.90
Environmental	95 A	**% DER<TER**	59.39		
CO_2 Emissions (t/year)	0.37	**DFEE**	45.02	**TFEE**	58.62
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	31.15 m	55.54 m²	2.39 m
1st Storey:	30.65 m	54.36 m²	2.63 m

7.0 Living Area	21.27	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	190.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	154.75	129.84

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	54.36	54.36
Bay roof	External Flat Roof	0.16	1.18	1.18

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	55.54

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.14	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.28	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100

W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		2.05	100
W14	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W15	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	19.35	0.065	No
Independently assessed	E3 Sill	17.31	0.004	No
Independently assessed	E4 Jamb	43.95	0.005	No
Independently assessed	E5 Ground floor (normal)	31.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.65	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.50	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.15	0.051	No
Independently assessed	E14 Flat roof	3.05	0.029	No
Independently assessed	E16 Corner (normal)	23.85	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.77	-0.092	No

Y-value	0.022	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 151 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 151	**Prop Type Ref**	As
Property	Type 4 - Det FG, Plot 151, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.27	**TER**	17.90
Environmental	95 A	**% DER<TER**	59.39		
CO_2 Emissions (t/year)	0.37	**DFEE**	45.02	**TFEE**	58.62
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	109.9	m^2	
DER	7.27	$kgCO_2/yr/m^2$	
TER	17.90	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.27	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.39	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.02	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	109.9	m^2	
DER	17.68	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.63	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.70	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.63	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.70	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.82	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.82	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	24	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 152 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 152	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 152, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing East: 3.49 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                       m2          Table 6a     Specific data     Specific data     factor           W
                                                     W/m2       or Table 6b       or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                 2.4400          10.6334          0.7200          0.7000          0.7700          9.0620 (74)
East                                  3.4900          19.6403          0.7200          0.7000          0.7700         23.9407 (76)
West                                  7.8500          19.6403          0.7200          0.7000          0.7700         53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    86.8521  169.4919  280.0362  412.7660  511.6058  526.7029  500.1875  425.4780  326.8497  201.1819  108.1742   71.5253 (83)
Total gains   461.8427  542.3579  639.3314  750.1960  826.8394  820.5679  780.1920  711.4956  624.1216  520.5311  452.8706  435.2268 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha           4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9955    0.9906    0.9754    0.9239    0.8073    0.6226    0.4694    0.5287    0.7944    0.9607    0.9916    0.9965 (86)

MIT            19.4960   19.6919   20.0274   20.4723   20.7919   20.9535   20.9895   20.9828   20.8613   20.4179   19.8935   19.4877 (87)
Th 2           19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9943    0.9881    0.9685    0.9028    0.7581    0.5429    0.3711    0.4262    0.7247    0.9457    0.9889    0.9956 (89)
MIT 2          17.9569   18.2456   18.7343   19.3798   19.7998   20.0022   20.0312   20.0328   19.9061   19.3204   18.5588   17.9591 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT            18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.3425   18.6079   19.0582   19.6535   20.0483   20.2405   20.2712   20.2708   20.1453   19.5953   18.8931   18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9832    0.9603    0.8940    0.7603    0.5606    0.3956    0.4515    0.7343    0.9376    0.9846    0.9933 (94)
Useful gains  457.8800  533.2649  613.9782  670.6461  628.6207  459.9766  308.6189  321.2092  458.3082  488.0386  445.8838  432.2903 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1288.8976 1250.9424 1139.3897  947.2366  730.9637  478.9648  311.7449  326.6449  519.7337  787.6117 1045.0449 1268.1402 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              618.2771  482.2793  390.9061  199.1452   76.1432    0.0000    0.0000    0.0000    0.0000  222.8824  431.3960  621.8723 (98)
Space heating                                                                                                         3042.9015 (98)
Space heating per m2                                                                                  (98) / (4) =     37.8847 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3261.4164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2771	482.2793	390.9061	199.1452	76.1432	0.0000	0.0000	0.0000	0.0000	222.8824	431.3960	621.8723	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6764	516.9124	418.9776	213.4460	81.6111	0.0000	0.0000	0.0000	0.0000	238.8878	462.3752	666.5298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5236	89.4502	89.2798	88.8397	88.0217	86.7000	86.7000	86.7000	86.7000	88.9046	89.3597	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3393	159.9683	166.2496	146.8871	143.1728	126.8093	118.8742	134.4666	135.4969	152.3537	163.8803	176.9481	(219)
Water heating fuel used												1807.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3261.4164	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4324.1122	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3261.4164	0.2160	704.4660	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.4463	0.2160	390.4084	(264)
Space and water heating			1094.8744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			708.3488	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.2783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.2783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	75.9956	148.3054	245.0317	361.1702	447.6551	460.8650	437.6640	372.2932	285.9935	176.0342	94.6525	62.5847	(83)
Total gains	464.1460	534.0634	616.5935	710.2432	773.9044	765.1203	728.0650	669.3324	594.9171	507.6587	452.2457	439.4493	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9963	0.9891	0.9600	0.8735	0.7056	0.5382	0.6021	0.8588	0.9804	0.9966	0.9987	(86)
MIT	19.7135	19.8631	20.1320	20.4918	20.7893	20.9495	20.9896	20.9822	20.8592	20.4622	20.0243	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9977	0.9950	0.9851	0.9447	0.8271	0.6142	0.4189	0.4791	0.7894	0.9703	0.9952	0.9983	(89)
MIT 2	18.2296	18.4497	18.8421	19.3625	19.7568	19.9397	19.9693	19.9676	19.8541	19.3304	18.6937	18.2013	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6013	18.8038	19.1652	19.6454	20.0154	20.1926	20.2249	20.2218	20.1059	19.6139	19.0270	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9929	0.9810	0.9388	0.8298	0.6350	0.4490	0.5100	0.8001	0.9656	0.9933	0.9974	(94)
Useful gains	462.5800	530.2900	604.8527	666.8002	642.1961	485.8866	326.9040	341.3760	476.0031	490.1916	449.1967	438.3133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1342.1684	1301.5015	1182.5697	991.3737	765.4586	509.4043	330.1730	347.4198	549.2871	829.7509	1102.9297	1335.5398	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating												3318.7460	(98)
Space heating per m2											(98) / (4) =	41.3190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3553.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.4138	518.2541	429.8215	233.6929	91.7073	0.0000	0.0000	0.0000	0.0000	252.6321	470.6878	667.5365	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.6572	554.8759	460.1943	250.2066	98.1877	0.0000	0.0000	0.0000	0.0000	270.4841	503.9484	714.7072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7915	87.5866	87.1042	85.9419	83.7243	80.3000	80.3000	80.3000	80.3000	86.0179	87.3183	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5462	202.9369	212.3119	190.8567	189.6773	174.1812	166.8789	186.0308	188.0853	199.9358	210.2491	224.8887	(219)
Water heating fuel used												2376.5789	(219)
Annual totals kWh/year													
Space heating fuel - main system												3553.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6361.6687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.2613	0.2160	767.5044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.5789	0.2160	513.3410	(264)
Space and water heating			1280.8455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1504.9645	(272)
Emissions per m2 for space and water heating			15.9468	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9468 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 152 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 152	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 152, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 152 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 152	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 152, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.82	**TER**	18.74
Environmental	94 A	**% DER<TER**	52.93		
CO_2 Emissions (t/year)	0.36	**DFEE**	40.96	**TFEE**	53.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.82	$kgCO_2/yr/m^2$	
TER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.82	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.93	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 153 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 153	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 153, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 2.44 m², No overhang
Windows facing West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                     3.4900           19.6403           0.7200           0.7000           0.7700           23.9407 (76)
South                                    2.4400           46.7521           0.7200           0.7000           0.7700           39.8432 (78)
West                                     7.8500           19.6403           0.7200           0.7000           0.7700           53.8494 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.6333  217.4268  333.7293  459.4422  545.8272  552.7488  528.5966  464.3804  378.2976  250.9485  144.2229   98.3990 (83)
Total gains   492.6239  590.2928  693.0245  796.8722  861.0607  846.6139  808.6011  750.3980  675.5696  570.2977  488.9192  462.1005 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9943    0.9872    0.9678    0.9095    0.7902    0.6071    0.4541    0.5040    0.7591    0.9472    0.9888    0.9956 (86)

MIT           19.5381   19.7557   20.0935   20.5171   20.8101   20.9579   20.9907   20.9857   20.8855   20.4748   19.9421   19.5249 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9927    0.9838    0.9590    0.8857    0.7393    0.5281    0.3584    0.4051    0.6862    0.9282    0.9853    0.9944 (89)
MIT 2         18.0182   18.3378   18.8278   19.4388   19.8202   20.0056   20.0318   20.0344   19.9295   19.3974   18.6289   18.0132 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3989   18.6930   19.1448   19.7089   20.0681   20.2442   20.2720   20.2727   20.1690   19.6673   18.9579   18.3919 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9893    0.9780    0.9499    0.8774    0.7427    0.5459    0.3822    0.4296    0.6980    0.9199    0.9801    0.9917 (94)
Useful gains  487.3517  577.2789  658.2806  699.1442  639.4800  462.1516  309.0856  322.3433  471.5342  524.6284  479.1864  458.2461 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1294.0794 1258.7105 1147.2507  952.1204  732.6977  479.2780  311.8119  326.8063  521.7677  793.9105 1050.7841 1272.6141 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.2054  457.9220  363.7938  182.1429   69.3539    0.0000    0.0000    0.0000    0.0000  200.3459  411.5503  605.8898 (98)
Space heating                                                                                                         2891.2040 (98)
Space heating per m2                                                                                  (98) / (4) =     35.9961 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3098.8253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.2054	457.9220	363.7938	182.1429	69.3539	0.0000	0.0000	0.0000	0.0000	200.3459	411.5503	605.8898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	643.3070	490.8061	389.9183	195.2228	74.3343	0.0000	0.0000	0.0000	0.0000	214.7330	441.1043	649.3995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5054	89.4160	89.2264	88.7616	87.9446	86.7000	86.7000	86.7000	86.7000	88.8125	89.3266	89.5294	(217)
Fuel for water heating, kWh/month													
	182.3764	160.0293	166.3490	147.0163	143.2983	126.8093	118.8742	134.4666	135.4969	152.5117	163.9410	176.9790	(219)
Water heating fuel used												1808.1482	(219)
Annual totals kWh/year													
Space heating fuel - main system												3098.8253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4162.2229	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3098.8253	0.2160	669.3463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.1482	0.2160	390.5600	(264)
Space and water heating			1059.9063	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			673.3807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.8383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(76)
South	2.4400	46.7521	0.6300	0.7000	0.7700	34.8628	(78)
West	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(80)

Solar gains	102.9291	190.2484	292.0132	402.0119	477.5988	483.6552	462.5220	406.3329	331.0104	219.5800	126.1950	86.0991	(83)
Total gains	491.0795	576.0064	663.5750	751.0849	803.8481	787.9105	752.9230	703.3721	639.9340	551.2044	483.7882	462.9638	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9978	0.9948	0.9852	0.9509	0.8595	0.6903	0.5220	0.5767	0.8293	0.9728	0.9954	0.9984	(86)
MIT	19.7446	19.9109	20.1832	20.5297	20.8068	20.9542	20.9909	20.9853	20.8824	20.5072	20.0603	19.7169	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9971	0.9930	0.9799	0.9330	0.8106	0.5990	0.4055	0.4571	0.7542	0.9594	0.9935	0.9978	(89)
MIT 2	18.2749	18.5190	18.9153	19.4135	19.7764	19.9432	19.9698	19.9690	19.8764	19.3925	18.7461	18.2411	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6431	18.8677	19.2329	19.6931	20.0345	20.1964	20.2256	20.2236	20.1284	19.6717	19.0753	18.6108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9904	0.9751	0.9272	0.8144	0.6201	0.4349	0.4872	0.7673	0.9544	0.9911	0.9968	(94)
Useful gains	488.9803	570.4956	647.0245	696.4335	654.6313	488.5754	327.4087	342.6570	491.0411	526.0650	479.4989	461.4677	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.0865	1307.4866	1188.8912	995.7770	767.2138	509.7518	330.2392	347.5855	551.3441	835.0772	1107.3942	1338.9447	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating												3170.2151	(98)
Space heating per m2											(98) / (4) =	39.4698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3394.2346	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.6870	495.2579	403.1488	215.5273	83.7614	0.0000	0.0000	0.0000	0.0000	229.9051	452.0846	652.8429	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	682.7484	530.2548	431.6369	230.7573	89.6803	0.0000	0.0000	0.0000	0.0000	246.1511	484.0306	698.9753	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7411	87.4935	86.9604	85.7396	83.5223	80.3000	80.3000	80.3000	80.3000	85.7828	87.2313	87.8329	(217)
Fuel for water heating, kWh/month													
	230.6787	203.1527	212.6630	191.3072	190.1361	174.1812	166.8789	186.0308	188.0853	200.4839	210.4588	224.9973	(219)
Water heating fuel used												2379.0539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3394.2346	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6205.1170	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3394.2346	0.2160	733.1547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.0539	0.2160	513.8756	(264)
Space and water heating			1247.0303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1471.1493	(272)
Emissions per m2 for space and water heating			15.5258	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5258 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 153 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 153	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 153, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 153 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 153	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 153, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.38	**TER**	18.32
Environmental	94 A	**% DER<TER**	54.25		
CO_2 Emissions (t/year)	0.34	**DFEE**	39.13	**TFEE**	51.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.55		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	8.38	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.25	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.13	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.97	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 154 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 154	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 154, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.19	**TER**	17.40
Environmental	96 A	**% DER<TER**	64.42		
CO_2 Emissions (t/year)	0.20	**DFEE**	39.49	**TFEE**	52.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.05		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.47 m², No overhang
Windows facing East: 7.88 m², No overhang
Windows facing South: 4.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1692.5948 (64)
Heat gains from water heating, kWh/month
               56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
               75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
              418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g              FF            Access            Gains
                                           m2           Table 6a      Specific data  Specific data        factor                W
                                                           W/m2      or Table 6b    or Table 6c       Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                   7.4700            10.6334            0.7200         0.7000            0.7700           27.7432 (74)
East                                    7.8800            19.6403            0.7200         0.7000            0.7700           54.0552 (76)
South                                   4.5500            46.7521            0.7200         0.7000            0.7700           74.2978 (78)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   156.0962  280.4427  419.2355  573.8725  688.7505  702.9989  669.8367  581.8473  472.7717  319.8292  189.6935  131.7806 (83)
Total gains   574.4672  696.6179  820.2905  950.4141 1040.1964 1030.3961  981.6918  900.0384  803.6222  675.4188  573.7275  537.3462 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha         4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
               0.9941    0.9866    0.9668    0.9076    0.7846    0.6008    0.4509    0.5059    0.7612    0.9465    0.9885    0.9955 (86)

MIT           19.4753   19.7038   20.0508   20.4894   20.7995   20.9545   20.9895   20.9833   20.8732   20.4441   19.8916   19.4583 (87)
Th 2          19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
               0.9926    0.9832    0.9582    0.8842    0.7348    0.5236    0.3570    0.4081    0.6904    0.9280    0.9850    0.9944 (89)
MIT 2         17.9423   18.2776   18.7807   19.4124   19.8171   20.0106   20.0393   20.0407   19.9256   19.3666   18.5695   17.9308 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1928 (91)
MIT           18.2379   18.5526   19.0256   19.6200   20.0066   20.1926   20.2225   20.2225   20.1083   19.5743   18.8244   18.2253 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.2379   18.5526   19.0256   19.6200   20.0066   20.1926   20.2225   20.2225   20.1083   19.5743   18.8244   18.2253 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9888    0.9765    0.9475    0.8732    0.7341    0.5361    0.3749    0.4264    0.6964    0.9172    0.9791    0.9913 (94)
Useful gains 568.0089  680.2319  777.2054  829.8719  763.5803  552.3768  367.9931  383.7955  559.6156  619.5227  561.7183  532.6540 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1537.6371 1497.9932 1366.8446 1137.7514  876.6337  573.4856  371.4663  389.6847  623.3056  947.1100 1251.3632 1513.7241 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              721.4034  549.5356  438.6915  221.6733   84.1117    0.0000    0.0000    0.0000    0.0000  243.7250  496.5443  729.9162 (98)
Space heating                                                                                                            3485.6009 (98)
Space heating per m2                                                                                    (98) / (4) =     35.5964 (99)
```

8c. Space cooling requirement

```
Not applicable
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		93.3000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		3735.9067 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	721.4034	549.5356	438.6915	221.6733	84.1117	0.0000	0.0000	0.0000	0.0000	243.7250	496.5443	729.9162	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	773.2083	588.9985	470.1945	237.5919	90.1519	0.0000	0.0000	0.0000	0.0000	261.2272	532.2018	782.3324	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5807	89.4965	89.3215	88.8830	88.0577	86.7000	86.7000	86.7000	86.7000	88.9321	89.4162	89.6043	(217)
Fuel for water heating, kWh/month													
	193.0803	169.3951	176.0162	155.4414	151.4670	134.1289	125.6569	142.2510	143.3756	161.2570	173.4821	187.3428	(219)
Water heating fuel used												1912.8941	(219)
Annual totals kWh/year													
Space heating fuel - main system												3735.9067	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 853 * 1.00) =										-1658.2902		-1658.2902	(233)
Total delivered energy for all uses												4465.8859	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3735.9067	0.2160	806.9558	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.8941	0.2160	413.1851	(264)
Space and water heating			1220.1410	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1658.2902	0.5190	-860.6526	(269)
Total CO2, kg/year			606.2081	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.1900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.1900	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		23.3777	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.3777	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.4700	10.6334	0.6300	0.7000	0.7700	24.2753	(74)
East	7.8800	19.6403	0.6300	0.7000	0.7700	47.2983	(76)
South	4.5500	46.7521	0.6300	0.7000	0.7700	65.0106	(78)

Solar gains	136.5841	245.3873	366.8311	502.1384	602.6567	615.1241	586.1071	509.1164	413.6752	279.8506	165.9818	115.3080	(83)
Total gains	568.1081	674.7191	781.0501	891.3110	966.0667	953.8204	909.2684	839.2782	757.1664	648.6138	563.1777	534.0301	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9983	0.9957	0.9872	0.9559	0.8663	0.6970	0.5296	0.5909	0.8436	0.9765	0.9962	0.9987	(86)
MIT	19.7114	19.8806	20.1536	20.5057	20.7964	20.9513	20.9900	20.9832	20.8700	20.4823	20.0293	19.6817	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9977	0.9942	0.9826	0.9393	0.8184	0.6052	0.4111	0.4687	0.7708	0.9647	0.9947	0.9983	(89)
MIT 2	18.2247	18.4730	18.8707	19.3775	19.7603	19.9349	19.9633	19.9617	19.8593	19.3545	18.6979	18.1871	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.5114	18.7444	19.1181	19.5950	19.9601	20.1309	20.1613	20.1586	20.0542	19.5719	18.9546	18.4752	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5114	18.7444	19.1181	19.5950	19.9601	20.1309	20.1613	20.1586	20.0542	19.5719	18.9546	18.4752	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9916	0.9776	0.9321	0.8185	0.6208	0.4340	0.4922	0.7782	0.9587	0.9924	0.9974	(94)
Useful gains	566.1032	669.0772	763.5535	830.7731	790.7010	592.1110	394.6648	413.1139	589.2035	621.8047	558.9191	532.6268	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1630.4247	1584.7758	1441.2329	1208.9738	931.9071	618.3216	398.1299	419.4778	667.9984	1012.2180	1342.7304	1623.5682	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	791.8552	615.3494	504.1934	272.3045	105.0573	0.0000	0.0000	0.0000	0.0000	290.4675	564.3441	811.6604	(98)
Space heating												3955.2320	(98)
Space heating per m2											(98) / (4) =	40.3925	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4234.7238	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	791.8552	615.3494	504.1934	272.3045	105.0573	0.0000	0.0000	0.0000	0.0000	290.4675	564.3441	811.6604	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	847.8107	658.8324	539.8217	291.5466	112.4811	0.0000	0.0000	0.0000	0.0000	310.9931	604.2229	869.0155	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0600	87.8258	87.3211	86.1667	83.8933	80.3000	80.3000	80.3000	80.3000	86.2142	87.5921	88.1469	(217)
Fuel for water heating, kWh/month													
	240.8650	212.8844	224.9128	202.5586	201.4269	185.3441	177.5738	197.9532	200.1393	211.8147	220.3705	234.8591	(219)
Water heating fuel used												2510.7024	(219)
Annual totals kWh/year													
Space heating fuel - main system												4234.7238	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												7220.8014	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4234.7238	0.2160	914.7003	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2510.7024	0.2160	542.3117	(264)
Space and water heating			1457.0121	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1703.7318	(272)
Emissions per m2 for space and water heating			14.8796	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8796 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			17.4000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 154 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 154	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 154, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.19	**TER**	17.40
Environmental	96 A	**% DER<TER**	64.42		
CO_2 Emissions (t/year)	0.20	**DFEE**	39.49	**TFEE**	52.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.05		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 154 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 154	**Prop Type Ref**	Opp
Property	Type 3S - Semi SG, Plot 154, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.19	**TER**	17.40
Environmental	96 A	**% DER<TER**	64.42		
CO_2 Emissions (t/year)	0.20	**DFEE**	39.49	**TFEE**	52.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.05		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	6.19	$kgCO_2/yr/m^2$	
TER	17.40	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.19	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.42	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.49	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	17.24	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.43	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.43	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.45	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.64	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.64	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 155 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 155	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 155, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.63 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.85 m², No overhang
Windows facing South: 3.49 m², No overhang
Windows facing West: 2.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                          Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                            Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
    53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6439	69.4944	65.0306	58.9641	55.0249	49.4801	44.7697	50.8077	52.9551	59.2336	66.3235	69.5050	(72)
Total internal gains													
	374.9906	372.8660	359.2952	337.4300	315.2335	293.8651	280.0045	286.0176	297.2720	319.3492	344.6963	363.7015	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8500	10.6334	0.7200	0.7000	0.7700	29.1545	(74)
South	3.4900	46.7521	0.7200	0.7000	0.7700	56.9889	(78)
West	2.4400	19.6403	0.7200	0.7000	0.7700	16.7379	(80)

Solar gains	102.8812	181.7917	267.4872	365.0862	441.2579	452.7184	430.3399	370.9879	300.7385	205.8429	124.3872	87.3127	(83)
Total gains	477.8719	554.6577	626.7824	702.5162	756.4914	746.5835	710.3444	657.0055	598.0104	525.1921	469.0836	451.0142	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1295	48.4082	48.6902	50.1507	50.4534	52.0234	52.0234	52.3492	51.3838	50.4534	49.8517	49.2641	
alpha	4.2086	4.2272	4.2460	4.3434	4.3636	4.4682	4.4682	4.4899	4.4256	4.3636	4.3234	4.2843	
util living area													
	0.9949	0.9898	0.9771	0.9375	0.8422	0.6698	0.5114	0.5667	0.8124	0.9595	0.9904	0.9960	(86)
MIT	19.5180	19.7083	20.0116	20.4234	20.7488	20.9380	20.9852	20.9773	20.8471	20.4234	19.9154	19.5096	(87)
Th 2	19.9661	19.9714	19.9767	20.0035	20.0089	20.0359	20.0359	20.0413	20.0251	20.0089	19.9982	19.9874	(88)
util rest of house													
	0.9935	0.9870	0.9706	0.9193	0.7973	0.5886	0.4062	0.4594	0.7450	0.9442	0.9873	0.9949	(89)
MIT 2	17.9889	18.2694	18.7119	19.3146	19.7507	19.9896	20.0291	20.0299	19.8919	19.3279	18.5905	17.9909	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.3719	18.6299	19.0374	19.5923	20.0007	20.2271	20.2686	20.2672	20.1311	19.6023	18.9224	18.3714	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3719	18.6299	19.0374	19.5923	20.0007	20.2271	20.2686	20.2672	20.1311	19.6023	18.9224	18.3714	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9820	0.9626	0.9101	0.7969	0.6057	0.4323	0.4857	0.7533	0.9360	0.9826	0.9923	(94)
Useful gains	473.2613	544.6517	603.3506	639.3695	602.8559	452.1767	307.0765	319.0914	450.4649	491.5820	460.9414	447.5609	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1291.6005	1252.9494	1137.5065	941.8487	726.7945	477.8329	311.5238	326.3432	518.5128	788.2222	1047.6376	1270.7713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	608.8444	475.9761	397.4119	217.7850	92.2103	0.0000	0.0000	0.0000	0.0000	220.7004	422.4213	612.4686	(98)
Space heating												3047.8179	(98)
Space heating per m2											(98) / (4) =	37.9459	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3266.6859	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	608.8444	475.9761	397.4119	217.7850	92.2103	0.0000	0.0000	0.0000	0.0000	220.7004	422.4213	612.4686	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	652.5664	510.1566	425.9506	233.4244	98.8320	0.0000	0.0000	0.0000	0.0000	236.5492	452.7559	656.4508	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5142	89.4416	89.2918	88.9167	88.1855	86.7000	86.7000	86.7000	86.7000	88.8962	89.3450	89.5359	(217)
Fuel for water heating, kWh/month													
	182.3585	159.9836	166.2272	146.7600	142.9068	126.8093	118.8742	134.4666	135.4969	152.3682	163.9073	176.9661	(219)
Water heating fuel used												1807.1247	(219)
Annual totals kWh/year													
Space heating fuel - main system												3266.6859	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4452.0231	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3266.6859	0.2160	705.6042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1247	0.2160	390.3389	(264)
Space and water heating			1095.9431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			773.2354	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.6300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		28.0883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8500	10.6334	0.6300	0.7000	0.7700	25.5102	(74)
South	3.4900	46.7521	0.6300	0.7000	0.7700	49.8653	(78)
West	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(80)

Solar gains	90.0211	159.0677	234.0513	319.4504	386.1007	396.1286	376.5474	324.6144	263.1462	180.1126	108.8388	76.3986	(83)
Total gains	478.1715	544.8257	605.6131	668.5234	712.3500	700.3839	666.9483	621.6536	572.0697	511.7370	466.4320	453.2632	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9981	0.9959	0.9899	0.9681	0.9008	0.7507	0.5820	0.6405	0.8733	0.9797	0.9961	0.9985	(86)
MIT	19.7297	19.8754	20.1199	20.4513	20.7491	20.9329	20.9852	20.9766	20.8459	20.4664	20.0405	19.7057	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9974	0.9945	0.9861	0.9554	0.8605	0.6604	0.4558	0.5134	0.8075	0.9693	0.9944	0.9980	(89)
MIT 2	18.2532	18.4676	18.8247	19.3073	19.7103	19.9270	19.9676	19.9649	19.8409	19.3363	18.7173	18.2247	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9923	0.9822	0.9497	0.8609	0.6801	0.4876	0.5453	0.8167	0.9646	0.9924	0.9970	(94)
Useful gains	476.3429	540.6531	594.8319	634.8825	613.2464	476.3289	325.2264	338.9847	467.2349	493.6306	462.8647	451.9251	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.2104	1303.0428	1181.0701	986.6223	761.3263	508.1598	329.9539	347.1110	548.0746	830.2614	1104.9423	1337.5411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating												3329.2520	(98)
Space heating per m2											(98) / (4) =	41.4499	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3564.5096	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	691.3205	548.5288	466.9820	271.1484	117.9566	0.0000	0.0000	0.0000	0.0000	268.1513	494.9635	705.4585	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7655	87.5632	87.1367	86.1411	84.1509	80.3000	80.3000	80.3000	80.3000	85.9964	87.2796	87.8505	(217)
Fuel for water heating, kWh/month													
	230.6146	202.9911	212.2329	190.4155	188.7158	174.1812	166.8789	186.0308	188.0853	199.9858	210.3422	224.9521	(219)
Water heating fuel used												2375.4263	(219)
Annual totals kWh/year													
Space heating fuel - main system												3564.5096	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6371.7645	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3564.5096	0.2160	769.9341	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.4263	0.2160	513.0921	(264)
Space and water heating			1283.0262	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1507.1452	(272)
Emissions per m2 for space and water heating			15.9739	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9739 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 155 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 155	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 155, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 92	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 155 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 155	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 155, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	9.63	$kgCO_2/yr/m^2$	
TER	18.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.63	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.68	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.59	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	18	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 156 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 156	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 156, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.63 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.85 m², No overhang
Windows facing East: 2.44 m², No overhang
Windows facing South: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                Area        Solar flux          g              FF          Access          Gains
                                     m2          Table 6a      Specific data  Specific data     factor          W
                                                    W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                              7.8500          10.6334          0.7200         0.7000       0.7700       29.1545 (74)
East                               2.4400          19.6403          0.7200         0.7000       0.7700       16.7379 (76)
South                              3.4900          46.7521          0.7200         0.7000       0.7700       56.9889 (78)
-------------------------------------------------------------------------------------------------------------------

Solar gains   102.8812  181.7917  267.4872  365.0862  441.2579  452.7184  430.3399  370.9879  300.7385  205.8429  124.3872   87.3127 (83)
Total gains   477.8719  554.6577  626.7824  702.5162  756.4914  746.5835  710.3444  657.0055  598.0104  525.1921  469.0836  451.0142 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9949    0.9898    0.9771    0.9375    0.8422    0.6698    0.5114    0.5667    0.8124    0.9595    0.9904    0.9960 (86)

MIT           19.5180   19.7083   20.0116   20.4234   20.7488   20.9380   20.9852   20.9773   20.8471   20.4234   19.9154   19.5096 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9935    0.9870    0.9706    0.9193    0.7973    0.5886    0.4062    0.4594    0.7450    0.9442    0.9873    0.9949 (89)
MIT 2         17.9889   18.2694   18.7119   19.3146   19.7507   19.9896   20.0291   20.0299   19.8919   19.3279   18.5905   17.9909 (90)
Living area fraction                                                                    fLA = Living area / (4) =     0.2505 (91)
MIT           18.3719   18.6299   19.0374   19.5923   20.0007   20.2271   20.2686   20.2672   20.1311   19.6023   18.9224   18.3714 (92)
Temperature adjustment                                                                                               0.0000
adjusted MIT  18.3719   18.6299   19.0374   19.5923   20.0007   20.2271   20.2686   20.2672   20.1311   19.6023   18.9224   18.3714 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9904    0.9820    0.9626    0.9101    0.7969    0.6057    0.4323    0.4857    0.7533    0.9360    0.9826    0.9923 (94)
Useful gains  473.2613  544.6517  603.3506  639.3695  602.8559  452.1767  307.0765  319.0914  450.4649  491.5820  460.9414  447.5609 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1291.6005 1252.9494 1137.5065  941.8487  726.7945  477.8329  311.5238  326.3432  518.5128  788.2222 1047.6376 1270.7713 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              608.8444  475.9761  397.4119  217.7850   92.2103    0.0000    0.0000    0.0000    0.0000  220.7004  422.4213  612.4686 (98)
Space heating                                                                                                       3047.8179 (98)
Space heating per m2                                                                                  (98) / (4) =    37.9459 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3266.6859	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	608.8444	475.9761	397.4119	217.7850	92.2103	0.0000	0.0000	0.0000	0.0000	220.7004	422.4213	612.4686	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	652.5664	510.1566	425.9506	233.4244	98.8320	0.0000	0.0000	0.0000	0.0000	236.5492	452.7559	656.4508	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5142	89.4416	89.2918	88.9167	88.1855	86.7000	86.7000	86.7000	86.7000	88.8962	89.3450	89.5359	(217)
Fuel for water heating, kWh/month													
	182.3585	159.9836	166.2272	146.7600	142.9068	126.8093	118.8742	134.4666	135.4969	152.3682	163.9073	176.9661	(219)
Water heating fuel used												1807.1247	(219)
Annual totals kWh/year													
Space heating fuel - main system												3266.6859	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4452.0231	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3266.6859	0.2160	705.6042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1247	0.2160	390.3389	(264)
Space and water heating			1095.9431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			773.2354	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.6300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		28.0883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8500	10.6334	0.6300	0.7000	0.7700	25.5102	(74)
East	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(76)
South	3.4900	46.7521	0.6300	0.7000	0.7700	49.8653	(78)

Solar gains	90.0211	159.0677	234.0513	319.4504	386.1007	396.1286	376.5474	324.6144	263.1462	180.1126	108.8388	76.3986	(83)
Total gains	478.1715	544.8257	605.6131	668.5234	712.3500	700.3839	666.9483	621.6536	572.0697	511.7370	466.4320	453.2632	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9981	0.9959	0.9899	0.9681	0.9008	0.7507	0.5820	0.6405	0.8733	0.9797	0.9961	0.9985	(86)
MIT	19.7297	19.8754	20.1199	20.4513	20.7491	20.9329	20.9852	20.9766	20.8459	20.4664	20.0405	19.7057	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9974	0.9945	0.9861	0.9554	0.8605	0.6604	0.4558	0.5134	0.8075	0.9693	0.9944	0.9980	(89)
MIT 2	18.2532	18.4676	18.8247	19.3073	19.7103	19.9270	19.9676	19.9649	19.8409	19.3363	18.7173	18.2247	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9923	0.9822	0.9497	0.8609	0.6801	0.4876	0.5453	0.8167	0.9646	0.9924	0.9970	(94)
Useful gains	476.3429	540.6531	594.8319	634.8825	613.2464	476.3289	325.2264	338.9847	467.2349	493.6306	462.8647	451.9251	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.2104	1303.0428	1181.0701	986.6223	761.3263	508.1598	329.9539	347.1110	548.0746	830.2614	1104.9423	1337.5411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating												3329.2520	(98)
Space heating per m2											(98) / (4) =	41.4499	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3564.5096	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	691.3205	548.5288	466.9820	271.1484	117.9566	0.0000	0.0000	0.0000	0.0000	268.1513	494.9635	705.4585	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7655	87.5632	87.1367	86.1411	84.1509	80.3000	80.3000	80.3000	80.3000	85.9964	87.2796	87.8505	(217)
Fuel for water heating, kWh/month													
	230.6146	202.9911	212.2329	190.4155	188.7158	174.1812	166.8789	186.0308	188.0853	199.9858	210.3422	224.9521	(219)
Water heating fuel used												2375.4263	(219)
Annual totals kWh/year													
Space heating fuel - main system												3564.5096	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6371.7645	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3564.5096	0.2160	769.9341	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.4263	0.2160	513.0921	(264)
Space and water heating			1283.0262	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1507.1452	(272)
Emissions per m2 for space and water heating			15.9739	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9739 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 156 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 156	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 156, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 92	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 156 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 156	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 156, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	9.63	$kgCO_2/yr/m^2$	
TER	18.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.63	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.68	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.59	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	18	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 157 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 157	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 157, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.63 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.85 m², No overhang
Windows facing South: 3.49 m², No overhang
Windows facing West: 2.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                          Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                            Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
    53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6439	69.4944	65.0306	58.9641	55.0249	49.4801	44.7697	50.8077	52.9551	59.2336	66.3235	69.5050	(72)
Total internal gains													
	374.9906	372.8660	359.2952	337.4300	315.2335	293.8651	280.0045	286.0176	297.2720	319.3492	344.6963	363.7015	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8500	10.6334	0.7200	0.7000	0.7700	29.1545	(74)
South	3.4900	46.7521	0.7200	0.7000	0.7700	56.9889	(78)
West	2.4400	19.6403	0.7200	0.7000	0.7700	16.7379	(80)

Solar gains	102.8812	181.7917	267.4872	365.0862	441.2579	452.7184	430.3399	370.9879	300.7385	205.8429	124.3872	87.3127	(83)
Total gains	477.8719	554.6577	626.7824	702.5162	756.4914	746.5835	710.3444	657.0055	598.0104	525.1921	469.0836	451.0142	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1295	48.4082	48.6902	50.1507	50.4534	52.0234	52.0234	52.3492	51.3838	50.4534	49.8517	49.2641	
alpha	4.2086	4.2272	4.2460	4.3434	4.3636	4.4682	4.4682	4.4899	4.4256	4.3636	4.3234	4.2843	
util living area													
	0.9949	0.9898	0.9771	0.9375	0.8422	0.6698	0.5114	0.5667	0.8124	0.9595	0.9904	0.9960	(86)
MIT	19.5180	19.7083	20.0116	20.4234	20.7488	20.9380	20.9852	20.9773	20.8471	20.4234	19.9154	19.5096	(87)
Th 2	19.9661	19.9714	19.9767	20.0035	20.0089	20.0359	20.0359	20.0413	20.0251	20.0089	19.9982	19.9874	(88)
util rest of house													
	0.9935	0.9870	0.9706	0.9193	0.7973	0.5886	0.4062	0.4594	0.7450	0.9442	0.9873	0.9949	(89)
MIT 2	17.9889	18.2694	18.7119	19.3146	19.7507	19.9896	20.0291	20.0299	19.8919	19.3279	18.5905	17.9909	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.3719	18.6299	19.0374	19.5923	20.0007	20.2271	20.2686	20.2672	20.1311	19.6023	18.9224	18.3714	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3719	18.6299	19.0374	19.5923	20.0007	20.2271	20.2686	20.2672	20.1311	19.6023	18.9224	18.3714	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9820	0.9626	0.9101	0.7969	0.6057	0.4323	0.4857	0.7533	0.9360	0.9826	0.9923	(94)
Useful gains	473.2613	544.6517	603.3506	639.3695	602.8559	452.1767	307.0765	319.0914	450.4649	491.5820	460.9414	447.5609	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1291.6005	1252.9494	1137.5065	941.8487	726.7945	477.8329	311.5238	326.3432	518.5128	788.2222	1047.6376	1270.7713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	608.8444	475.9761	397.4119	217.7850	92.2103	0.0000	0.0000	0.0000	0.0000	220.7004	422.4213	612.4686	(98)
Space heating												3047.8179	(98)
Space heating per m2											(98) / (4) =	37.9459	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3266.6859	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	608.8444	475.9761	397.4119	217.7850	92.2103	0.0000	0.0000	0.0000	0.0000	220.7004	422.4213	612.4686	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	652.5664	510.1566	425.9506	233.4244	98.8320	0.0000	0.0000	0.0000	0.0000	236.5492	452.7559	656.4508	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5142	89.4416	89.2918	88.9167	88.1855	86.7000	86.7000	86.7000	86.7000	88.8962	89.3450	89.5359	(217)
Fuel for water heating, kWh/month													
	182.3585	159.9836	166.2272	146.7600	142.9068	126.8093	118.8742	134.4666	135.4969	152.3682	163.9073	176.9661	(219)
Water heating fuel used												1807.1247	(219)
Annual totals kWh/year													
Space heating fuel - main system												3266.6859	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4452.0231	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3266.6859	0.2160	705.6042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1247	0.2160	390.3389	(264)
Space and water heating			1095.9431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			773.2354	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.6300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		28.0883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8500	10.6334	0.6300	0.7000	0.7700	25.5102	(74)
South	3.4900	46.7521	0.6300	0.7000	0.7700	49.8653	(78)
West	2.4400	19.6403	0.6300	0.7000	0.7700	14.6457	(80)

Solar gains	90.0211	159.0677	234.0513	319.4504	386.1007	396.1286	376.5474	324.6144	263.1462	180.1126	108.8388	76.3986	(83)
Total gains	478.1715	544.8257	605.6131	668.5234	712.3500	700.3839	666.9483	621.6536	572.0697	511.7370	466.4320	453.2632	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9981	0.9959	0.9899	0.9681	0.9008	0.7507	0.5820	0.6405	0.8733	0.9797	0.9961	0.9985	(86)
MIT	19.7297	19.8754	20.1199	20.4513	20.7491	20.9329	20.9852	20.9766	20.8459	20.4664	20.0405	19.7057	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9974	0.9945	0.9861	0.9554	0.8605	0.6604	0.4558	0.5134	0.8075	0.9693	0.9944	0.9980	(89)
MIT 2	18.2532	18.4676	18.8247	19.3073	19.7103	19.9270	19.9676	19.9649	19.8409	19.3363	18.7173	18.2247	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6231	18.8202	19.1492	19.5939	19.9706	20.1790	20.2225	20.2184	20.0927	19.6194	19.0488	18.5957	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9923	0.9822	0.9497	0.8609	0.6801	0.4876	0.5453	0.8167	0.9646	0.9924	0.9970	(94)
Useful gains	476.3429	540.6531	594.8319	634.8825	613.2464	476.3289	325.2264	338.9847	467.2349	493.6306	462.8647	451.9251	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.2104	1303.0428	1181.0701	986.6223	761.3263	508.1598	329.9539	347.1110	548.0746	830.2614	1104.9423	1337.5411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating												3329.2520	(98)
Space heating per m2											(98) / (4) =	41.4499	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3564.5096	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	645.6934	512.3259	436.1612	253.2526	110.1714	0.0000	0.0000	0.0000	0.0000	250.4533	462.2959	658.8983	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	691.3205	548.5288	466.9820	271.1484	117.9566	0.0000	0.0000	0.0000	0.0000	268.1513	494.9635	705.4585	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7655	87.5632	87.1367	86.1411	84.1509	80.3000	80.3000	80.3000	80.3000	85.9964	87.2796	87.8505	(217)
Fuel for water heating, kWh/month													
	230.6146	202.9911	212.2329	190.4155	188.7158	174.1812	166.8789	186.0308	188.0853	199.9858	210.3422	224.9521	(219)
Water heating fuel used												2375.4263	(219)
Annual totals kWh/year													
Space heating fuel - main system												3564.5096	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6371.7645	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3564.5096	0.2160	769.9341	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.4263	0.2160	513.0921	(264)
Space and water heating			1283.0262	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1507.1452	(272)
Emissions per m2 for space and water heating			15.9739	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9739 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.7600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 157 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 157	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 157, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 92	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 157 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 157	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 157, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.63	**TER**	18.76
Environmental	93 A	**% DER<TER**	48.68		
CO_2 Emissions (t/year)	0.45	**DFEE**	40.59	**TFEE**	53.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.50		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	9.63	$kgCO_2/yr/m^2$	
TER	18.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.63	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.68	%	
CfSH ENE1 credits achieved	5.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.59	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.60	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	18	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 158 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 158	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 158, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 2.44 m², No overhang
Windows facing South East: 3.49 m², No overhang
Windows facing North West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.7955    10.6404    11.7492    11.3349    11.6870    11.2803    11.6379    11.6697    11.3100    11.7235    11.3863    11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                              Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367   143.0919   148.4273   130.4941   126.0231   109.9437   103.0640   116.5825   117.4758   135.4495   146.4429   158.4482 (64)
                                                                                                Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031    46.7002    48.3828    42.4542    40.9385    35.6256    33.3086    37.8009    38.1276    44.0698    47.7529    51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452   123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051    17.9460    14.5947    11.0491     8.2593     6.9729     7.5344     9.7935    13.1449    16.6904    19.4802    20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080   222.3921   216.6364   204.3832   188.9158   174.3786   164.6668   162.3828   168.1385   180.3916   195.8591   210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445    35.3445 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562   -98.7562 (71)
Water heating gains (Table 5)
               71.6439    69.4944    65.0306    58.9641    55.0249    49.4801    44.7697    50.8077    52.9551    59.2336    66.3235    69.5050 (72)
Total internal gains
              374.9906   372.8660   359.2952   337.4300   315.2335   293.8651   280.0045   286.0176   297.2720   319.3492   344.6963   363.7015 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                            2.4400            11.2829            0.7200           0.7000           0.7700           9.6156 (75)
Southeast                            3.4900            36.7938            0.7200           0.7000           0.7700          44.8502 (77)
Northwest                            7.8500            11.2829            0.7200           0.7000           0.7700          30.9354 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains     85.4012   158.9392   253.2447   373.7504   473.3675   494.0209   466.2693   388.2696   294.3952   185.3081   104.7438    71.4984 (83)
Total gains    460.3918   531.8052   612.5399   711.1804   788.6011   787.8860   746.2738   674.2872   591.6672   504.6573   449.4402   435.1999 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            48.1295    48.4082    48.6902    50.1507    50.4534    52.0234    52.0234    52.3492    51.3838    50.4534    49.8517    49.2641
alpha           4.2086     4.2272     4.2460     4.3434     4.3636     4.4682     4.4682     4.4899     4.4256     4.3636     4.3234     4.2843
util living area
                0.9956     0.9913     0.9788     0.9351     0.8264     0.6429     0.4890     0.5542     0.8167     0.9646     0.9918     0.9965 (86)

MIT            19.4940    19.6777    19.9936    20.4325    20.7694    20.9473    20.9876    20.9793    20.8434    20.3991    19.8888    19.4877 (87)
Th 2           19.9661    19.9714    19.9767    20.0035    20.0089    20.0359    20.0359    20.0413    20.0251    20.0089    19.9982    19.9874 (88)
util rest of house
                0.9944     0.9889     0.9728     0.9164     0.7794     0.5623     0.3874     0.4483     0.7500     0.9508     0.9892     0.9956 (89)
MIT 2          17.9540    18.2250    18.6862    19.3268    19.7744    19.9972    20.0303    20.0309    19.8882    19.2945    18.5520    17.9590 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.2505 (91)
MIT            18.3398    18.5889    19.0137    19.6038    20.0237    20.2352    20.2701    20.2685    20.1274    19.5712    18.8869    18.3420 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   18.3398    18.5889    19.0137    19.6038    20.0237    20.2352    20.2701    20.2685    20.1274    19.5712    18.8869    18.3420 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9915     0.9843     0.9651     0.9072     0.7801     0.5798     0.4127     0.4743     0.7579     0.9428     0.9850     0.9933 (94)
Useful gains  456.4842   523.4471   591.1682   645.2161   615.2197   456.8555   307.9502   319.8423   448.4332   475.7944   442.6819   432.2642 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1288.6525  1249.2135  1135.3492   942.8577   728.8044   478.5135   311.6490   326.4502   518.1949   785.5015  1044.4941  1268.1357 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              619.1332   487.7150   404.8706   214.3019    84.5070     0.0000     0.0000     0.0000     0.0000   230.4221   433.3048   621.8884 (98)
Space heating                                                                                                                 3096.1431 (98)
Space heating per m2                                                                                                (98) / (4) =     38.5476 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3318.4813	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.1332	487.7150	404.8706	214.3019	84.5070	0.0000	0.0000	0.0000	0.0000	230.4221	433.3048	621.8884	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	663.5940	522.7385	433.9450	229.6912	90.5756	0.0000	0.0000	0.0000	0.0000	246.9690	464.4210	666.5470	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5244	89.4574	89.3052	88.9029	88.1100	86.7000	86.7000	86.7000	86.7000	88.9329	89.3627	89.5450	(217)
Fuel for water heating, kWh/month													
	182.3376	159.9553	166.2022	146.7827	143.0293	126.8093	118.8742	134.4666	135.4969	152.3052	163.8747	176.9480	(219)
Water heating fuel used												1807.0821	(219)
Annual totals kWh/year													
Space heating fuel - main system												3318.4813	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4223.5659	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3318.4813	0.2160	716.7920	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0821	0.2160	390.3297	(264)
Space and water heating			1107.1217	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			638.9850	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.9600	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.4183	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.4183	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.4400	11.2829	0.6300	0.7000	0.7700	8.4136	(75)
Southeast	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439	(77)
Northwest	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(81)

Solar gains	74.7260	139.0718	221.5891	327.0316	414.1966	432.2683	407.9857	339.7359	257.5958	162.1446	91.6508	62.5611	(83)
Total gains	462.8764	524.8297	593.1509	676.1046	740.4459	736.5236	698.3866	636.7751	566.5194	493.7690	449.2441	439.4257	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9983	0.9966	0.9907	0.9667	0.8886	0.7252	0.5588	0.6280	0.8767	0.9825	0.9967	0.9987	(86)
MIT	19.7121	19.8526	20.1061	20.4588	20.7682	20.9428	20.9877	20.9785	20.8425	20.4474	20.0208	19.6896	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9978	0.9954	0.9873	0.9536	0.8455	0.6340	0.4361	0.5021	0.8118	0.9733	0.9953	0.9983	(89)
MIT 2	18.2275	18.4343	18.8049	19.3176	19.7326	19.9346	19.9686	19.9659	19.8375	19.3098	18.6887	18.2013	(90)
Living area fraction										fLA = Living area / (4) =		0.2505	(91)
MIT	18.5994	18.7896	19.1308	19.6034	19.9920	20.1872	20.2238	20.2196	20.0892	19.5948	19.0224	18.5741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5994	18.7896	19.1308	19.6034	19.9920	20.1872	20.2238	20.2196	20.0892	19.5948	19.0224	18.5741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9835	0.9478	0.8468	0.6545	0.4670	0.5337	0.8208	0.9688	0.9934	0.9974	(94)
Useful gains	461.3327	521.3753	583.3884	640.8030	627.0429	482.0453	326.1781	339.8320	464.9811	478.3624	446.2970	438.2901	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.9834	1300.1764	1179.3588	987.5040	763.3031	508.9059	330.0781	347.2204	547.7615	827.9956	1102.5030	1335.5364	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	655.2042	523.3544	443.4020	249.6248	101.3776	0.0000	0.0000	0.0000	0.0000	260.1271	472.4683	667.5513	(98)
Space heating												3373.1096	(98)
Space heating per m2											(98) / (4) =	41.9959	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3611.4663	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	655.2042	523.3544	443.4020	249.6248	101.3776	0.0000	0.0000	0.0000	0.0000	260.1271	472.4683	667.5513	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	701.5034	560.3366	474.7345	267.2642	108.5413	0.0000	0.0000	0.0000	0.0000	278.5086	505.8548	714.7230	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7939	87.6064	87.1729	86.1055	83.9548	80.3000	80.3000	80.3000	80.3000	86.0903	87.3264	87.8753	(217)
Fuel for water heating, kWh/month													
	230.5401	202.8909	212.1446	190.4942	189.1567	174.1812	166.8789	186.0308	188.0853	199.7677	210.2296	224.8886	(219)
Water heating fuel used												2375.2888	(219)
Annual totals kWh/year													
Space heating fuel - main system												3611.4663	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6418.5836	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3611.4663	0.2160	780.0767	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.2888	0.2160	513.0624	(264)
Space and water heating			1293.1391	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1517.2581	(272)
Emissions per m2 for space and water heating			16.0998	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0998 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.8900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 158 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 158	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 158, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 158 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 158	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 158, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.96	**TER**	18.89
Environmental	95 A	**% DER<TER**	57.86		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.44	**TFEE**	54.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.09		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.96	$kgCO_2/yr/m^2$	
TER	18.89	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.96	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.86	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.44	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	19.10	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.56	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 159 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 159	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 159, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.64 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 3.49 m², No overhang
Windows facing South West: 2.44 m², No overhang
Windows facing North West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7955	10.6404	11.7492	11.3349	11.6870	11.2803	11.6379	11.6697	11.3100	11.7235	11.3863	11.7854 (61)

Total heat required for water heating calculated for each month

	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482 (64)

Total per year (kWh/year) = Sum(64)m = 1598.6795 (64)

Heat gains from water heating, kWh/month

	53.3031	46.7002	48.3828	42.4542	40.9385	35.6256	33.3086	37.8009	38.1276	44.0698	47.7529	51.7117 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)

Water heating gains (Table 5)

	71.6439	69.4944	65.0306	58.9641	55.0249	49.4801	44.7697	50.8077	52.9551	59.2336	66.3235	69.5050	(72)

Total internal gains

	374.9906	372.8660	359.2952	337.4300	315.2335	293.8651	280.0045	286.0176	297.2720	319.3492	344.6963	363.7015	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.4900	36.7938	0.7200	0.7000	0.7700	44.8502	(77)
Southwest	2.4400	36.7938	0.7200	0.7000	0.7700	31.3566	(79)
Northwest	7.8500	11.2829	0.7200	0.7000	0.7700	30.9354	(81)

Solar gains	107.1422	192.7782	291.0611	406.3870	496.9441	511.7179	485.7069	415.3392	330.5561	220.4200	130.2029	90.4805	(83)
Total gains	482.1328	565.6442	650.3563	743.8170	812.1776	805.5829	765.7114	701.3568	627.8281	539.7693	474.8992	454.1820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.1295	48.4082	48.6902	50.1507	50.4534	52.0234	52.0234	52.3492	51.3838	50.4534	49.8517	49.2641	
alpha	4.2086	4.2272	4.2460	4.3434	4.3636	4.4682	4.4682	4.4899	4.4256	4.3636	4.3234	4.2843	
util living area	0.9947	0.9890	0.9740	0.9258	0.8146	0.6318	0.4776	0.5354	0.7918	0.9558	0.9900	0.9959	(86)
MIT	19.5238	19.7230	20.0412	20.4659	20.7835	20.9508	20.9887	20.9819	20.8632	20.4403	19.9232	19.5139	(87)
Th 2	19.9661	19.9714	19.9767	20.0035	20.0089	20.0359	20.0359	20.0413	20.0251	20.0089	19.9982	19.9874	(88)
util rest of house	0.9933	0.9861	0.9667	0.9051	0.7662	0.5517	0.3779	0.4320	0.7219	0.9392	0.9868	0.9948	(89)
MIT 2	17.9974	18.2906	18.7538	19.3714	19.7905	20.0000	20.0308	20.0324	19.9079	19.3509	18.6018	17.9973	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.3797	18.6494	19.0763	19.6456	20.0392	20.2381	20.2708	20.2702	20.1472	19.6238	18.9328	18.3772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3797	18.6494	19.0763	19.6456	20.0392	20.2381	20.2708	20.2702	20.1472	19.6238	18.9328	18.3772	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9808	0.9583	0.8962	0.7679	0.5693	0.4027	0.4575	0.7317	0.9310	0.9819	0.9922	(94)
Useful gains	477.3377	554.7696	623.2314	666.5888	623.6460	458.6034	308.3497	320.8672	459.3564	502.5097	466.3114	450.6174	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1292.3174	1254.7343	1141.0303	946.5391	730.1646	478.7665	311.7063	326.5962	519.8961	790.1046	1048.5632	1271.2983	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	606.3449	470.3763	385.2424	201.5642	79.2498	0.0000	0.0000	0.0000	0.0000	213.9706	419.2213	610.5866	(98)
Space heating												2986.5562	(98)
Space heating per m2											(98) / (4) =	37.1832	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3201.0248	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	606.3449	470.3763	385.2424	201.5642	79.2498	0.0000	0.0000	0.0000	0.0000	213.9706	419.2213	610.5866	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	649.8874	504.1547	412.9072	216.0388	84.9409	0.0000	0.0000	0.0000	0.0000	229.3362	449.3261	654.4336	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5116	89.4338	89.2691	88.8502	88.0553	86.7000	86.7000	86.7000	86.7000	88.8696	89.3396	89.5340	(217)
Fuel for water heating, kWh/month													
	182.3636	159.9975	166.2695	146.8698	143.1181	126.8093	118.8742	134.4666	135.4969	152.4138	163.9171	176.9698	(219)
Water heating fuel used												1807.5663	(219)
Annual totals kWh/year													
Space heating fuel - main system												3201.0248	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4106.5936	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3201.0248	0.2160	691.4214	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.5663	0.2160	390.4343	(264)
Space and water heating			1081.8557	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			613.7190	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.6400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.6400	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.0983	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.0983	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.4900	36.7938	0.6300	0.7000	0.7700	39.2439	(77)
Southwest	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(79)
Northwest	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(81)

Solar gains	93.7494	168.6809	254.6785	355.5886	434.8261	447.7531	424.9936	363.4218	289.2366	192.8675	113.9275	79.1704	(83)
Total gains	481.8998	554.4389	626.2403	704.6616	761.0754	752.0084	715.3945	660.4610	598.1602	524.4920	471.5207	456.0351	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9980	0.9956	0.9884	0.9611	0.8794	0.7145	0.5469	0.6090	0.8567	0.9776	0.9959	0.9985	(86)
MIT	19.7340	19.8864	20.1426	20.4865	20.7814	20.9465	20.9888	20.9813	20.8610	20.4798	20.0463	19.7089	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9973	0.9941	0.9841	0.9462	0.8342	0.6232	0.4261	0.4852	0.7869	0.9663	0.9942	0.9980	(89)
MIT 2	18.2595	18.4835	18.8573	19.3553	19.7478	19.9374	19.9690	19.9672	19.8559	19.3548	18.7258	18.2294	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6289	18.8349	19.1793	19.6386	20.0067	20.1902	20.2245	20.2212	20.1077	19.6366	19.0566	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6289	18.8349	19.1793	19.6386	20.0067	20.1902	20.2245	20.2212	20.1077	19.6366	19.0566	18.6000	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9918	0.9798	0.9403	0.8364	0.6439	0.4565	0.5163	0.7978	0.9615	0.9920	0.9970	(94)
Useful gains	479.9960	549.8833	613.6069	662.6250	636.5463	484.1939	326.6121	340.9896	477.1832	504.2826	467.7521	454.6533	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.7526	1304.4164	1183.8806	990.7525	764.6570	509.1850	330.1348	347.3699	549.4496	831.8428	1105.6624	1337.9423	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	643.3789	507.0462	424.2836	236.2519	95.3143	0.0000	0.0000	0.0000	0.0000	243.7048	459.2955	657.1671	(98)
Space heating												3266.4422	(98)
Space heating per m2											(98) / (4) =	40.6679	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3497.2615	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	643.3789	507.0462	424.2836	236.2519	95.3143	0.0000	0.0000	0.0000	0.0000	243.7048	459.2955	657.1671	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	688.8425	542.8760	454.2651	252.9463	102.0496	0.0000	0.0000	0.0000	0.0000	260.9259	491.7510	703.6050	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7585	87.5420	87.0754	85.9690	83.8122	80.3000	80.3000	80.3000	80.3000	85.9285	87.2656	87.8455	(217)
Fuel for water heating, kWh/month													
	230.6330	203.0402	212.3823	190.7966	189.4785	174.1812	166.8789	186.0308	188.0853	200.1440	210.3761	224.9649	(219)
Water heating fuel used												2376.9918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3497.2615	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6306.0818	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3497.2615	0.2160	755.4085	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2376.9918	0.2160	513.4302	(264)
Space and water heating			1268.8387	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1492.9577	(272)
Emissions per m2 for space and water heating			15.7973	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7973 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.5900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 159 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 159	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 159, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 159 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 159	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 159, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.64	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.90		
CO_2 Emissions (t/year)	0.27	**DFEE**	40.11	**TFEE**	53.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.64	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.64	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.90	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.11	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 160 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 160	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 160, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.47	**TER**	16.90
Environmental	96 A	**% DER<TER**	61.72		
CO_2 Emissions (t/year)	0.22	**DFEE**	37.50	**TFEE**	49.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.87		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 0.96 m², No overhang
Windows facing South East: 5.90 m², No overhang
Windows facing North West: 7.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.8900	1.2357	17.1644			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.2100	17.3796			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.6840			(33)
Party Wall			44.7700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	207.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6523 (36)
Total fabric heat loss (33) + (36) =	52.3363 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	106.6133	105.9458	105.2783	101.9408	101.2733	97.9359	97.9359	97.2684	99.2709	101.2733	102.6083	103.9433	(39)
Average = Sum(39)m / 12 =												101.7740	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0669	1.0602	1.0266	1.0199	0.9863	0.9863	0.9795	0.9997	1.0199	1.0333	1.0468	(40)
HLP (average)												1.0249	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8169	10.6637	11.7839	11.3667	11.7162	11.3045	11.6603	11.6966	11.3384	11.7548	11.4100	11.8062 (61)

Total heat required for water heating calculated for each month

	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760 (64)

Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)

Heat gains from water heating, kWh/month

	56.7099	49.6809	51.4612	45.1385	43.5138	37.8477	35.3677	40.1640	40.5192	46.8565	50.7922	55.0110 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)

Water heating gains (Table 5)

	76.2229	73.9299	69.1683	62.6923	58.4863	52.5663	47.5372	53.9839	56.2767	62.9792	70.5448	73.9395	(72)

Total internal gains

	422.8200	420.4456	404.9619	379.9959	354.4866	330.1579	314.5477	321.0757	334.0906	359.2830	388.1520	409.9553	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9600	11.2829	0.7200	0.7000	0.7700	3.7832	(75)
Southeast	5.9000	36.7938	0.7200	0.7000	0.7700	75.8212	(77)
Northwest	7.0300	11.2829	0.7200	0.7000	0.7700	27.7039	(81)

Solar gains	107.3083	193.2445	292.1859	408.5966	500.1637	515.2418	488.9681	417.7967	332.0487	221.0667	130.4353	90.6011	(83)
Total gains	530.1283	613.6902	697.1478	788.5925	854.6503	845.3997	803.5157	738.8724	666.1393	580.3497	518.5873	500.5565	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5557	53.8931	54.2348	56.0104	56.3796	58.3009	58.3009	58.7010	57.5169	56.3796	55.6461	54.9314	
alpha	4.5704	4.5929	4.6157	4.7340	4.7586	4.8867	4.8867	4.9134	4.8345	4.7586	4.7097	4.6621	
util living area	0.9972	0.9941	0.9852	0.9530	0.8639	0.6878	0.5241	0.5841	0.8399	0.9728	0.9946	0.9979	(86)
MIT	19.6074	19.7793	20.0631	20.4583	20.7710	20.9486	20.9889	20.9820	20.8582	20.4500	19.9782	19.6049	(87)
Th 2	20.0224	20.0279	20.0335	20.0612	20.0668	20.0948	20.0948	20.1004	20.0836	20.0668	20.0557	20.0445	(88)
util rest of house	0.9964	0.9925	0.9808	0.9384	0.8228	0.6092	0.4222	0.4797	0.7779	0.9617	0.9927	0.9973	(89)
MIT 2	18.1518	18.4064	18.8225	19.4064	19.8292	20.0564	20.0897	20.0913	19.9581	19.4064	18.7168	18.1635	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3313	18.5757	18.9754	19.5361	19.9453	20.1664	20.2006	20.2011	20.0690	19.5350	18.8723	18.3412	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3313	18.5757	18.9754	19.5361	19.9453	20.1664	20.2006	20.2011	20.0690	19.5350	18.8723	18.3412	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9888	0.9740	0.9280	0.8166	0.6158	0.4344	0.4919	0.7768	0.9530	0.9893	0.9956	(94)
Useful gains	527.1318	606.7917	679.0500	731.8121	697.9182	520.6048	349.0605	363.4708	517.4455	553.0958	513.0259	498.3760	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1495.9177	1448.8792	1313.3935	1084.2511	835.0262	545.1461	352.6243	369.7285	592.5517	904.8792	1207.9373	1469.8837	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	720.7768	565.8828	471.9516	253.7561	102.0084	0.0000	0.0000	0.0000	0.0000	261.7268	500.3362	722.8017	(98)
Space heating												3599.2404	(98)
Space heating per m2											(98) / (4) =	36.2461	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3857.7067	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	720.7768	565.8828	471.9516	253.7561	102.0084	0.0000	0.0000	0.0000	0.0000	261.7268	500.3362	722.8017	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	772.5367	606.5196	505.8430	271.9787	109.3337	0.0000	0.0000	0.0000	0.0000	280.5218	536.2661	774.7071	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5784	89.5128	89.3706	88.9948	88.2216	86.7000	86.7000	86.7000	86.7000	88.9895	89.4193	89.5971	(217)
Fuel for water heating, kWh/month													
	193.6717	169.8776	176.4500	155.7114	151.6360	134.5243	126.0233	142.6715	143.8012	161.6353	174.0001	187.9257	(219)
Water heating fuel used												1917.9282	(219)
Annual totals kWh/year													
Space heating fuel - main system												3857.7067	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =										-1671.3992		-1671.3992	(233)
Total delivered energy for all uses												4610.3532	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3857.7067	0.2160	833.2646	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.9282	0.2160	414.2725	(264)
Space and water heating			1247.5371	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			642.7559	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4700	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		23.5576	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.5576	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.1800	14.8968			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0614	(36)
Total fabric heat loss (33) + (36) =	58.8500	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	105.9085	105.6526	105.4019	104.2239	104.0035	102.9776	102.9776	102.7876	103.3728	104.0035	104.4494	104.9155	(39)
Average = Sum(39)m / 12 =												104.2229	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0666	1.0640	1.0614	1.0496	1.0474	1.0370	1.0370	1.0351	1.0410	1.0474	1.0519	1.0566	(40)
HLP (average)												1.0496	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330	(42)
Average daily hot water use (litres/day)	99.1076	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.9725	433.6018	418.1255	392.6802	366.5019	341.5062	325.9030	333.0976	346.7848	372.4565	401.3135	423.1115	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(75)
Southeast	5.9000	36.7938	0.6300	0.7000	0.7700	66.3436	(77)
Northwest	7.0300	11.2829	0.6300	0.7000	0.7700	24.2409	(81)

Solar gains	93.8948	169.0890	255.6627	357.5220	437.6432	450.8366	427.8470	365.5721	290.5426	193.4333	114.1309	79.2760	(83)
Total gains	529.8673	602.6908	673.7882	750.2022	804.1452	792.3427	753.7500	698.6698	637.3273	565.8898	515.4444	502.3875	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1112	65.2689	65.4242	66.1636	66.3038	66.9644	66.9644	67.0882	66.7084	66.3038	66.0208	65.7275	
alpha	5.3407	5.3513	5.3616	5.4109	5.4203	5.4643	5.4643	5.4725	5.4472	5.4203	5.4014	5.3818	
util living area	0.9989	0.9975	0.9930	0.9747	0.9108	0.7583	0.5857	0.6487	0.8883	0.9855	0.9976	0.9992	(86)
MIT	19.8097	19.9432	20.1740	20.4895	20.7736	20.9438	20.9888	20.9811	20.8580	20.4950	20.0971	19.7871	(87)
Th 2	20.0282	20.0304	20.0324	20.0422	20.0440	20.0526	20.0526	20.0542	20.0493	20.0440	20.0403	20.0365	(88)
util rest of house	0.9985	0.9966	0.9905	0.9646	0.8745	0.6734	0.4676	0.5291	0.8294	0.9780	0.9966	0.9989	(89)
MIT 2	18.4294	18.6260	18.9638	19.4247	19.8117	20.0131	20.0482	20.0458	19.9272	19.4388	18.8585	18.4023	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.5995	18.7884	19.1130	19.5559	19.9303	20.1278	20.1641	20.1611	20.0420	19.5690	19.0112	18.5730	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5995	18.7884	19.1130	19.5559	19.9303	20.1278	20.1641	20.1611	20.0420	19.5690	19.0112	18.5730	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9949	0.9869	0.9577	0.8694	0.6808	0.4820	0.5434	0.8289	0.9727	0.9950	0.9982	(94)
Useful gains	528.6029	599.6428	664.9803	718.4984	699.0893	539.4125	363.2978	379.6698	528.2733	550.4408	512.8478	501.4829	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1514.4397	1467.3449	1329.4340	1110.6007	855.9816	569.2397	367.0239	386.5916	614.2365	932.8070	1244.1146	1507.9450	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	733.4626	583.0958	494.3536	282.3136	116.7278	0.0000	0.0000	0.0000	0.0000	284.4804	526.5121	748.8078	(98)
Space heating												3769.7538	(98)
Space heating per m2											(98) / (4) =	37.9633	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4036.1390	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	733.4626	583.0958	494.3536	282.3136	116.7278	0.0000	0.0000	0.0000	0.0000	284.4804	526.5121	748.8078	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	785.2919	624.2995	529.2865	302.2630	124.9763	0.0000	0.0000	0.0000	0.0000	304.5829	563.7175	801.7214	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9148	87.7163	87.2736	86.2472	84.1329	80.3000	80.3000	80.3000	80.3000	86.1573	87.4442	87.9981	(217)
Fuel for water heating, kWh/month													
	241.8591	213.6728	225.5775	203.0278	201.5066	185.9471	178.1515	198.5972	200.7905	212.4517	221.2778	235.8330	(219)
Water heating fuel used												2518.6926	(219)
Annual totals kWh/year													
Space heating fuel - main system												4036.1390	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Total delivered energy for all uses												7060.9491	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4036.1390	0.2160	871.8060	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2518.6926	0.2160	544.0376	(264)
Space and water heating			1415.8436	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Total CO2, kg/m2/year			1678.5186	(272)
Emissions per m2 for space and water heating			14.2582	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2533	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2582 * 1.00) + 2.2533 + 0.3920, rounded to 2 d.p.			16.9000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 160 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 160	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 160, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.47	**TER**	16.90
Environmental	96 A	**% DER<TER**	61.72		
CO_2 Emissions (t/year)	0.22	**DFEE**	37.50	**TFEE**	49.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.87		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.02 m	49.65 m²	2.31 m
1st Storey:	20.02 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	207.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	98.79	82.76

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	44.77

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.065	No
Independently assessed	E3 Sill	8.97	0.004	No
Independently assessed	E4 Jamb	26.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.02	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.02	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.95	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.07	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.07	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.07	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.07	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 160 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 160	**Prop Type Ref**	Opp
Property	L363-3-R Semi SG, Plot 160, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.47	**TER**	16.90
Environmental	96 A	**% DER<TER**	61.72		
CO_2 Emissions (t/year)	0.22	**DFEE**	37.50	**TFEE**	49.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.87		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	6.47	$kgCO_2/yr/m^2$	
TER	16.90	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.47	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.72	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.50	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	17.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.47	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.47	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.65	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.74	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.74	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 161 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 161	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 161, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.37	**TER**	16.80
Environmental	96 A	**% DER<TER**	62.09		
CO_2 Emissions (t/year)	0.21	**DFEE**	37.06	**TFEE**	48.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 5.90 m², No overhang
Windows facing South West: 0.96 m², No overhang
Windows facing North West: 7.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.8900	1.2357	17.1644			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.2100	17.3796			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.6840			(33)
Party Wall			44.7700	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	207.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6523 (36)
Total fabric heat loss (33) + (36) =	52.3363 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	106.6133	105.9458	105.2783	101.9408	101.2733	97.9359	97.9359	97.2684	99.2709	101.2733	102.6083	103.9433	(39)
Average = Sum(39)m / 12 =												101.7740	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0669	1.0602	1.0266	1.0199	0.9863	0.9863	0.9795	0.9997	1.0199	1.0333	1.0468	(40)
HLP (average)												1.0249	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8169	10.6637	11.7839	11.3667	11.7162	11.3045	11.6603	11.6966	11.3384	11.7548	11.4100	11.8062 (61)

Total heat required for water heating calculated for each month

	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760 (64)

Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)

Heat gains from water heating, kWh/month

	56.7099	49.6809	51.4612	45.1385	43.5138	37.8477	35.3677	40.1640	40.5192	46.8565	50.7922	55.0110 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)

Water heating gains (Table 5)

	76.2229	73.9299	69.1683	62.6923	58.4863	52.5663	47.5372	53.9839	56.2767	62.9792	70.5448	73.9395	(72)

Total internal gains

	422.8200	420.4456	404.9619	379.9959	354.4866	330.1579	314.5477	321.0757	334.0906	359.2830	388.1520	409.9553	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	5.9000	36.7938	0.7200	0.7000	0.7700	75.8212	(77)
Southwest	0.9600	36.7938	0.7200	0.7000	0.7700	12.3370	(79)
Northwest	7.0300	11.2829	0.7200	0.7000	0.7700	27.7039	(81)

Solar gains	115.8622	206.5583	307.0645	421.4372	509.4397	522.2045	496.6156	428.4471	346.2759	234.8812	140.4520	98.0695	(83)
Total gains	538.6821	627.0039	712.0264	801.4331	863.9263	852.3624	811.1633	749.5227	680.3666	594.1643	528.6040	508.0248	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5557	53.8931	54.2348	56.0104	56.3796	58.3009	58.3009	58.7010	57.5169	56.3796	55.6461	54.9314	
alpha	4.5704	4.5929	4.6157	4.7340	4.7586	4.8867	4.8867	4.9134	4.8345	4.7586	4.7097	4.6621	
util living area	0.9970	0.9936	0.9840	0.9503	0.8600	0.6835	0.5196	0.5769	0.8314	0.9703	0.9941	0.9978	(86)
MIT	19.6167	19.7937	20.0785	20.4697	20.7762	20.9499	20.9893	20.9830	20.8651	20.4635	19.9891	19.6132	(87)
Th 2	20.0224	20.0279	20.0335	20.0612	20.0668	20.0948	20.0948	20.1004	20.0836	20.0668	20.0557	20.0445	(88)
util rest of house	0.9962	0.9918	0.9792	0.9350	0.8182	0.6050	0.4183	0.4733	0.7680	0.9583	0.9921	0.9971	(89)
MIT 2	18.1655	18.4273	18.8445	19.4219	19.8353	20.0575	20.0899	20.0918	19.9652	19.4250	18.7327	18.1756	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3444	18.5957	18.9966	19.5510	19.9513	20.1675	20.2008	20.2017	20.0761	19.5530	18.8875	18.3528	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3444	18.5957	18.9966	19.5510	19.9513	20.1675	20.2008	20.2017	20.0761	19.5530	18.8875	18.3528	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9878	0.9721	0.9246	0.8123	0.6117	0.4305	0.4855	0.7674	0.9494	0.9885	0.9954	(94)
Useful gains	535.4464	619.3851	692.1903	740.9829	701.7762	521.4007	349.2188	363.8713	522.0927	564.1232	522.5165	505.6794	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1497.3193	1451.0056	1315.6242	1085.7737	835.6347	545.2581	352.6461	369.7834	593.2550	906.7021	1209.4994	1471.0887	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	715.6334	558.8490	463.8348	248.2494	99.5907	0.0000	0.0000	0.0000	0.0000	254.8787	494.6277	718.2645	(98)
Space heating												3553.9283	(98)
Space heating per m2											(98) / (4) =	35.7898	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3809.1407	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	715.6334	558.8490	463.8348	248.2494	99.5907	0.0000	0.0000	0.0000	0.0000	254.8787	494.6277	718.2645	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	767.0240	598.9807	497.1434	266.0765	106.7425	0.0000	0.0000	0.0000	0.0000	273.1819	530.1476	769.8440	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5743	89.5051	89.3586	88.9765	88.2006	86.7000	86.7000	86.7000	86.7000	88.9673	89.4116	89.5935	(217)
Fuel for water heating, kWh/month													
	193.6806	169.8923	176.4737	155.7435	151.6721	134.5243	126.0233	142.6715	143.8012	161.6756	174.0150	187.9332	(219)
Water heating fuel used												1918.1064	(219)
Annual totals kWh/year													
Space heating fuel - main system												3809.1407	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =										-1671.3992		-1671.3992	(233)
Total delivered energy for all uses												4561.9654	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3809.1407	0.2160	822.7744	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1918.1064	0.2160	414.3110	(264)
Space and water heating			1237.0854	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			632.3042	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.3700	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		23.4576	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.4576	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	98.7900	16.0300	82.7600	0.1800	14.8968			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			198.0900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0614	(36)
Total fabric heat loss (33) + (36) =	58.8500	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	105.9085	105.6526	105.4019	104.2239	104.0035	102.9776	102.9776	102.7876	103.3728	104.0035	104.4494	104.9155	(39)
Average = Sum(39)m / 12 =												104.2229	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0666	1.0640	1.0614	1.0496	1.0474	1.0370	1.0370	1.0351	1.0410	1.0474	1.0519	1.0566	(40)
HLP (average)												1.0496	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330	(42)
Average daily hot water use (litres/day)	99.1076	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.4117	21.6822	17.6332	13.3494	9.9789	8.4246	9.1031	11.8325	15.8815	20.1653	23.5358	25.0901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.9725	433.6018	418.1255	392.6802	366.5019	341.5062	325.9030	333.0976	346.7848	372.4565	401.3135	423.1115	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	5.9000	36.7938	0.6300	0.7000	0.7700	66.3436	(77)
Southwest	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(79)
Northwest	7.0300	11.2829	0.6300	0.7000	0.7700	24.2409	(81)

Solar gains	101.3794	180.7385	268.6815	368.7576	445.7598	456.9289	434.5387	374.8912	302.9914	205.5211	122.8955	85.8108	(83)
Total gains	537.3519	614.3403	686.8070	761.4378	812.2617	798.4351	760.4417	707.9888	649.7762	577.9775	524.2090	508.9223	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1112	65.2689	65.4242	66.1636	66.3038	66.9644	66.9644	67.0882	66.7084	66.3038	66.0208	65.7275	
alpha	5.3407	5.3513	5.3616	5.4109	5.4203	5.4643	5.4643	5.4725	5.4472	5.4203	5.4014	5.3818	
util living area													
	0.9988	0.9973	0.9924	0.9731	0.9077	0.7544	0.5811	0.6416	0.8814	0.9841	0.9974	0.9991	(86)
MIT	19.8168	19.9543	20.1860	20.4989	20.7784	20.9452	20.9892	20.9820	20.8644	20.5057	20.1054	19.7933	(87)
Th 2	20.0282	20.0304	20.0324	20.0422	20.0440	20.0526	20.0526	20.0542	20.0493	20.0440	20.0403	20.0365	(88)
util rest of house													
	0.9984	0.9963	0.9896	0.9624	0.8708	0.6693	0.4636	0.5226	0.8207	0.9760	0.9963	0.9988	(89)
MIT 2	18.4398	18.6421	18.9812	19.4376	19.8174	20.0142	20.0484	20.0463	19.9338	19.4538	18.8706	18.4114	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.6095	18.8038	19.1297	19.5684	19.9359	20.1290	20.1643	20.1616	20.0485	19.5835	19.0228	18.5817	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6095	18.8038	19.1297	19.5684	19.9359	20.1290	20.1643	20.1616	20.0485	19.5835	19.0228	18.5817	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9945	0.9859	0.9554	0.8658	0.6768	0.4780	0.5369	0.8207	0.9704	0.9946	0.9981	(94)
Useful gains	535.9849	610.9606	677.0957	727.5054	703.2207	540.3569	363.4657	380.1112	533.2603	560.8745	521.3632	507.9492	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1515.5016	1468.9761	1331.1908	1111.9062	856.5622	569.3608	367.0451	386.6470	614.9166	934.3128	1245.3306	1508.8671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	728.7604	576.5864	486.6468	276.7686	114.0861	0.0000	0.0000	0.0000	0.0000	277.8381	521.2565	744.6830	(98)
Space heating												3726.6259	(98)
Space heating per m2											(98) / (4) =	37.5290	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3989.9635	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	728.7604	576.5864	486.6468	276.7686	114.0861	0.0000	0.0000	0.0000	0.0000	277.8381	521.2565	744.6830	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	780.2574	617.3302	521.0351	296.3261	122.1479	0.0000	0.0000	0.0000	0.0000	297.4712	558.0905	797.3051	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9027	87.6941	87.2396	86.1986	84.0786	80.3000	80.3000	80.3000	80.3000	86.0990	87.4232	87.9880	(217)
Fuel for water heating, kWh/month													
	241.8923	213.7269	225.6654	203.1423	201.6367	185.9471	178.1515	198.5972	200.7905	212.5954	221.3310	235.8602	(219)
Water heating fuel used												2519.3364	(219)
Annual totals kWh/year													
Space heating fuel - main system												3989.9635	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1175	(232)
Total delivered energy for all uses												7015.4174	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3989.9635	0.2160	861.8321	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2519.3364	0.2160	544.1767	(264)
Space and water heating			1406.0088	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1175	0.5190	223.7500	(268)
Total CO2, kg/m2/year			1668.6838	(272)
Emissions per m2 for space and water heating			14.1592	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2533	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1592 * 1.00) + 2.2533 + 0.3920, rounded to 2 d.p.			16.8000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 161 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 161	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 161, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.37	**TER**	16.80
Environmental	96 A	**% DER<TER**	62.09		
CO_2 Emissions (t/year)	0.21	**DFEE**	37.06	**TFEE**	48.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.02 m	49.65 m²	2.31 m
1st Storey:	20.02 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	207.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	98.79	82.76

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	44.77

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.065	No
Independently assessed	E3 Sill	8.97	0.004	No
Independently assessed	E4 Jamb	26.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.02	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.02	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.95	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.07	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.07	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.07	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.07	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 161 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 161	**Prop Type Ref**	As
Property	L363-3-R Semi SG, Plot 161, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.37	**TER**	16.80
Environmental	96 A	**% DER<TER**	62.09		
CO_2 Emissions (t/year)	0.21	**DFEE**	37.06	**TFEE**	48.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	6.37	$kgCO_2/yr/m^2$	
TER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.09	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	17.27	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.36	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.36	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.63	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.63	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 162 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 162	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 162, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 9.16 m², No overhang
Windows facing South East: 7.51 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 6.76 m², No overhang
Windows facing West: 1.07 m², No overhang
Windows facing North West: 0.48 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                          m2          Table 6a     Specific data  Specific data      factor               W
                                                         W/m2     or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                9.1600           11.2829         0.7200         0.7000      0.7700      36.0979 (75)
Southeast                                7.5100           36.7938         0.7200         0.7000      0.7700      96.5114 (77)
South                                    1.0700           46.7521         0.7200         0.7000      0.7700      17.4722 (78)
Southwest                                6.7600           36.7938         0.7200         0.7000      0.7700      86.8731 (79)
West                                     1.0700           19.6403         0.7200         0.7000      0.7700       7.3400 (80)
Northwest                                0.4800           11.2829         0.7200         0.7000      0.7700       1.8916 (81)
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Solar gains   246.1862  432.6740  626.8192  834.0602  985.9179 1001.3450  956.0300  839.4110  698.1288  487.6407  297.3157  209.0967 (83)
Total gains   716.3445  900.5580 1077.6469 1257.0811 1380.1617 1368.2507 1305.4197 1195.3852 1068.5973  886.1513  728.0896  664.5881 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9960    0.9895    0.9722    0.9194    0.8044    0.6238    0.4705    0.5275    0.7811    0.9551    0.9916    0.9971 (86)

MIT           19.3950   19.6383   19.9951   20.4461   20.7746   20.9466   20.9874   20.9800   20.8572   20.4024   19.8261   19.3778 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9949    0.9867    0.9644    0.8969    0.7534    0.5408    0.3675    0.4207    0.7077    0.9380    0.9889    0.9962 (89)
MIT 2         17.7777   18.1352   18.6538   19.3062   19.7369   19.9501   19.9829   19.9842   19.8575   19.2624   18.4283   17.7666 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1191 (91)
MIT           17.9704   18.3143   18.8136   19.4420   19.8605   20.0688   20.1026   20.1028   19.9766   19.3982   18.5948   17.9586 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  17.9704   18.3143   18.8136   19.4420   19.8605   20.0688   20.1026   20.1028   19.9766   19.3982   18.5948   17.9586 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9917    0.9803    0.9533    0.8833    0.7478    0.5478    0.3794    0.4327    0.7076    0.9256    0.9835    0.9938 (94)
Useful gains  710.4110  882.8238 1027.3076 1110.4047 1032.1432  749.5274  495.3090  517.2190  756.1111  820.2383  716.0905  660.4741 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2103.6689 2052.8637 1873.9600 1559.5688 1200.3255  781.1738  500.3121  525.7731  849.4106 1294.1252 1710.2934 2070.4925 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1036.5839  786.2669  629.9094  323.3981  125.1276    0.0000    0.0000    0.0000    0.0000  352.5718  715.8261 1049.0537 (98)
Space heating                                                                                                          5018.7375 (98)
Space heating per m2                                                                                  (98) / (4) =     39.1844 (99)


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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5379.1399	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1036.5839	786.2669	629.9094	323.3981	125.1276	0.0000	0.0000	0.0000	0.0000	352.5718	715.8261	1049.0537	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1111.0224	842.7297	675.1440	346.6218	134.1132	0.0000	0.0000	0.0000	0.0000	377.8905	767.2305	1124.3876	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7497	89.6789	89.5350	89.1628	88.3730	86.7000	86.7000	86.7000	86.7000	89.2007	89.6167	89.7690	(217)
Fuel for water heating, kWh/month													
	200.0885	175.5031	182.2656	160.8016	156.5896	139.1090	130.2717	147.5475	148.7340	166.8313	179.6781	194.1368	(219)
Water heating fuel used												1981.5569	(219)
Annual totals kWh/year													
Space heating fuel - main system												5379.1399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =											-2338.3122	-2338.3122	(233)
Total delivered energy for all uses												5564.9564	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5379.1399	0.2160	1161.8942	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.5569	0.2160	428.0163	(264)
Space and water heating			1589.9105	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			657.9213	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.1400	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.2773	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.2773	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019 (64)
Heat gains from water heating, kWh/month												
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.1600	11.2829	0.6300	0.7000	0.7700	31.5856	(75)
Southeast	7.5100	36.7938	0.6300	0.7000	0.7700	84.4475	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	6.7600	36.7938	0.6300	0.7000	0.7700	76.0140	(79)
West	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(80)
Northwest	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(81)

Solar gains	215.4130	378.5897	548.4668	729.8027	862.6782	876.1769	836.5262	734.4846	610.8627	426.6856	260.1512	182.9596 (83)
Total gains	698.7194	859.6258	1012.4543	1165.9939	1269.5309	1254.9998	1197.8408	1103.0749	994.5121	838.3661	704.0827	651.6030 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9987	0.9962	0.9881	0.9581	0.8718	0.7069	0.5396	0.6022	0.8503	0.9785	0.9969	0.9991	(86)
MIT	19.6339	19.8196	20.1064	20.4719	20.7767	20.9439	20.9880	20.9800	20.8561	20.4463	19.9675	19.6021	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9982	0.9948	0.9837	0.9420	0.8244	0.6133	0.4165	0.4758	0.7777	0.9674	0.9957	0.9987	(89)
MIT 2	18.0920	18.3646	18.7826	19.3093	19.7128	19.9023	19.9349	19.9327	19.8200	19.2832	18.5883	18.0512	(90)
Living area fraction										fLA = Living area / (4) =		0.1191	(91)
MIT	18.2757	18.5380	18.9403	19.4479	19.8395	20.0264	20.0604	20.0574	19.9434	19.4218	18.7526	18.2360	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2757	18.5380	18.9403	19.4479	19.8395	20.0264	20.0604	20.0574	19.9434	19.4218	18.7526	18.2360	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9922	0.9781	0.9326	0.8196	0.6216	0.4311	0.4904	0.7783	0.9600	0.9934	0.9979	(94)
Useful gains	696.7033	852.9278	990.2387	1087.4454	1040.5111	780.1098	516.3403	540.9997	774.0680	804.8129	699.4607	650.2474	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2159.0767	2102.2961	1913.5654	1606.0891	1237.0143	817.3446	521.2162	549.9823	883.2022	1340.6996	1777.7699	2150.0138	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1088.0058	839.5755	686.9550	373.4235	146.1984	0.0000	0.0000	0.0000	0.0000	398.6997	776.3827	1115.8262	(98)
Space heating												5425.0668	(98)
Space heating per m2											(98) / (4) =	42.3569	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5808.4227	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1088.0058	839.5755	686.9550	373.4235	146.1984	0.0000	0.0000	0.0000	0.0000	398.6997	776.3827	1115.8262	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1164.8885	898.9031	735.4979	399.8110	156.5294	0.0000	0.0000	0.0000	0.0000	426.8734	831.2448	1194.6747	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5362	88.3258	87.8848	86.8305	84.5896	80.3000	80.3000	80.3000	80.3000	86.8976	88.1390	88.6106	(217)
Fuel for water heating, kWh/month													
	247.0268	218.2170	230.2505	208.8045	207.9536	192.9379	184.8492	206.0635	207.8622	216.3562	225.6836	240.8459	(219)
Water heating fuel used												2586.8509	(219)
Annual totals kWh/year													
Space heating fuel - main system												5808.4227	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												8937.8455	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5808.4227	0.2160	1254.6193	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.8509	0.2160	558.7598	(264)
Space and water heating			1813.3791	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2094.9739	(272)
Emissions per m2 for space and water heating			14.1582	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1582 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.3600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 162 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 162	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 162, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	South East							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	0.48	100
W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	2.05	100
D2	Half Glazed Door	[1] External Wall	North West			2.14	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00	1.07	100
W15	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 162 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 162	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 162, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.14	**TER**	16.36
Environmental	96 A	**% DER<TER**	68.58		
CO_2 Emissions (t/year)	0.13	**DFEE**	41.72	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.14	$kgCO_2/yr/m^2$	
TER	16.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.14	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.58	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.66	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.80	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.80	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.33	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.33	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 163 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 163	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 163, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.43	**TER**	16.44
Environmental	95 A	**% DER<TER**	60.88		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.72	**TFEE**	55.48
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.43 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 10.34 m², No overhang
Windows facing South West: 8.19 m², No overhang
Windows facing North West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8318	10.6767	11.7973	11.3860	11.7376	11.3222	11.6766	11.7162	11.3556	11.7670	11.4232	11.8206	(61)
Total heat required for water heating calculated for each month													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
								Total per year (kWh/year) = Sum(64)m =				1766.1786	(64)
Heat gains from water heating, kWh/month													
	59.0688	51.7440	53.5902	46.9965	45.2973	39.3865	36.7936	41.8005	42.1746	48.7837	52.8959	57.2955	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	79.3935	77.0001	72.0298	65.2729	60.8835	54.7035	49.4538	56.1835	58.5759	65.5695	73.4666	77.0101	(72)
Total internal gains													
	487.3714	484.8707	466.9195	437.7862	407.6209	379.1718	361.1270	367.9639	383.3372	412.7072	446.3802	472.1928	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.3400	11.2829	0.7200	0.7000	0.7700	40.7480	(75)
Southwest	8.1900	36.7938	0.7200	0.7000	0.7700	105.2501	(79)
Northwest	0.7200	11.2829	0.7200	0.7000	0.7700	2.8374	(81)

Solar gains	148.8356	267.9993	405.1427	566.4468	693.2995	714.1641	677.7611	579.1670	460.3791	306.5646	180.9072	125.6662	(83)
Total gains	636.2069	752.8700	872.0623	1004.2331	1100.9204	1093.3359	1038.8881	947.1309	843.7163	719.2718	627.2874	597.8590	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area													
	0.9980	0.9957	0.9889	0.9647	0.8948	0.7438	0.5843	0.6495	0.8815	0.9811	0.9962	0.9985	(86)
MIT	19.3681	19.5499	19.8576	20.2941	20.6636	20.9057	20.9753	20.9615	20.7767	20.2952	19.7754	19.3672	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house													
	0.9975	0.9945	0.9856	0.9534	0.8597	0.6654	0.4711	0.5368	0.8286	0.9733	0.9950	0.9981	(89)
MIT 2	17.7802	18.0495	18.5014	19.1490	19.6610	19.9766	20.0393	20.0361	19.8302	19.1614	18.3985	17.7937	(90)
Living area fraction									fLA = Living area / (4) =			0.2010	(91)
MIT	18.0994	18.3512	18.7741	19.3792	19.8626	20.1634	20.2275	20.2221	20.0205	19.3894	18.6753	18.1100	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0994	18.3512	18.7741	19.3792	19.8626	20.1634	20.2275	20.2221	20.0205	19.3894	18.6753	18.1100	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9915	0.9800	0.9438	0.8529	0.6756	0.4931	0.5579	0.8273	0.9661	0.9924	0.9969	(94)
Useful gains	633.6009	746.4915	854.5839	947.7786	938.9970	738.6061	512.2887	528.3604	697.9702	694.8526	622.5233	595.9988	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2169.2578	2101.5513	1905.8164	1576.6378	1220.2228	804.8575	524.7893	549.2696	867.9400	1313.9187	1752.6994	2133.0265	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1142.5287	910.6002	782.1170	452.7786	209.2320	0.0000	0.0000	0.0000	0.0000	460.5851	813.7268	1143.5486	(98)
Space heating												5915.1171	(98)
Space heating per m2											(98) / (4) =	42.4571	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6339.8897	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1142.5287	910.6002	782.1170	452.7786	209.2320	0.0000	0.0000	0.0000	0.0000	460.5851	813.7268	1143.5486	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1224.5753	975.9916	838.2819	485.2933	224.2572	0.0000	0.0000	0.0000	0.0000	493.6604	872.1616	1225.6684	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7911	89.7482	89.6544	89.4035	88.8269	86.7000	86.7000	86.7000	86.7000	89.3898	89.6820	89.8045	(217)
Fuel for water heating, kWh/month													
	201.1180	176.3492	183.0370	161.2553	156.6473	139.8673	130.9744	148.3539	149.5485	167.3989	180.5489	195.1464	(219)
Water heating fuel used												1990.2452	(219)
Annual totals kWh/year													
Space heating fuel - main system												6339.8897	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1029 * 1.00) =										-2338.3122		-2338.3122	(233)
Total delivered energy for all uses												6589.6311	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6339.8897	0.2160	1369.4162	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.2452	0.2160	429.8930	(264)
Space and water heating			1799.3091	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2338.3122	0.5190	-1213.5840	(269)
Total CO2, kg/year			895.9877	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4300	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.9139	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.9139	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.3400	11.2829	0.6300	0.7000	0.7700	35.6545	(75)
Southwest	8.1900	36.7938	0.6300	0.7000	0.7700	92.0939	(79)
Northwest	0.7200	11.2829	0.6300	0.7000	0.7700	2.4827	(81)

Solar gains	130.2311	234.4994	354.4999	495.6410	606.6371	624.8936	593.0410	506.7711	402.8317	268.2441	158.2938	109.9580	(83)
Total gains	630.7500	732.5214	834.5786	946.5970	1026.9650	1016.0767	966.1869	887.4493	799.3492	694.1205	617.8309	595.3020	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9995	0.9987	0.9962	0.9848	0.9401	0.8160	0.6509	0.7188	0.9283	0.9924	0.9989	0.9996	(86)
MIT	19.6827	19.8175	20.0552	20.3857	20.6994	20.9114	20.9793	20.9658	20.7983	20.3973	19.9825	19.6612	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9993	0.9983	0.9947	0.9782	0.9121	0.7347	0.5216	0.5924	0.8824	0.9882	0.9984	0.9995	(89)
MIT 2	18.2217	18.4203	18.7691	19.2548	19.6930	19.9554	20.0126	20.0066	19.8336	19.2763	18.6688	18.1959	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.5154	18.7012	19.0277	19.4822	19.8953	20.1476	20.2070	20.1994	20.0275	19.5017	18.9329	18.4905	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5154	18.7012	19.0277	19.4822	19.8953	20.1476	20.2070	20.1994	20.0275	19.5017	18.9329	18.4905	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9974	0.9926	0.9733	0.9079	0.7465	0.5477	0.6173	0.8830	0.9849	0.9976	0.9992	(94)
Useful gains	630.0448	730.6071	828.3832	921.3698	932.4018	758.5443	529.1363	547.8370	705.8124	683.6719	616.3330	594.8135	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2186.0525	2117.5598	1917.8922	1603.1269	1239.0854	831.0409	540.3295	568.1789	891.1319	1345.8809	1796.2305	2178.3347	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1157.6697	932.0322	810.5947	490.8651	228.1726	0.0000	0.0000	0.0000	0.0000	492.6834	849.5262	1178.1398	(98)
Space heating												6139.6838	(98)
Space heating per m2											(98) / (4) =	44.0689	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6573.5373	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1157.6697	932.0322	810.5947	490.8651	228.1726	0.0000	0.0000	0.0000	0.0000	492.6834	849.5262	1178.1398	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1239.4751	997.8932	867.8744	525.5515	244.2962	0.0000	0.0000	0.0000	0.0000	527.4983	909.5570	1261.3916	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6219	88.4856	88.1765	87.4246	85.6921	80.3000	80.3000	80.3000	80.3000	87.3557	88.2855	88.6827	(217)
Fuel for water heating, kWh/month													
	247.9220	218.8163	230.5175	208.2903	206.5081	194.0940	185.9568	207.2983	208.7397	216.1618	226.3243	241.7477	(219)
Water heating fuel used												2592.3769	(219)
Annual totals kWh/year													
Space heating fuel - main system												6573.5373	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9763.7227	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6573.5373	0.2160	1419.8840	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2592.3769	0.2160	559.9534	(264)
Space and water heating			1979.8375	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2290.1001	(272)
Emissions per m2 for space and water heating			14.2107	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2107 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.4400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 163 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 163	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 163, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.43	**TER**	16.44
Environmental	95 A	**% DER<TER**	60.88		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.72	**TFEE**	55.48
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	South East							2.14	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 163 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 163	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 163, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.43	**TER**	16.44
Environmental	95 A	**% DER<TER**	60.88		
CO_2 Emissions (t/year)	0.31	**DFEE**	42.72	**TFEE**	55.48
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	6.43	$kgCO_2/yr/m^2$	
TER	16.44	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.43	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.88	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	17.05	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.53	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.53	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.34	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.82	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.82	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 164 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 164	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 164, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 12.05 m², No overhang
Windows facing South East: 0.48 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 9.18 m², No overhang
Windows facing West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.6600 (1b)	x	2.3100 (2b)	=	177.0846	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.4392	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1598	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3848	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3271	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4170	0.4089	0.4007	0.3598	0.3516	0.3107	0.3107	0.3026	0.3271	0.3516	0.3680	0.3843	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6670	0.6589	0.6507	0.6098	0.6016	0.5607	0.5607	0.5526	0.5771	0.6016	0.6180	0.6343	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8500	1.2357	29.4724			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.6600	0.1200	9.1992			(28a)
External Wall	178.2400	28.1300	150.1100	0.2100	31.5231			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			331.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.0925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		190.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.9464	(36)
Total fabric heat loss	(33) + (36) =	88.0390	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6430	81.6299	80.6167	75.5511	74.5380	69.4724	69.4724	68.4593	71.4986	74.5380	76.5643	78.5905	(38)
Heat transfer coeff	170.6819	169.6688	168.6557	163.5901	162.5770	157.5113	157.5113	156.4982	159.5376	162.5770	164.6032	166.6295	(39)
Average = Sum(39)m / 12 =												163.3368	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1223	1.1157	1.1090	1.0757	1.0690	1.0357	1.0357	1.0291	1.0490	1.0690	1.0823	1.0957	(40)
HLP (average)												1.0740	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9374 (42)
Average daily hot water use (litres/day)		103.9630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3592	110.2007	106.0422	101.8837	97.7252	93.5667	93.5667	97.7252	101.8837	106.0422	110.2007	114.3592	(44)
Energy conte	169.5915	148.3258	153.0589	133.4405	128.0393	110.4882	102.3835	117.4866	118.8998	138.5546	151.2432	164.2403	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7421	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4387	22.2489	22.9588	20.0161	19.2059	16.5732	15.3575	17.6230	17.8335	20.7832	22.6865	24.6360	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8336	10.6782	11.7989	11.3874	11.7402	11.3243	11.6786	11.7185	11.3569	11.7684	11.4248	11.8223 (61)

Total heat required for water heating calculated for each month

	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626 (64)

Total per year (kWh/year) = Sum(64)m = 1774.2743 (64)

Heat gains from water heating, kWh/month

	59.3476	51.9879	53.8418	47.2158	45.5081	39.5684	36.9622	41.9939	42.3701	49.0115	53.1446	57.5655 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	30.1414	26.7713	21.7719	16.4827	12.3210	10.4019	11.2397	14.6097	19.6092	24.8983	29.0600	30.9791	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	322.7760	326.1254	317.6850	299.7164	277.0343	255.7163	241.4745	238.1251	246.5655	264.5341	287.2162	308.5342	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	(71)

Water heating gains (Table 5)

	79.7682	77.3629	72.3680	65.5775	61.1668	54.9561	49.6804	56.4435	58.8473	65.8757	73.8119	77.3730	(72)

Total internal gains

	502.7464	500.3204	481.8857	451.8375	420.5829	391.1351	372.4554	379.2391	395.0828	425.3689	460.1490	486.9471	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0500	11.2829	0.7200	0.7000	0.7700	47.4868	(75)
Southeast	0.4800	36.7938	0.7200	0.7000	0.7700	6.1685	(77)
South	1.0700	46.7521	0.7200	0.7000	0.7700	17.4722	(78)
Southwest	9.1800	36.7938	0.7200	0.7000	0.7700	117.9727	(79)
West	1.0700	19.6403	0.7200	0.7000	0.7700	7.3400	(80)

Solar gains	196.4402	351.0928	523.5756	720.1813	871.1836	893.0793	849.3036	732.4607	591.0651	399.7353	238.3059	166.1528	(83)
Total gains	699.1866	851.4132	1005.4613	1172.0187	1291.7665	1284.2145	1221.7590	1111.6999	986.1479	825.1043	698.4549	653.0999	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.0257	47.3065	47.5907	49.0644	49.3701	50.9579	50.9579	51.2878	50.3107	49.3701	48.7624	48.1694	
alpha	4.1350	4.1538	4.1727	4.2710	4.2913	4.3972	4.3972	4.4192	4.3540	4.2913	4.2508	4.2113	
util living area													
	0.9977	0.9946	0.9854	0.9536	0.8689	0.7052	0.5460	0.6106	0.8550	0.9759	0.9955	0.9983	(86)
MIT	19.3490	19.5523	19.8810	20.3320	20.6976	20.9198	20.9797	20.9678	20.7991	20.3125	19.7674	19.3432	(87)
Th 2	19.9826	19.9881	19.9935	20.0207	20.0262	20.0537	20.0537	20.0592	20.0427	20.0262	20.0153	20.0044	(88)
util rest of house													
	0.9971	0.9931	0.9813	0.9397	0.8295	0.6262	0.4381	0.5014	0.7969	0.9663	0.9941	0.9979	(89)
MIT 2	17.7591	18.0594	18.5411	19.2057	19.7054	19.9909	20.0437	20.0417	19.8574	19.1904	18.3926	17.7648	(90)
Living area fraction									fLA = Living area / (4) =			0.2134	(91)
MIT	18.0984	18.3780	18.8271	19.4461	19.9172	20.1892	20.2435	20.2394	20.0584	19.4299	18.6860	18.1017	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0984	18.3780	18.8271	19.4461	19.9172	20.1892	20.2435	20.2394	20.0584	19.4299	18.6860	18.1017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9896	0.9745	0.9293	0.8244	0.6384	0.4606	0.5235	0.7980	0.9583	0.9911	0.9965	(94)
Useful gains	695.9391	842.5370	979.8095	1089.1374	1064.9137	819.8464	562.7248	581.9799	786.9370	790.6798	692.2327	650.8291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2355.1427	2286.8005	2079.0302	1725.2367	1335.9245	880.3584	573.8875	600.8578	950.5826	1435.5358	1907.0940	2316.4353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1234.4475	970.5451	817.8202	457.9915	201.6320	0.0000	0.0000	0.0000	0.0000	479.7729	874.7001	1239.2110	(98)
Space heating												6276.1202	(98)
Space heating per m2											(98) / (4) =	41.2685	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6726.8169	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1234.4475	970.5451	817.8202	457.9915	201.6320	0.0000	0.0000	0.0000	0.0000	479.7729	874.7001	1239.2110	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1323.0948	1040.2412	876.5489	490.8805	216.1115	0.0000	0.0000	0.0000	0.0000	514.2260	937.5135	1328.2004	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8221	89.7753	89.6753	89.4081	88.7906	86.7000	86.7000	86.7000	86.7000	89.4143	89.7159	89.8360	(217)
Fuel for water heating, kWh/month													
	201.9826	177.1134	183.8385	161.9852	157.4261	140.4988	131.5596	149.0256	150.2268	168.1197	181.3146	195.9824	(219)
Water heating fuel used												1999.0733	(219)
Annual totals kWh/year													
Space heating fuel - main system												6726.8169	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												532.3067	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6665.5450	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6726.8169	0.2160	1452.9925	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.0733	0.2160	431.7998	(264)
Space and water heating			1884.7923	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	532.3067	0.5190	276.2672	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			815.4731	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.3600	ZC1
Total Floor Area	TFA	152.0800	
Assumed number of occupants	N	2.9374	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5769	ZC2
CO2 emissions from cooking, equation (L16)		1.2460	ZC3
Total CO2 emissions		19.1830	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.1830	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.6600 (1b)	x	2.3100 (2b)	=	177.0846	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.4392	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3031	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3864	0.3788	0.3712	0.3334	0.3258	0.2879	0.2879	0.2803	0.3031	0.3258	0.3409	0.3561	(22b)
Effective ac	0.5747	0.5718	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			23.8500	1.3258	31.6193			(27)
Ground floor			76.6600	0.1300	9.9658			(28a)
External Wall	178.2400	28.1300	150.1100	0.1800	27.0198			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			331.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.7067			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0510	(36)
Total fabric heat loss (33) + (36) =	97.7577	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.1966	70.8375	70.4854	68.8319	68.5225	67.0823	67.0823	66.8156	67.6371	68.5225	69.1484	69.8027	(38)
Heat transfer coeff	168.9544	168.5952	168.2432	166.5896	166.2802	164.8401	164.8401	164.5734	165.3948	166.2802	166.9061	167.5604	(39)
Average = Sum(39)m / 12 =												166.5881	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1110	1.1086	1.1063	1.0954	1.0934	1.0839	1.0839	1.0821	1.0876	1.0934	1.0975	1.1018	(40)
HLP (average)												1.0954	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9374 (42)
Average daily hot water use (litres/day)	103.9630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3592	110.2007	106.0422	101.8837	97.7252	93.5667	93.5667	97.7252	101.8837	106.0422	110.2007	114.3592	(44)
Energy conte	169.5915	148.3258	153.0589	133.4405	128.0393	110.4882	102.3835	117.4866	118.8898	138.5546	151.2432	164.2403	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7421	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4387	22.2489	22.9588	20.0161	19.2059	16.5732	15.3575	17.6230	17.8335	20.7832	22.6865	24.6360	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.7997	46.1425	47.6805	49.7997	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992 (64)
								Total per year (kWh/year) = Sum(64)m =				2226.9727 (64)
Heat gains from water heating, kWh/month												
	69.1289	60.8252	63.6318	56.6977	55.0230	48.2729	45.9627	51.5142	51.8596	58.8091	62.6171	67.3496 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.1414	26.7713	21.7719	16.4827	12.3210	10.4019	11.2397	14.6097	19.6092	24.8983	29.0600	30.9791	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.7760	326.1254	317.6850	299.7164	277.0343	255.7163	241.4745	238.1251	246.5655	264.5341	287.2162	308.5342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	(71)
Water heating gains (Table 5)													
	92.9152	90.5136	85.5266	78.7468	73.9556	67.0457	61.7778	69.2395	72.0272	79.0445	86.9682	90.5237	(72)
Total internal gains													
	515.8934	513.4712	495.0443	465.0068	433.3717	403.2248	384.5528	392.0352	408.2627	438.5378	473.3053	500.0979	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0500	11.2829	0.6300	0.7000	0.7700	41.5510	(75)
Southeast	0.4800	36.7938	0.6300	0.7000	0.7700	5.3974	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	9.1800	36.7938	0.6300	0.7000	0.7700	103.2261	(79)
West	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(80)

Solar gains	171.8852	307.2062	458.1286	630.1586	762.2856	781.4444	743.1407	640.9031	517.1820	349.7684	208.5177	145.3837 (83)
Total gains	687.7786	820.6773	953.1730	1095.1654	1195.6574	1184.6692	1127.6935	1032.9384	925.4447	788.3062	681.8230	645.4815 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5087	62.6418	62.7729	63.3960	63.5139	64.0688	64.0688	64.1727	63.8540	63.5139	63.2758	63.0287	
alpha	5.1672	5.1761	5.1849	5.2264	5.2343	5.2713	5.2713	5.2782	5.2569	5.2343	5.2184	5.2019	
util living area													
	0.9995	0.9986	0.9953	0.9807	0.9261	0.7881	0.6193	0.6886	0.9140	0.9910	0.9988	0.9996	(86)
MIT	19.6727	19.8209	20.0720	20.4126	20.7260	20.9242	20.9831	20.9714	20.8155	20.4084	19.9781	19.6482	(87)
Th 2	19.9919	19.9938	19.9957	20.0046	20.0062	20.0140	20.0140	20.0154	20.0110	20.0062	20.0029	19.9994	(88)
util rest of house													
	0.9993	0.9981	0.9935	0.9726	0.8936	0.7031	0.4925	0.5623	0.8623	0.9861	0.9983	0.9995	(89)
MIT 2	18.2028	18.4211	18.7890	19.2877	19.7204	19.9595	20.0073	20.0025	19.8467	19.2872	18.6578	18.1724	(90)
Living area fraction										fLA = Living area / (4) =		0.2134	(91)
MIT	18.5166	18.7199	19.0628	19.5278	19.9350	20.1654	20.2156	20.2093	20.0535	19.5265	18.9396	18.4874	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5166	18.7199	19.0628	19.5278	19.9350	20.1654	20.2156	20.2093	20.0535	19.5265	18.9396	18.4874	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9971	0.9911	0.9674	0.8907	0.7176	0.5197	0.5890	0.8650	0.9826	0.9975	0.9992	(94)
Useful gains	687.0117	818.2753	944.6863	1059.4381	1064.9961	850.0767	586.0647	608.4421	800.5557	774.5740	680.0897	644.9658	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2401.9502	2329.9699	2113.6065	1770.4781	1369.3244	917.4002	595.9931	626.9055	984.6704	1484.3065	1976.1026	2394.0002	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1275.9143	1015.8588	869.6766	511.9488	226.4202	0.0000	0.0000	0.0000	0.0000	528.0410	933.1292	1301.2816	(98)
Space heating												6662.2706	(98)
Space heating per m2											(98) / (4) =	43.8077	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7133.0520	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1275.9143	1015.8588	869.6766	511.9488	226.4202	0.0000	0.0000	0.0000	0.0000	528.0410	933.1292	1301.2816	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1366.0752	1087.6432	931.1313	548.1251	242.4199	0.0000	0.0000	0.0000	0.0000	565.3544	999.0677	1393.2351	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7547	88.6101	88.2899	87.5046	85.6603	80.3000	80.3000	80.3000	80.3000	87.4935	88.4323	88.8148	(217)
Fuel for water heating, kWh/month													
	248.4942	219.3351	231.0772	208.8525	207.6096	195.0568	186.8793	208.3266	209.4705	216.6029	226.7930	242.3011	(219)
Water heating fuel used												2600.7991	(219)
Annual totals kWh/year													
Space heating fuel - main system												7133.0520	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												532.3067	(232)
Total delivered energy for all uses												10341.1577	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7133.0520	0.2160	1540.7392	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2600.7991	0.2160	561.7726	(264)
Space and water heating			2102.5118	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	532.3067	0.5190	276.2672	(268)
Total CO2, kg/m2/year			2417.7040	(272)
Emissions per m2 for space and water heating			13.8250	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8166	(272b)
Emissions per m2 for pumps and fans			0.2560	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8250 * 1.00) + 1.8166 + 0.2560, rounded to 2 d.p.			15.9000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 164 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 164	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 164, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.43 m	76.66 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	190.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	178.24	150.11

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.07	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.07	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.05	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	South East							2.14	100

W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.17	0.065	No
Independently assessed	E3 Sill	16.31	0.004	No
Independently assessed	E4 Jamb	44.40	0.005	No
Independently assessed	E5 Ground floor (normal)	36.43	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 164 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 164	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 164, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.08	m^2	
DER	5.36	$kgCO_2/yr/m^2$	
TER	15.90	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.36	$kgCO_2/yr/m^2$	
Reduction DER/TER	66.28	%	
CfSH ENE1 credits achieved	6.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.15	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.08	m^2	
DER	16.28	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.58	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	30.10	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	30.10	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.58	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.00	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.00	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 165 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 165	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 165, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 12.05 m², No overhang
Windows facing South East: 0.48 m², No overhang
Windows facing South: 1.07 m², No overhang
Windows facing South West: 9.18 m², No overhang
Windows facing West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.6600 (1b)	x	2.3100 (2b)	=	177.0846	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.4392	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1598	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3848	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3271	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4170	0.4089	0.4007	0.3598	0.3516	0.3107	0.3107	0.3026	0.3271	0.3516	0.3680	0.3843	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6670	0.6589	0.6507	0.6098	0.6016	0.5607	0.5607	0.5526	0.5771	0.6016	0.6180	0.6343	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8500	1.2357	29.4724			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.6600	0.1200	9.1992			(28a)
External Wall	178.2400	28.1300	150.1100	0.2100	31.5231			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			331.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.0925			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		190.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.9464	(36)
Total fabric heat loss	(33) + (36) =	88.0390	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6430	81.6299	80.6167	75.5511	74.5380	69.4724	69.4724	68.4593	71.4986	74.5380	76.5643	78.5905	(38)
Heat transfer coeff	170.6819	169.6688	168.6557	163.5901	162.5770	157.5113	157.5113	156.4982	159.5376	162.5770	164.6032	166.6295	(39)
Average = Sum(39)m / 12 =												163.3368	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1223	1.1157	1.1090	1.0757	1.0690	1.0357	1.0357	1.0291	1.0490	1.0690	1.0823	1.0957	(40)
HLP (average)												1.0740	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9374 (42)
Average daily hot water use (litres/day)		103.9630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3592	110.2007	106.0422	101.8837	97.7252	93.5667	93.5667	97.7252	101.8837	106.0422	110.2007	114.3592	(44)
Energy conte	169.5915	148.3258	153.0589	133.4405	128.0393	110.4882	102.3835	117.4866	118.8998	138.5546	151.2432	164.2403	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7421	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4387	22.2489	22.9588	20.0161	19.2059	16.5732	15.3575	17.6230	17.8335	20.7832	22.6865	24.6360	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8336	10.6782	11.7989	11.3874	11.7402	11.3243	11.6786	11.7185	11.3569	11.7684	11.4248	11.8223 (61)

Total heat required for water heating calculated for each month

	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626 (64)

Total per year (kWh/year) = Sum(64)m = 1774.2743 (64)

Heat gains from water heating, kWh/month

	59.3476	51.9879	53.8418	47.2158	45.5081	39.5684	36.9622	41.9939	42.3701	49.0115	53.1446	57.5655 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	30.1414	26.7713	21.7719	16.4827	12.3210	10.4019	11.2397	14.6097	19.6092	24.8983	29.0600	30.9791	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	322.7760	326.1254	317.6850	299.7164	277.0343	255.7163	241.4745	238.1251	246.5655	264.5341	287.2162	308.5342	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	(71)

Water heating gains (Table 5)

	79.7682	77.3629	72.3680	65.5775	61.1668	54.9561	49.6804	56.4435	58.8473	65.8757	73.8119	77.3730	(72)

Total internal gains

	502.7464	500.3204	481.8857	451.8375	420.5829	391.1351	372.4554	379.2391	395.0828	425.3689	460.1490	486.9471	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0500	11.2829	0.7200	0.7000	0.7700	47.4868	(75)
Southeast	0.4800	36.7938	0.7200	0.7000	0.7700	6.1685	(77)
South	1.0700	46.7521	0.7200	0.7000	0.7700	17.4722	(78)
Southwest	9.1800	36.7938	0.7200	0.7000	0.7700	117.9727	(79)
West	1.0700	19.6403	0.7200	0.7000	0.7700	7.3400	(80)

Solar gains	196.4402	351.0928	523.5756	720.1813	871.1836	893.0793	849.3036	732.4607	591.0651	399.7353	238.3059	166.1528	(83)
Total gains	699.1866	851.4132	1005.4613	1172.0187	1291.7665	1284.2145	1221.7590	1111.6999	986.1479	825.1043	698.4549	653.0999	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.0257	47.3065	47.5907	49.0644	49.3701	50.9579	50.9579	51.2878	50.3107	49.3701	48.7624	48.1694	
alpha	4.1350	4.1538	4.1727	4.2710	4.2913	4.3972	4.3972	4.4192	4.3540	4.2913	4.2508	4.2113	
util living area													
	0.9977	0.9946	0.9854	0.9536	0.8689	0.7052	0.5460	0.6106	0.8550	0.9759	0.9955	0.9983	(86)
MIT	19.3490	19.5523	19.8810	20.3320	20.6976	20.9198	20.9797	20.9678	20.7991	20.3125	19.7674	19.3432	(87)
Th 2	19.9826	19.9881	19.9935	20.0207	20.0262	20.0537	20.0537	20.0592	20.0427	20.0262	20.0153	20.0044	(88)
util rest of house													
	0.9971	0.9931	0.9813	0.9397	0.8295	0.6262	0.4381	0.5014	0.7969	0.9663	0.9941	0.9979	(89)
MIT 2	17.7591	18.0594	18.5411	19.2057	19.7054	19.9909	20.0437	20.0417	19.8574	19.1904	18.3926	17.7648	(90)
Living area fraction									fLA = Living area / (4) =			0.2134	(91)
MIT	18.0984	18.3780	18.8271	19.4461	19.9172	20.1892	20.2435	20.2394	20.0584	19.4299	18.6860	18.1017	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0984	18.3780	18.8271	19.4461	19.9172	20.1892	20.2435	20.2394	20.0584	19.4299	18.6860	18.1017	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9896	0.9745	0.9293	0.8244	0.6384	0.4606	0.5235	0.7980	0.9583	0.9911	0.9965	(94)
Useful gains	695.9391	842.5370	979.8095	1089.1374	1064.9137	819.8464	562.7248	581.9799	786.9370	790.6798	692.2327	650.8291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2355.1427	2286.8005	2079.0302	1725.2367	1335.9245	880.3584	573.8875	600.8578	950.5826	1435.5358	1907.0940	2316.4353	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1234.4475	970.5451	817.8202	457.9915	201.6320	0.0000	0.0000	0.0000	0.0000	479.7729	874.7001	1239.2110	(98)
Space heating												6276.1202	(98)
Space heating per m2											(98) / (4) =	41.2685	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6726.8169	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1234.4475	970.5451	817.8202	457.9915	201.6320	0.0000	0.0000	0.0000	0.0000	479.7729	874.7001	1239.2110	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1323.0948	1040.2412	876.5489	490.8805	216.1115	0.0000	0.0000	0.0000	0.0000	514.2260	937.5135	1328.2004	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4250	159.0040	164.8578	144.8279	139.7795	121.8125	114.0622	129.2052	130.2466	150.3230	162.6680	176.0626	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8221	89.7753	89.6753	89.4081	88.7906	86.7000	86.7000	86.7000	86.7000	89.4143	89.7159	89.8360	(217)
Fuel for water heating, kWh/month													
	201.9826	177.1134	183.8385	161.9852	157.4261	140.4988	131.5596	149.0256	150.2268	168.1197	181.3146	195.9824	(219)
Water heating fuel used												1999.0733	(219)
Annual totals kWh/year													
Space heating fuel - main system												6726.8169	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												532.3067	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1029 * 1.00) =										-2667.6520		-2667.6520	(233)
Total delivered energy for all uses												6665.5450	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6726.8169	0.2160	1452.9925	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.0733	0.2160	431.7998	(264)
Space and water heating			1884.7923	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	532.3067	0.5190	276.2672	(268)
Energy saving/generation technologies				
PV Unit	-2667.6520	0.5190	-1384.5114	(269)
Total CO2, kg/year			815.4731	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.3600	ZC1
Total Floor Area	TFA	152.0800	
Assumed number of occupants	N	2.9374	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5769	ZC2
CO2 emissions from cooking, equation (L16)		1.2460	ZC3
Total CO2 emissions		19.1830	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.1830	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.6600 (1b)	x	2.3100 (2b)	=	177.0846	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.4392	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3031	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3864	0.3788	0.3712	0.3334	0.3258	0.2879	0.2879	0.2803	0.3031	0.3258	0.3409	0.3561	(22b)
Effective ac	0.5747	0.5718	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			23.8500	1.3258	31.6193			(27)
Ground floor			76.6600	0.1300	9.9658			(28a)
External Wall	178.2400	28.1300	150.1100	0.1800	27.0198			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			331.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.7067			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0510	(36)
Total fabric heat loss (33) + (36) =	97.7577	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.1966	70.8375	70.4854	68.8319	68.5225	67.0823	67.0823	66.8156	67.6371	68.5225	69.1484	69.8027	(38)
Heat transfer coeff	168.9544	168.5952	168.2432	166.5896	166.2802	164.8401	164.8401	164.5734	165.3948	166.2802	166.9061	167.5604	(39)
Average = Sum(39)m / 12 =												166.5881	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1110	1.1086	1.1063	1.0954	1.0934	1.0839	1.0839	1.0821	1.0876	1.0934	1.0975	1.1018	(40)
HLP (average)												1.0954	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9374 (42)
Average daily hot water use (litres/day)	103.9630 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3592	110.2007	106.0422	101.8837	97.7252	93.5667	93.5667	97.7252	101.8837	106.0422	110.2007	114.3592	(44)
Energy conte	169.5915	148.3258	153.0589	133.4405	128.0393	110.4882	102.3835	117.4866	118.8898	138.5546	151.2432	164.2403	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7421	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4387	22.2489	22.9588	20.0161	19.2059	16.5732	15.3575	17.6230	17.8335	20.7832	22.6865	24.6360	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.7997	46.1425	47.6805	49.7997	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992 (64)
								Total per year (kWh/year) = Sum(64)m =				2226.9727 (64)
Heat gains from water heating, kWh/month												
	69.1289	60.8252	63.6318	56.6977	55.0230	48.2729	45.9627	51.5142	51.8596	58.8091	62.6171	67.3496 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	146.8694	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.1414	26.7713	21.7719	16.4827	12.3210	10.4019	11.2397	14.6097	19.6092	24.8983	29.0600	30.9791	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.7760	326.1254	317.6850	299.7164	277.0343	255.7163	241.4745	238.1251	246.5655	264.5341	287.2162	308.5342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	37.6869	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	-117.4955	(71)
Water heating gains (Table 5)													
	92.9152	90.5136	85.5266	78.7468	73.9556	67.0457	61.7778	69.2395	72.0272	79.0445	86.9682	90.5237	(72)
Total internal gains													
	515.8934	513.4712	495.0443	465.0068	433.3717	403.2248	384.5528	392.0352	408.2627	438.5378	473.3053	500.0979	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.0500	11.2829	0.6300	0.7000	0.7700	41.5510	(75)
Southeast	0.4800	36.7938	0.6300	0.7000	0.7700	5.3974	(77)
South	1.0700	46.7521	0.6300	0.7000	0.7700	15.2882	(78)
Southwest	9.1800	36.7938	0.6300	0.7000	0.7700	103.2261	(79)
West	1.0700	19.6403	0.6300	0.7000	0.7700	6.4225	(80)

Solar gains	171.8852	307.2062	458.1286	630.1586	762.2856	781.4444	743.1407	640.9031	517.1820	349.7684	208.5177	145.3837 (83)
Total gains	687.7786	820.6773	953.1730	1095.1654	1195.6574	1184.6692	1127.6935	1032.9384	925.4447	788.3062	681.8230	645.4815 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5087	62.6418	62.7729	63.3960	63.5139	64.0688	64.0688	64.1727	63.8540	63.5139	63.2758	63.0287	
alpha	5.1672	5.1761	5.1849	5.2264	5.2343	5.2713	5.2713	5.2782	5.2569	5.2343	5.2184	5.2019	
util living area													
	0.9995	0.9986	0.9953	0.9807	0.9261	0.7881	0.6193	0.6886	0.9140	0.9910	0.9988	0.9996	(86)
MIT	19.6727	19.8209	20.0720	20.4126	20.7260	20.9242	20.9831	20.9714	20.8155	20.4084	19.9781	19.6482	(87)
Th 2	19.9919	19.9938	19.9957	20.0046	20.0062	20.0140	20.0140	20.0154	20.0110	20.0062	20.0029	19.9994	(88)
util rest of house													
	0.9993	0.9981	0.9935	0.9726	0.8936	0.7031	0.4925	0.5623	0.8623	0.9861	0.9983	0.9995	(89)
MIT 2	18.2028	18.4211	18.7890	19.2877	19.7204	19.9595	20.0073	20.0025	19.8467	19.2872	18.6578	18.1724	(90)
Living area fraction										fLA = Living area / (4) =		0.2134	(91)
MIT	18.5166	18.7199	19.0628	19.5278	19.9350	20.1654	20.2156	20.2093	20.0535	19.5265	18.9396	18.4874	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5166	18.7199	19.0628	19.5278	19.9350	20.1654	20.2156	20.2093	20.0535	19.5265	18.9396	18.4874	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9971	0.9911	0.9674	0.8907	0.7176	0.5197	0.5890	0.8650	0.9826	0.9975	0.9992	(94)
Useful gains	687.0117	818.2753	944.6863	1059.4381	1064.9961	850.0767	586.0647	608.4421	800.5557	774.5740	680.0897	644.9658	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2401.9502	2329.9699	2113.6065	1770.4781	1369.3244	917.4002	595.9931	626.9055	984.6704	1484.3065	1976.1026	2394.0002	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1275.9143	1015.8588	869.6766	511.9488	226.4202	0.0000	0.0000	0.0000	0.0000	528.0410	933.1292	1301.2816	(98)
Space heating												6662.2706	(98)
Space heating per m2											(98) / (4) =	43.8077	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7133.0520	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1275.9143	1015.8588	869.6766	511.9488	226.4202	0.0000	0.0000	0.0000	0.0000	528.0410	933.1292	1301.2816	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1366.0752	1087.6432	931.1313	548.1251	242.4199	0.0000	0.0000	0.0000	0.0000	565.3544	999.0677	1393.2351	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5504	194.3532	204.0178	182.7555	177.8390	156.6307	150.0641	167.2863	168.2048	189.5135	200.5582	215.1992	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7547	88.6101	88.2899	87.5046	85.6603	80.3000	80.3000	80.3000	80.3000	87.4935	88.4323	88.8148	(217)
Fuel for water heating, kWh/month													
	248.4942	219.3351	231.0772	208.8525	207.6096	195.0568	186.8793	208.3266	209.4705	216.6029	226.7930	242.3011	(219)
Water heating fuel used												2600.7991	(219)
Annual totals kWh/year													
Space heating fuel - main system												7133.0520	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												532.3067	(232)
Total delivered energy for all uses												10341.1577	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7133.0520	0.2160	1540.7392	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2600.7991	0.2160	561.7726	(264)
Space and water heating			2102.5118	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	532.3067	0.5190	276.2672	(268)
Total CO2, kg/m2/year			2417.7040	(272)
Emissions per m2 for space and water heating			13.8250	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8166	(272b)
Emissions per m2 for pumps and fans			0.2560	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8250 * 1.00) + 1.8166 + 0.2560, rounded to 2 d.p.			15.9000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 165 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 165	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 165, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	36.43 m	76.66 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	190.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	178.24	150.11

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.07	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.07	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.05	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	South East							2.14	100

W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.17	0.065	No
Independently assessed	E3 Sill	16.31	0.004	No
Independently assessed	E4 Jamb	44.40	0.005	No
Independently assessed	E5 Ground floor (normal)	36.43	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 165 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 165	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 165, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.36	**TER**	15.90
Environmental	96 A	**% DER<TER**	66.28		
CO_2 Emissions (t/year)	0.19	**DFEE**	42.15	**TFEE**	55.15
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.08	m^2	
DER	5.36	$kgCO_2/yr/m^2$	
TER	15.90	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.36	$kgCO_2/yr/m^2$	
Reduction DER/TER	66.28	%	
CfSH ENE1 credits achieved	6.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.15	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.08	m^2	
DER	16.28	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.58	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	30.10	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	30.10	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.58	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.00	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.00	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 166 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 166	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 166, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 10.34 m², No overhang
Windows facing South: 8.19 m², No overhang
Windows facing West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8318 10.6767 11.7973 11.3860 11.7376 11.3222 11.6766 11.7162 11.3556 11.7670 11.4232 11.8206 (61)
Total heat required for water heating calculated for each month
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (64)
Total per year (kWh/year) = Sum(64)m = 1766.1786 (64)
Heat gains from water heating, kWh/month
59.0688 51.7440 53.5902 46.9965 45.2973 39.3865 36.7936 41.8005 42.1746 48.7837 52.8959 57.2955 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
29.6036 26.2936 21.3834 16.1886 12.1012 10.2163 11.0391 14.3491 19.2593 24.4541 28.5415 30.4264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
308.6376 311.8403 303.7696 286.5881 264.8995 244.5153 230.8973 227.6947 235.7653 252.9469 274.6354 295.0197 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 (71)
Water heating gains (Table 5)
79.3935 77.0001 72.0298 65.2729 60.8835 54.7035 49.4538 56.1835 58.5759 65.5695 73.4666 77.0101 (72)
Total internal gains
487.3714 484.8707 466.9195 437.7862 407.6209 379.1718 361.1270 367.9639 383.3372 412.7072 446.3802 472.1928 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3400	10.6334	0.7200	0.7000	0.7700	38.4022	(74)
South	8.1900	46.7521	0.7200	0.7000	0.7700	133.7360	(78)
West	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(80)

Solar gains	177.0773	302.0756	419.6160	538.8443	626.8669	634.2046	606.3818	537.8300	459.8895	335.0633	212.0553	151.6359	(83)
Total gains	664.4487	786.9462	886.5355	976.6305	1034.4877	1013.3764	967.5088	905.7939	843.2267	747.7704	658.4355	623.8286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area	0.9977	0.9949	0.9883	0.9679	0.9115	0.7787	0.6195	0.6718	0.8817	0.9783	0.9955	0.9982	(86)
MIT	19.3910	19.5773	19.8689	20.2746	20.6286	20.8856	20.9689	20.9560	20.7764	20.3167	19.8007	19.3884	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house	0.9970	0.9935	0.9848	0.9574	0.8802	0.7030	0.5028	0.5581	0.8288	0.9694	0.9940	0.9978	(89)
MIT 2	17.8136	18.0893	18.5177	19.1219	19.6173	19.9580	20.0357	20.0326	19.8300	19.1916	18.4352	17.8247	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.1308	18.3885	18.7893	19.3536	19.8206	20.1445	20.2233	20.2182	20.0203	19.4178	18.7097	18.1391	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1308	18.3885	18.7893	19.3536	19.8206	20.1445	20.2233	20.2182	20.0203	19.4178	18.7097	18.1391	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9901	0.9789	0.9481	0.8724	0.7113	0.5253	0.5791	0.8275	0.9617	0.9910	0.9964	(94)
Useful gains	661.2683	779.1820	867.8016	925.9379	902.4540	720.8344	508.1890	524.5090	697.7438	719.1660	652.4992	621.5573	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2174.1852	2107.3803	1908.1850	1572.7809	1213.9508	802.1334	524.1914	548.7065	867.9026	1318.1754	1757.9137	2137.4872	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1125.6101	892.5492	774.0452	465.7269	231.7536	0.0000	0.0000	0.0000	0.0000	445.6630	795.8984	1127.8518	(98)
Space heating												5859.0984	(98)
Space heating per m2											(98) / (4) =	42.0550	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6279.8482	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1125.6101	892.5492	774.0452	465.7269	231.7536	0.0000	0.0000	0.0000	0.0000	445.6630	795.8984	1127.8518	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1206.4417	956.6444	829.6305	499.1714	248.3962	0.0000	0.0000	0.0000	0.0000	477.6667	853.0530	1208.8444	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7846	89.7388	89.6489	89.4223	88.9149	86.7000	86.7000	86.7000	86.7000	89.3672	89.6706	89.7985	(217)
Fuel for water heating, kWh/month													
	201.1327	176.3678	183.0482	161.2213	156.4922	139.8673	130.9744	148.3539	149.5485	167.4412	180.5719	195.1593	(219)
Water heating fuel used												1990.1787	(219)
Annual totals kWh/year													
Space heating fuel - main system												6279.8482	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6415.1554	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6279.8482	0.2160	1356.4472	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.1787	0.2160	429.8786	(264)
Space and water heating			1786.3258	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			823.6475	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.3939	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3939	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.3400	10.6334	0.6300	0.7000	0.7700	33.6019	(74)
South	8.1900	46.7521	0.6300	0.7000	0.7700	117.0190	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	154.9426	264.3161	367.1640	471.4888	548.5085	554.9291	530.5841	470.6012	402.4033	293.1804	185.5484	132.6814	(83)
Total gains	655.4615	762.3381	847.2427	922.4448	968.8365	946.1121	903.7301	851.2794	798.9209	719.0569	645.0855	618.0255	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9994	0.9985	0.9959	0.9864	0.9516	0.8469	0.6865	0.7405	0.9284	0.9911	0.9986	0.9996	(86)
MIT	19.6994	19.8376	20.0637	20.3705	20.6697	20.8924	20.9735	20.9607	20.7981	20.4135	20.0009	19.6767	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9992	0.9979	0.9943	0.9804	0.9276	0.7709	0.5546	0.6141	0.8826	0.9862	0.9980	0.9994	(89)
MIT 2	18.2462	18.4497	18.7813	19.2333	19.6551	19.9383	20.0098	20.0037	19.8333	19.2995	18.6958	18.2185	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.5384	18.7287	19.0392	19.4619	19.8591	20.1301	20.2036	20.1961	20.0273	19.5235	18.9582	18.5117	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5384	18.7287	19.0392	19.4619	19.8591	20.1301	20.2036	20.1961	20.0273	19.5235	18.9582	18.5117	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9969	0.9921	0.9758	0.9229	0.7807	0.5811	0.6389	0.8832	0.9827	0.9971	0.9990	(94)
Useful gains	654.5877	759.9602	840.5428	900.1476	894.1341	738.6429	525.1321	543.8646	705.5735	706.6009	643.1875	617.4216	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2189.5798	2121.7821	1919.6483	1600.0565	1233.6046	828.4192	539.8226	567.6765	891.0985	1349.1781	1800.0593	2181.5592	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1142.0342	915.1443	802.8545	503.9344	252.5661	0.0000	0.0000	0.0000	0.0000	478.0775	832.9476	1163.7184	(98)
Space heating												6091.2770	(98)
Space heating per m2											(98) / (4) =	43.7215	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6521.7098	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1142.0342	915.1443	802.8545	503.9344	252.5661	0.0000	0.0000	0.0000	0.0000	478.0775	832.9476	1163.7184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1222.7347	979.8119	859.5873	539.5444	270.4133	0.0000	0.0000	0.0000	0.0000	511.8602	891.8069	1245.9512	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6019	88.4571	88.1598	87.4794	85.9463	80.3000	80.3000	80.3000	80.3000	87.2913	88.2524	88.6651	(217)
Fuel for water heating, kWh/month													
	247.9779	218.8869	230.5612	208.1597	205.8973	194.0940	185.9568	207.2983	208.7397	216.3212	226.4093	241.7958	(219)
Water heating fuel used												2592.0982	(219)
Annual totals kWh/year													
Space heating fuel - main system												6521.7098	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9711.6165	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6521.7098	0.2160	1408.6893	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2592.0982	0.2160	559.8932	(264)
Space and water heating			1968.5825	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2278.8452	(272)
Emissions per m2 for space and water heating			14.1299	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1299 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.3600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 166 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 166	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 166, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 166 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 166	**Prop Type Ref**	As
Property	L472-R - Det SG, Plot 166, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	16.36
Environmental	96 A	**% DER<TER**	63.87		
CO_2 Emissions (t/year)	0.24	**DFEE**	42.08	**TFEE**	54.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	16.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.87	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.29	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.29	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 167 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 167	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 167, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.51 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.05 m², No overhang
Windows facing South: 6.92 m², No overhang
Windows facing South West: 1.07 m², No overhang
Windows facing West: 6.75 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8268	10.6723	11.7927	11.3819	11.7303	11.3161	11.6710	11.7094	11.3519	11.7628	11.4187	11.8158 (61)

Total heat required for water heating calculated for each month

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183 (64)

Total per year (kWh/year) = Sum(64)m = 1742.9413 (64)

Heat gains from water heating, kWh/month

	58.2686	51.0442	52.8680	46.3668	44.6923	38.8645	36.3099	41.2453	41.6136	48.1300	52.1823	56.5205 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)

Water heating gains (Table 5)

	78.3179	75.9586	71.0591	64.3983	60.0703	53.9785	48.8036	55.4373	57.7967	64.6908	72.4754	75.9684	(72)

Total internal gains

	454.4556	452.2051	435.7469	408.9569	381.3228	354.9930	338.0709	344.5956	358.5138	385.5371	416.6277	440.3588	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
South	6.9200	46.7521	0.7200	0.7000	0.7700	112.9980	(78)
Southwest	1.0700	36.7938	0.7200	0.7000	0.7700	13.7506	(79)
West	6.7500	19.6403	0.7200	0.7000	0.7700	46.3036	(80)
Northwest	1.0700	11.2829	0.7200	0.7000	0.7700	4.2167	(81)

Solar gains	210.8801	371.8796	541.5663	724.4140	859.0494	873.5053	833.5725	730.1601	604.5209	419.9234	254.9158	178.9497	(83)
Total gains	665.3357	824.0846	977.3131	1133.3708	1240.3722	1228.4983	1171.6434	1074.7558	963.0347	805.4605	671.5435	619.3084	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3274	47.5916	47.8587	49.2408	49.5269	51.0084	51.0084	51.3155	50.4053	49.5269	48.9580	48.4021	
alpha	4.1552	4.1728	4.1906	4.2827	4.3018	4.4006	4.4006	4.4210	4.3604	4.3018	4.2639	4.2268	
util living area	0.9967	0.9915	0.9775	0.9328	0.8284	0.6518	0.4947	0.5528	0.8052	0.9627	0.9931	0.9976	(86)
MIT	19.4173	19.6429	19.9833	20.4246	20.7583	20.9414	20.9861	20.9781	20.8470	20.3918	19.8360	19.4034	(87)
Th 2	19.8894	19.8948	19.9003	19.9278	19.9333	19.9610	19.9610	19.9665	19.9499	19.9333	19.9223	19.9113	(88)
util rest of house	0.9957	0.9891	0.9707	0.9121	0.7781	0.5648	0.3841	0.4389	0.7314	0.9472	0.9907	0.9968	(89)
MIT 2	17.7824	18.1145	18.6105	19.2526	19.6933	19.9197	19.9552	19.9564	19.8224	19.2227	18.4158	17.7765	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.1965	18.5016	18.9583	19.5494	19.9630	20.1785	20.2163	20.2152	20.0819	19.5189	18.7755	18.1886	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1965	18.5016	18.9583	19.5494	19.9630	20.1785	20.2163	20.2152	20.0819	19.5189	18.7755	18.1886	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9845	0.9628	0.9032	0.7797	0.5840	0.4120	0.4674	0.7419	0.9393	0.9869	0.9951	(94)
Useful gains	660.9389	811.3346	940.9205	1023.6657	967.0664	717.4969	482.7360	502.3244	714.4993	756.5726	662.7409	616.2477	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2024.7198	1970.7588	1795.0160	1491.3267	1150.4588	754.1318	488.8753	512.6769	818.3399	1241.7671	1644.4603	1992.8804	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1014.6530	779.1331	635.4471	336.7159	136.4439	0.0000	0.0000	0.0000	0.0000	360.9847	706.8380	1024.2147	(98)
Space heating												4994.4304	(98)
Space heating per m2											(98) / (4) =	42.4516	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5353.0872	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1014.6530	779.1331	635.4471	336.7159	136.4439	0.0000	0.0000	0.0000	0.0000	360.9847	706.8380	1024.2147	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1087.5166	835.0837	681.0794	360.8959	146.2421	0.0000	0.0000	0.0000	0.0000	386.9075	757.5970	1097.7650	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7434	89.6783	89.5449	89.1999	88.4576	86.7000	86.7000	86.7000	86.7000	89.2244	89.6140	89.7616	(217)
Fuel for water heating, kWh/month													
	198.5419	174.1384	180.8338	159.4991	155.2420	138.0547	129.2947	146.4262	147.6013	165.5044	178.2896	192.6416	(219)
Water heating fuel used												1966.0678	(219)
Annual totals kWh/year													
Space heating fuel - main system												5353.0872	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =										-2098.5959		-2098.5959	(233)
Total delivered energy for all uses												5740.7710	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5353.0872	0.2160	1156.2668	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0678	0.2160	424.6706	(264)
Space and water heating			1580.9375	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			761.7562	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4700	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.2735	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.2735	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
								Total per year (kWh/year) = Sum(64)m =				2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
South	6.9200	46.7521	0.6300	0.7000	0.7700	98.8732	(78)
Southwest	1.0700	36.7938	0.6300	0.7000	0.7700	12.0318	(79)
West	6.7500	19.6403	0.6300	0.7000	0.7700	40.5157	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	184.5201	325.3946	473.8705	633.8622	751.6682	764.3172	729.3760	638.8901	528.9558	367.4330	223.0513	156.5810 (83)
Total gains	652.1249	790.7526	922.7780	1055.9796	1145.4635	1131.0965	1079.2407	995.9652	900.6405	766.1408	652.8375	610.0927 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9986	0.9962	0.9888	0.9620	0.8843	0.7285	0.5620	0.6241	0.8631	0.9797	0.9968	0.9990	(86)
MIT	19.5955	19.7751	20.0594	20.4281	20.7454	20.9313	20.9843	20.9746	20.8356	20.4141	19.9338	19.5653	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9981	0.9948	0.9846	0.9470	0.8389	0.6334	0.4323	0.4923	0.7924	0.9691	0.9955	0.9986	(89)
MIT 2	18.0162	18.2799	18.6947	19.2279	19.6520	19.8662	19.9064	19.9033	19.7744	19.2174	18.5197	17.9780	(90)
Living area fraction										fLA = Living area / (4) =		0.2533	(91)
MIT	18.4162	18.6586	19.0404	19.5319	19.9289	20.1359	20.1794	20.1747	20.0432	19.5205	18.8779	18.3801	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4162	18.6586	19.0404	19.5319	19.9289	20.1359	20.1794	20.1747	20.0432	19.5205	18.8779	18.3801	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9926	0.9801	0.9405	0.8401	0.6546	0.4654	0.5257	0.8027	0.9640	0.9936	0.9978	(94)
Useful gains	650.1946	784.8931	904.4333	993.1642	962.3317	740.4678	502.2457	523.6137	722.8994	738.5447	648.6481	608.7650	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2062.5565	2005.7791	1824.1421	1530.4491	1182.2155	788.0326	509.5243	536.3962	849.0203	1281.5777	1698.8256	2053.7988	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1050.7973	820.4354	684.2633	386.8452	163.5935	0.0000	0.0000	0.0000	0.0000	404.0166	756.1278	1075.1052	(98)
Space heating												5341.1841	(98)
Space heating per m2											(98) / (4) =	45.3989	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5718.6126	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1050.7973	820.4354	684.2633	386.8452	163.5935	0.0000	0.0000	0.0000	0.0000	404.0166	756.1278	1075.1052	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1125.0506	878.4105	732.6160	414.1811	175.1537	0.0000	0.0000	0.0000	0.0000	432.5659	809.5587	1151.0762	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4926	88.2981	87.8891	86.9258	84.8900	80.3000	80.3000	80.3000	80.3000	86.9417	88.1034	88.5648	(217)
Fuel for water heating, kWh/month													
	245.5689	216.9009	228.8037	207.2747	205.4911	191.3303	183.3090	204.3466	206.6034	214.9330	224.3599	239.4422	(219)
Water heating fuel used												2568.3638	(219)
Annual totals kWh/year													
Space heating fuel - main system												5718.6126	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												8807.1882	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5718.6126	0.2160	1235.2203	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2568.3638	0.2160	554.7666	(264)
Space and water heating			1789.9869	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2059.9768	(272)
Emissions per m2 for space and water heating			15.2145	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2145 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.5100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 167 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 167	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 167, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 167 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 167	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 167, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.47	**TER**	17.51
Environmental	95 A	**% DER<TER**	63.05		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.06	**TFEE**	58.08
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	6.47	$kgCO_2/yr/m^2$	
TER	17.51	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.47	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.05	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	17.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 168 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 168	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 168, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.99	**TER**	17.88
Environmental	95 A	**% DER<TER**	60.92		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.65	**TFEE**	54.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.88 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.99 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.72 m², No overhang
Windows facing East: 7.03 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 5.90 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.6100	1.2357	18.0542			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.2100	26.6301			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8964	(36)
Total fabric heat loss					(33) + (36) =		62.7206	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	116.9976	116.3301	115.6626	112.3251	111.6576	108.3202	108.3202	107.6527	109.6552	111.6576	112.9926	114.3276	(39)
Average = Sum(39)m / 12 =												112.1583	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1715	1.1648	1.1312	1.1244	1.0908	1.0908	1.0841	1.1043	1.1244	1.1379	1.1513	(40)
HLP (average)												1.1295	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8169 10.6637 11.7839 11.3667 11.7162 11.3045 11.6603 11.6966 11.3384 11.7548 11.4100 11.8062 (61)
Total heat required for water heating calculated for each month
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (64)
Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)
Heat gains from water heating, kWh/month
56.7099 49.6809 51.4612 45.1385 43.5138 37.8477 35.3677 40.1640 40.5192 46.8565 50.7922 55.0110 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.1477 21.4477 17.4425 13.2051 9.8709 8.3335 9.0046 11.7045 15.7098 19.9472 23.2813 24.8188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
255.1911 257.8392 251.1661 236.9599 219.0271 202.1728 190.9131 188.2650 194.9381 209.1443 227.0771 243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
76.2229 73.9299 69.1683 62.6923 58.4863 52.5663 47.5372 53.9839 56.2767 62.9792 70.5448 73.9395 (72)
Total internal gains
422.5560 420.2112 404.7712 379.8515 354.3787 330.0668 314.4492 320.9477 333.9189 359.0650 387.8975 409.6840 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.7200	0.7000	0.7700	2.6740	(74)
East	7.0300	19.6403	0.7200	0.7000	0.7700	48.2244	(76)
South	0.9600	46.7521	0.7200	0.7000	0.7700	15.6760	(78)
West	5.9000	19.6403	0.7200	0.7000	0.7700	40.4728	(80)

Solar gains 107.0472 204.2939 327.1337 467.6546 568.0421 580.0109 552.7511 477.6346 376.9383 239.6588 132.4751 88.7149 (83)
Total gains 529.6032 624.5051 731.9049 847.5061 922.4208 910.0777 867.2003 798.5823 710.8572 598.7238 520.3726 498.3989 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.1520	47.4225	47.6962	49.1134	49.4070	50.9293	50.9293	51.2450	50.3092	49.4070	48.8232	48.2531	
alpha	4.1435	4.1615	4.1797	4.2742	4.2938	4.3953	4.3953	4.4163	4.3539	4.2938	4.2549	4.2169	

util living area
0.9967 0.9931 0.9821 0.9455 0.8558 0.6905 0.5310 0.5892 0.8377 0.9710 0.9939 0.9975 (86)

MIT	19.4078	19.5992	19.9269	20.3708	20.7187	20.9262	20.9817	20.9719	20.8171	20.3449	19.8135	19.4012	(87)
Th 2	19.9375	19.9429	19.9483	19.9755	19.9809	20.0083	20.0083	20.0138	19.9973	19.9809	19.9700	19.9591	(88)

util rest of house
0.9958 0.9911 0.9769 0.9288 0.8121 0.6072 0.4199 0.4765 0.7728 0.9591 0.9919 0.9968 (89)

MIT 2	17.8079	18.0906	18.5698	19.2206	19.6904	19.9530	20.0000	19.9996	19.8357	19.1979	18.4225	17.8127	(90)

Living area fraction fLA = Living area / (4) = 0.1233 (91)

MIT	18.0051	18.2766	18.7370	19.3624	19.8172	20.0730	20.1210	20.1195	19.9566	19.3393	18.5939	18.0085	(92)

Temperature adjustment 0.0000
adjusted MIT 18.0051 18.2766 18.7370 19.3624 19.8172 20.0730 20.1210 20.1195 19.9566 19.3393 18.5939 18.0085 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9865	0.9683	0.9161	0.8039	0.6131	0.4331	0.4893	0.7698	0.9487	0.9877	0.9947	(94)
Useful gains	525.9904	616.0599	708.6956	776.3840	741.5363	557.9688	375.5452	390.7151	547.1857	568.0031	513.9533	495.7541	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W
1603.4658 1556.0952 1415.3689 1175.1903 906.3469 592.8314 381.3918 400.4120 642.2109 975.8127 1298.7283 1578.6921 (97)

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh
801.6417 631.7037 525.7649 287.1405 122.6191 0.0000 0.0000 0.0000 0.0000 303.4103 565.0380 805.7059 (98)
Space heating 4043.0242 (98)
Space heating per m2 (98) / (4) = 40.7152 (99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		93.3000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		4333.3592 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.6417	631.7037	525.7649	287.1405	122.6191	0.0000	0.0000	0.0000	0.0000	303.4103	565.0380	805.7059	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	859.2087	677.0672	563.5208	307.7605	131.4246	0.0000	0.0000	0.0000	0.0000	325.1986	605.6141	863.5647	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6378	89.5784	89.4431	89.0958	88.3852	86.7000	86.7000	86.7000	86.7000	89.1100	89.4976	89.6565	(217)
Fuel for water heating, kWh/month													
	193.5433	169.7533	176.3070	155.5349	151.3554	134.5243	126.0233	142.6715	143.8012	161.4167	173.8477	187.8012	(219)
Water heating fuel used												1916.5799	(219)
Annual totals kWh/year													
Space heating fuel - main system												4333.3592	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												4986.5257	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4333.3592	0.2160	936.0056	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.5799	0.2160	413.9813	(264)
Space and water heating			1349.9869	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			694.2753	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.9900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.9900	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		24.0776	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.0776	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.1800	22.8258			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.6721			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7119	(36)
Total fabric heat loss (33) + (36) =	68.3840	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	115.4425	115.1867	114.9359	113.7580	113.5376	112.5116	112.5116	112.3217	112.9068	113.5376	113.9834	114.4495	(39)
Average = Sum(39)m / 12 =												113.7569	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1626	1.1600	1.1575	1.1456	1.1434	1.1330	1.1330	1.1311	1.1370	1.1434	1.1479	1.1526	(40)
HLP (average)												1.1456	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.1477	21.4477	17.4425	13.2051	9.8709	8.3335	9.0046	11.7045	15.7098	19.9472	23.2813	24.8188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.7085	433.3673	417.9348	392.5359	366.3940	341.4150	325.8045	332.9697	346.6130	372.2384	401.0589	422.8401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.6300	0.7000	0.7700	2.3398	(74)
East	7.0300	19.6403	0.6300	0.7000	0.7700	42.1963	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137	(80)

Solar gains	93.6663	178.7572	286.2420	409.1978	497.0368	507.5095	483.6572	417.9303	329.8210	209.7015	115.9157	77.6256	(83)
Total gains	529.3748	612.1245	704.1768	801.7336	863.4308	848.9246	809.4617	750.8999	676.4340	581.9399	516.9747	500.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7339	59.8666	59.9972	60.6185	60.7361	61.2900	61.2900	61.3936	61.0754	60.7361	60.4986	60.2522	
alpha	4.9823	4.9911	4.9998	5.0412	5.0491	5.0860	5.0860	5.0929	5.0717	5.0491	5.0332	5.0168	
util living area													
	0.9988	0.9973	0.9922	0.9715	0.9063	0.7601	0.5911	0.6525	0.8882	0.9856	0.9976	0.9991	(86)
MIT	19.6798	19.8256	20.0858	20.4344	20.7411	20.9291	20.9842	20.9746	20.8310	20.4250	19.9889	19.6550	(87)
Th 2	19.9501	19.9521	19.9542	19.9638	19.9656	19.9739	19.9739	19.9755	19.9707	19.9656	19.9619	19.9581	(88)
util rest of house													
	0.9984	0.9964	0.9892	0.9600	0.8674	0.6705	0.4636	0.5243	0.8267	0.9778	0.9966	0.9988	(89)
MIT 2	18.1836	18.3981	18.7786	19.2860	19.7027	19.9247	19.9679	19.9645	19.8268	19.2800	18.6443	18.1531	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3680	18.5741	18.9398	19.4275	19.8307	20.0485	20.0932	20.0890	19.9506	19.4212	18.8100	18.3383	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3680	18.5741	18.9398	19.4275	19.8307	20.0485	20.0932	20.0890	19.9506	19.4212	18.8100	18.3383	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9945	0.9851	0.9520	0.8613	0.6777	0.4791	0.5395	0.8252	0.9719	0.9948	0.9981	(94)
Useful gains	528.0338	608.7671	693.6698	763.2790	743.6616	575.2906	387.8339	405.1201	558.2167	565.6047	514.2907	499.5057	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1624.0470	1575.0726	1429.7766	1197.5882	923.1440	613.0150	393.0254	414.3580	660.5729	1001.5321	1334.7491	1618.1192	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	815.4339	649.3573	547.6635	312.7027	133.5349	0.0000	0.0000	0.0000	0.0000	324.3299	590.7301	832.2485	(98)
Space heating												4206.0007	(98)
Space heating per m2											(98) / (4) =	42.3565	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4503.2127	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	815.4339	649.3573	547.6635	312.7027	133.5349	0.0000	0.0000	0.0000	0.0000	324.3299	590.7301	832.2485	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	873.0555	695.2434	586.3635	334.7994	142.9710	0.0000	0.0000	0.0000	0.0000	347.2483	632.4733	891.0583	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1079	87.9230	87.4902	86.4948	84.4576	80.3000	80.3000	80.3000	80.3000	86.4760	87.6790	88.1862	(217)
Fuel for water heating, kWh/month													
	241.3289	213.1705	225.0189	202.4468	200.7319	185.9471	178.1515	198.5972	200.7905	211.6686	220.6854	235.3302	(219)
Water heating fuel used												2513.8674	(219)
Annual totals kWh/year													
Space heating fuel - main system												4503.2127	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Total delivered energy for all uses												7518.5353	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4503.2127	0.2160	972.6939	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.8674	0.2160	542.9954	(264)
Space and water heating			1515.6893	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Total CO2, kg/m2/year			1775.9445	(272)
Emissions per m2 for space and water heating			15.2637	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2289	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2637 * 1.00) + 2.2289 + 0.3920, rounded to 2 d.p.			17.8800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 168 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 168	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 168, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.99	**TER**	17.88
Environmental	95 A	**% DER<TER**	60.92		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.65	**TFEE**	54.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.09 m	49.65 m²	2.31 m
1st Storey:	29.09 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	143.56	126.81

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.26	0.065	No
Independently assessed	E3 Sill	9.65	0.004	No
Independently assessed	E4 Jamb	28.80	0.005	No
Independently assessed	E5 Ground floor (normal)	29.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	29.09	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.94	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.15	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 168 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 168	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 168, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.99	**TER**	17.88
Environmental	95 A	**% DER<TER**	60.92		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.65	**TFEE**	54.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	6.99	$kgCO_2/yr/m^2$	
TER	17.88	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.99	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.92	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.65	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	18.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.66	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.66	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.34	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.43	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.43	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 169 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 169	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 169, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.76 m², No overhang
Windows facing North East: 1.07 m², No overhang
Windows facing East: 0.48 m², No overhang
Windows facing South: 9.16 m², No overhang
Windows facing West: 7.51 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m = 1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.7600           10.6334           0.7200           0.7000           0.7700           25.1063 (74)
Northeast                                1.0700           11.2829           0.7200           0.7000           0.7700            4.2167 (75)
East                                     0.4800           19.6403           0.7200           0.7000           0.7700            3.2927 (76)
South                                    9.1600           46.7521           0.7200           0.7000           0.7700          149.5754 (78)
West                                     7.5100           19.6403           0.7200           0.7000           0.7700           51.5171 (80)
Northwest                                1.0700           11.2829           0.7200           0.7000           0.7700            4.2167 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   237.9247  417.3311  601.0753  791.9500  927.8021  938.3989  897.5603  793.9724  667.0406  469.5355  287.2223  202.1367 (83)
Total gains   708.0830  885.2151 1051.9030 1214.9709 1322.0460 1305.3046 1246.9500 1149.9466 1037.5092  868.0461  717.9962  657.6281 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9962    0.9902    0.9744    0.9269    0.8215    0.6470    0.4906    0.5456    0.7938    0.9580    0.9921    0.9972 (86)

MIT           19.3880   19.6256   19.9753   20.4202   20.7535   20.9386   20.9852   20.9773   20.8473   20.3894   19.8176   19.3719 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9951    0.9874    0.9671    0.9059    0.7725    0.5631    0.3841    0.4363    0.7217    0.9417    0.9894    0.9964 (89)
MIT 2         17.7675   18.1169   18.6258   19.2718   19.7132   19.9437   19.9818   19.9827   19.8479   19.2448   18.4160   17.7579 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1191 (91)
MIT           17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9920    0.9813    0.9564    0.8923    0.7659    0.5697    0.3964    0.4485    0.7208    0.9295    0.9842    0.9940 (94)
Useful gains 702.4418  868.6956 1005.9894 1084.0839 1012.4943  743.5904  494.2287  515.7354  747.8626  806.8828  706.6872  653.7031 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              2102.1554 2050.1625 1869.8504 1554.6389 1196.8832  780.2414  500.1460  525.5457  848.0212 1291.6166 1708.5378 2069.2310 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              1041.3869  793.9457  642.7125  338.7996  137.1853    0.0000    0.0000    0.0000    0.0000  360.6419  721.3325 1053.1528 (98)
Space heating                                                                                                          5089.1573 (98)
Space heating per m2                                                                                  (98) / (4) =   39.7342 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5454.6166	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1041.3869	793.9457	642.7125	338.7996	137.1853	0.0000	0.0000	0.0000	0.0000	360.6419	721.3325	1053.1528	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1116.1703	850.9601	688.8666	363.1293	147.0368	0.0000	0.0000	0.0000	0.0000	386.5401	773.1323	1128.7811	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7519	89.6839	89.5471	89.1987	88.4556	86.7000	86.7000	86.7000	86.7000	89.2179	89.6209	89.7708	(217)
Fuel for water heating, kWh/month													
	200.0837	175.4933	182.2411	160.7369	156.4434	139.1090	130.2717	147.5475	148.7340	166.7991	179.6696	194.1330	(219)
Water heating fuel used												1981.2624	(219)
Annual totals kWh/year													
Space heating fuel - main system												5454.6166	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 908 * 1.00) =											-2353.1582	-2353.1582	(233)
Total delivered energy for all uses												5625.2927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5454.6166	0.2160	1178.1972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.2624	0.2160	427.9527	(264)
Space and water heating			1606.1499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2353.1582	0.5190	-1221.2891	(269)
Total CO2, kg/year			666.4556	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.2000	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.3373	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3373	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019	(64)
Heat gains from water heating, kWh/month													
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7600	10.6334	0.6300	0.7000	0.7700	21.9680	(74)
Northeast	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(75)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	9.1600	46.7521	0.6300	0.7000	0.7700	130.8784	(78)
West	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	208.1841	365.1647	525.9409	692.9562	811.8269	821.0991	785.3653	694.7258	583.6606	410.8435	251.3195	176.8696	(83)
Total gains	691.4906	846.2008	989.9284	1129.1475	1218.6796	1199.9219	1146.6798	1063.3161	967.3100	822.5240	695.2510	645.5130	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9987	0.9964	0.9891	0.9627	0.8857	0.7297	0.5610	0.6211	0.8608	0.9801	0.9971	0.9991	(86)
MIT	19.6287	19.8100	20.0910	20.4500	20.7567	20.9355	20.9858	20.9772	20.8467	20.4359	19.9611	19.5977	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9983	0.9952	0.9851	0.9480	0.8412	0.6364	0.4344	0.4924	0.7907	0.9697	0.9959	0.9988	(89)
MIT 2	18.0844	18.3507	18.7605	19.2796	19.6899	19.8959	19.9340	19.9313	19.8107	19.2688	18.5791	18.0448	(90)
Living area fraction									fLA = Living area / (4) =			0.1191	(91)
MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9927	0.9798	0.9389	0.8356	0.6442	0.4493	0.5073	0.7905	0.9625	0.9938	0.9980	(94)
Useful gains	689.5797	840.0031	969.8948	1060.1725	1018.2913	772.9630	515.2167	539.3682	764.6892	791.6387	690.9120	644.2224	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2157.9449	2100.2331	1910.2881	1601.7058	1233.5985	816.3431	521.0607	549.7577	881.8035	1338.5872	1776.4184	2149.0641	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating												5497.1800	(98)
Space heating per m2											(98) / (4) =	42.9199	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5885.6317	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1169.6614	906.7179	749.0928	417.4560	171.5081	0.0000	0.0000	0.0000	0.0000	435.6849	836.7930	1198.7176	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5424	88.3400	87.9192	86.9295	84.8165	80.3000	80.3000	80.3000	80.3000	86.9442	88.1506	88.6155	(217)
Fuel for water heating, kWh/month													
	247.0095	218.1819	230.1603	208.5666	207.3972	192.9379	184.8492	206.0635	207.8622	216.2403	225.6538	240.8324	(219)
Water heating fuel used												2585.7547	(219)
Annual totals kWh/year													
Space heating fuel - main system												5885.6317	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												9013.9583	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5885.6317	0.2160	1271.2965	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.7547	0.2160	558.5230	(264)
Space and water heating			1829.8195	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2111.4143	(272)
Emissions per m2 for space and water heating			14.2865	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2865 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.4900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 169 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 169	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 169, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.48	100
W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		2.05	100
D2	Half Glazed Door	[1] External Wall	East				2.14	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.07	100
W15	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 169 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 169	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 169, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.20	$kgCO_2/yr/m^2$	
TER	16.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.20	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.46	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.26	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 170 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 170	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 170, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.81 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.21 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 7.93 m², No overhang
Windows facing West: 0.72 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2          Table 6a      Specific data  Specific data      factor              W
                                                         W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                   7.2100           10.6334            0.7200         0.7000          0.7700      26.7776 (74)
Northeast                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (75)
East                                    1.4400           19.6403            0.7200         0.7000          0.7700       9.8781 (76)
South                                   7.9300           46.7521            0.7200         0.7000          0.7700     129.4905 (78)
West                                    0.7200           19.6403            0.7200         0.7000          0.7700       4.9391 (80)
Northwest                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (81)
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Solar gains   179.2821  308.9158  434.8941  563.9803  657.9963  665.6994  636.5533  563.9149  478.8922  344.4388  215.3130  153.0937 (83)
Total gains   657.9342  785.1137  893.5159  994.0736 1058.5894 1038.4074  991.5246  925.6634  855.6470  749.9580  653.8292  616.8666 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9977    0.9947    0.9871    0.9631    0.8974    0.7517    0.5886    0.6426    0.8669    0.9764    0.9954    0.9983 (86)

MIT           19.4526   19.6418   19.9354   20.3366   20.6772   20.9080   20.9768   20.9660   20.8061   20.3600   19.8502   19.4461 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9971    0.9932    0.9833    0.9510    0.8622    0.6726    0.4737    0.5289    0.8091    0.9666    0.9938    0.9978 (89)
MIT 2         17.8987   18.1784   18.6092   19.2040   19.6752   19.9750   20.0361   20.0346   19.8596   19.2476   18.5016   17.9036 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1959 (91)
MIT           18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9953    0.9899    0.9772    0.9417    0.8558    0.6827    0.4956    0.5499    0.8098    0.9589    0.9909    0.9965 (94)
Useful gains 654.8371  777.1491  873.1301  936.0967  905.9451  708.9032  491.4174  509.0341  692.8608  719.1338  647.8593  614.6773 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2087.4508 2024.9131 1835.6163 1516.3560 1170.0875  771.6827  502.6753  526.6711  835.7753 1269.4621 1690.7179 2054.1822 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1065.8645  838.4974  716.0897  417.7867  196.5220    0.0000    0.0000    0.0000    0.0000  409.4442  750.8582 1070.9916 (98)
Space heating                                                                                                         5466.0543 (98)
Space heating per m2                                                                                  (98) / (4) =   41.0796 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5858.5791	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1065.8645	838.4974	716.0897	417.7867	196.5220	0.0000	0.0000	0.0000	0.0000	409.4442	750.8582	1070.9916	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1142.4057	898.7110	767.5131	447.7885	210.6345	0.0000	0.0000	0.0000	0.0000	438.8470	804.7783	1147.9010	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7613	89.7100	89.6079	89.3502	88.7745	86.7000	86.7000	86.7000	86.7000	89.3095	89.6413	89.7771	(217)
Fuel for water heating, kWh/month													
	200.6108	175.9221	182.6130	160.8977	156.3007	139.4795	130.6150	147.9414	149.1319	167.0782	180.1183	194.6502	(219)
Water heating fuel used												1985.3589	(219)
Annual totals kWh/year													
Space heating fuel - main system												5858.5791	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =											-2098.5959	-2098.5959	(233)
Total delivered energy for all uses												6325.0575	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5858.5791	0.2160	1265.4531	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.3589	0.2160	428.8375	(264)
Space and water heating			1694.2906	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			905.9916	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.8100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.8100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		21.6494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		21.6494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.2100	10.6334	0.6300	0.7000	0.7700	23.4304	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	7.9300	46.7521	0.6300	0.7000	0.7700	113.3041	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	156.8718	270.3013	380.5323	493.4827	575.7467	582.4870	556.9841	493.4255	419.0307	301.3839	188.3989	133.9570 (83)
Total gains	648.6718	759.6509	852.3136	936.7462	988.9967	967.1581	923.9263	867.8381	808.9661	720.0728	640.0723	610.8815 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9981	0.9949	0.9829	0.9410	0.8250	0.6607	0.7163	0.9167	0.9893	0.9983	0.9995	(86)
MIT	19.6822	19.8273	20.0639	20.3821	20.6854	20.9016	20.9764	20.9643	20.8069	20.4148	19.9901	19.6582	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9990	0.9975	0.9929	0.9755	0.9130	0.7440	0.5284	0.5879	0.8657	0.9835	0.9976	0.9993	(89)
MIT 2	18.2065	18.4203	18.7670	19.2345	19.6583	19.9279	19.9917	19.9864	19.8256	19.2863	18.6657	18.1772	(90)
Living area fraction										fLA = Living area / (4) =		0.1959	(91)
MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9962	0.9902	0.9702	0.9083	0.7549	0.5543	0.6125	0.8669	0.9794	0.9965	0.9988	(94)
Useful gains	647.6285	756.7635	843.9831	908.8096	898.3418	730.0702	512.1056	531.5433	701.3288	705.2595	637.8127	610.1600	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2131.9030	2067.1650	1871.9493	1562.0452	1204.6412	807.1895	524.3046	551.6293	868.7059	1315.0585	1752.8642	2123.7564	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating												5830.5567	(98)
Space heating per m2											(98) / (4) =	43.8190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6242.5661	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1182.3343	942.8156	818.8510	503.5650	243.9901	0.0000	0.0000	0.0000	0.0000	485.7500	859.5687	1205.6913	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5553	88.3997	88.0781	87.3388	85.6966	80.3000	80.3000	80.3000	80.3000	87.1824	88.1934	88.6208	(217)
Fuel for water heating, kWh/month													
	247.5280	218.5203	230.2482	208.0315	205.8681	193.5027	185.3903	206.6667	208.2909	216.1096	226.0408	241.3548	(219)
Water heating fuel used												2587.5520	(219)
Annual totals kWh/year													
Space heating fuel - main system												6242.5661	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9409.8334	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6242.5661	0.2160	1348.3943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.5520	0.2160	558.9112	(264)
Space and water heating			1907.3055	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2208.1778	(272)
Emissions per m2 for space and water heating			14.3342	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3342 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 170 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 170	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 170, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 170 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 170	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 170, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	6.81	$kgCO_2/yr/m^2$	
TER	16.60	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.81	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.96	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.32	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 171 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 171	**Prop Type Ref**	Opp
Property	L472-R - Det SG, Plot 171, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	16.12
Environmental	96 A	**% DER<TER**	64.89		
CO_2 Emissions (t/year)	0.21	**DFEE**	41.01	**TFEE**	53.72
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 139 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.12 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.19 m², No overhang
Windows facing South: 10.34 m², No overhang
Windows facing West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1744	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3994	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3395	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4328	0.4243	0.4158	0.3734	0.3649	0.3225	0.3225	0.3140	0.3395	0.3649	0.3819	0.3989	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6828	0.6743	0.6658	0.6234	0.6149	0.5725	0.5725	0.5640	0.5895	0.6149	0.6319	0.6489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.2500	1.2357	23.7880			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			69.6600	0.1200	8.3592			(28a)
External Wall	170.6800	23.5300	147.1500	0.2100	30.9015			(29a)
Main Roof	69.6600		69.6600	0.0700	4.8762			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.3449			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							195.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3154	(36)
Total fabric heat loss					(33) + (36) =		79.6603	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	77.5390	76.5753	75.6116	70.7931	69.8294	65.0108	65.0108	64.0471	66.9382	69.8294	71.7568	73.6842	(38)
Heat transfer coeff	157.1993	156.2356	155.2719	150.4534	149.4897	144.6711	144.6711	143.7074	146.5985	149.4897	151.4171	153.3445	(39)
Average = Sum(39)m / 12 =												150.2124	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1283	1.1214	1.1145	1.0799	1.0730	1.0384	1.0384	1.0315	1.0522	1.0730	1.0868	1.1007	(40)
HLP (average)												1.0782	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9158	(42)
Average daily hot water use (litres/day)												103.4498	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8318 10.6767 11.7973 11.3860 11.7376 11.3222 11.6766 11.7162 11.3556 11.7670 11.4232 11.8206 (61)
Total heat required for water heating calculated for each month
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
180.5861 158.2703 164.1007 144.1678 139.1449 121.2650 113.5548 128.6229 129.6586 149.6376 161.9198 175.2502 (64)
Total per year (kWh/year) = Sum(64)m = 1766.1786 (64)
Heat gains from water heating, kWh/month
59.0688 51.7440 53.5902 46.9965 45.2973 39.3865 36.7936 41.8005 42.1746 48.7837 52.8959 57.2955 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
29.6036 26.2936 21.3834 16.1886 12.1012 10.2163 11.0391 14.3491 19.2593 24.4541 28.5415 30.4264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
308.6376 311.8403 303.7696 286.5881 264.8995 244.5153 230.8973 227.6947 235.7653 252.9469 274.6354 295.0197 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 37.5789 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 -116.6312 (71)
Water heating gains (Table 5)
79.3935 77.0001 72.0298 65.2729 60.8835 54.7035 49.4538 56.1835 58.5759 65.5695 73.4666 77.0101 (72)
Total internal gains
487.3714 484.8707 466.9195 437.7862 407.6209 379.1718 361.1270 367.9639 383.3372 412.7072 446.3802 472.1928 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1900	10.6334	0.7200	0.7000	0.7700	30.4172	(74)
South	10.3400	46.7521	0.7200	0.7000	0.7700	168.8438	(78)
West	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(80)

Solar gains	204.2001	344.3133	466.9276	579.9730	657.0209	657.1550	631.4145	572.1088	505.2227	378.9150	243.8195	175.3155	(83)
Total gains	691.5714	829.1840	933.8471	1017.7592	1064.6418	1036.3268	992.5414	940.0727	888.5599	791.6221	690.1997	647.5083	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.0059	48.3020	48.6018	50.1584	50.4818	52.1631	52.1631	52.5129	51.4773	50.4818	49.8392	49.2127	
alpha	4.2004	4.2201	4.2401	4.3439	4.3655	4.4775	4.4775	4.5009	4.4318	4.3655	4.3226	4.2808	
util living area	0.9973	0.9938	0.9858	0.9631	0.9040	0.7686	0.6068	0.6532	0.8646	0.9735	0.9946	0.9980	(86)
MIT	19.4130	19.6110	19.9054	20.3035	20.6449	20.8918	20.9713	20.9606	20.7971	20.3492	19.8263	19.4078	(87)
Th 2	19.9778	19.9834	19.9890	20.0173	20.0229	20.0514	20.0514	20.0572	20.0400	20.0229	20.0116	20.0003	(88)
util rest of house	0.9965	0.9921	0.9817	0.9513	0.8710	0.6920	0.4913	0.5403	0.8076	0.9629	0.9928	0.9974	(89)
MIT 2	17.8457	18.1384	18.5703	19.1622	19.6377	19.9638	20.0371	20.0355	19.8529	19.2371	18.4725	17.8530	(90)
Living area fraction										fLA = Living area / (4) =		0.2010	(91)
MIT	18.1608	18.4345	18.8387	19.3916	19.8402	20.1504	20.2249	20.2215	20.0427	19.4607	18.7447	18.1656	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1608	18.4345	18.8387	19.3916	19.8402	20.1504	20.2249	20.2215	20.0427	19.4607	18.7447	18.1656	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9882	0.9751	0.9416	0.8636	0.7009	0.5136	0.5614	0.8078	0.9546	0.9894	0.9958	(94)
Useful gains	687.7552	819.4123	910.5710	958.3352	919.4419	726.3359	509.7625	527.7471	717.7398	755.6859	682.8627	644.8053	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2178.9069	2114.5661	1915.8606	1578.5022	1216.8729	802.9809	524.4211	549.1801	871.1901	1324.5774	1763.2040	2141.5478	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1109.4169	870.3433	747.9355	446.5202	221.2887	0.0000	0.0000	0.0000	0.0000	423.2553	777.8457	1113.5764	(98)
Space heating												5710.1820	(98)
Space heating per m2											(98) / (4) =	40.9861	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6120.2379	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1109.4169	870.3433	747.9355	446.5202	221.2887	0.0000	0.0000	0.0000	0.0000	423.2553	777.8457	1113.5764	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1189.0856	932.8439	801.6458	478.5855	237.1797	0.0000	0.0000	0.0000	0.0000	453.6498	833.7039	1193.5438	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.5861	158.2703	164.1007	144.1678	139.1449	121.2650	113.5548	128.6229	129.6586	149.6376	161.9198	175.2502	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7781	89.7267	89.6304	89.3941	88.8754	86.7000	86.7000	86.7000	86.7000	89.3312	89.6586	89.7930	(217)
Fuel for water heating, kWh/month													
	201.1471	176.3914	183.0860	161.2723	156.5618	139.8673	130.9744	148.3539	149.5485	167.5089	180.5961	195.1713	(219)
Water heating fuel used												1990.4790	(219)
Annual totals kWh/year													
Space heating fuel - main system												6120.2379	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6255.8455	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6120.2379	0.2160	1321.9714	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.4790	0.2160	429.9435	(264)
Space and water heating			1751.9148	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			789.2366	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.6600	ZC1
Total Floor Area	TFA	139.3200	
Assumed number of occupants	N	2.9158	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.1275	ZC2
CO2 emissions from cooking, equation (L16)		1.3564	ZC3
Total CO2 emissions		20.1439	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.1439	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.6600 (1b)	x	2.3100 (2b)	=	160.9146	(1b) - (3b)
First floor	69.6600 (1c)	x	2.6300 (2c)	=	183.2058	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	344.1204	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1162	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3113	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3969	0.3891	0.3813	0.3424	0.3347	0.2957	0.2957	0.2880	0.3113	0.3347	0.3502	0.3658	(22b)
Effective ac	0.5788	0.5757	0.5727	0.5586	0.5560	0.5437	0.5437	0.5415	0.5485	0.5560	0.5613	0.5669	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2500	1.3258	25.5208			(27)
Ground floor			69.6600	0.1300	9.0558			(28a)
External Wall	170.6800	23.5300	147.1500	0.1800	26.4870			(29a)
Main Roof	69.6600		69.6600	0.1300	9.0558			(30)
Total net area of external elements Aum(A, m2)			310.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2554			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7998	(36)
Total fabric heat loss (33) + (36) =	88.0552	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.7249	65.3775	65.0371	63.4379	63.1387	61.7459	61.7459	61.4879	62.2824	63.1387	63.7440	64.3768	(38)
Heat transfer coeff	153.7801	153.4328	153.0923	151.4931	151.1939	149.8011	149.8011	149.5432	150.3376	151.1939	151.7992	152.4320	(39)
Average = Sum(39)m / 12 =												151.4917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1038	1.1013	1.0989	1.0874	1.0852	1.0752	1.0752	1.0734	1.0791	1.0852	1.0896	1.0941	(40)
HLP (average)												1.0874	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9158	(42)
Average daily hot water use (litres/day)	103.4498	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.7947	109.6568	105.5188	101.3808	97.2428	93.1048	93.1048	97.2428	101.3808	105.5188	109.6568	113.7947	(44)
Energy conte	168.7543	147.5936	152.3034	132.7818	127.4073	109.9428	101.8782	116.9067	118.3029	137.8706	150.4966	163.4295	(45)
Energy content (annual)										Total = Sum(45)m =		1627.6677	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3131	22.1390	22.8455	19.9173	19.1111	16.4914	15.2817	17.5360	17.7454	20.6806	22.5745	24.5144	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5539	45.9147	47.4452	49.5539	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
								Total per year (kWh/year) = Sum(64)m =				2217.9435	(64)
Heat gains from water heating, kWh/month													
	68.8505	60.5817	63.3806	56.4787	54.7514	48.0347	45.7358	51.2599	51.6645	58.5817	62.3689	67.0801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	145.7890	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6036	26.2936	21.3834	16.1886	12.1012	10.2163	11.0391	14.3491	19.2593	24.4541	28.5415	30.4264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.6376	311.8403	303.7696	286.5881	264.8995	244.5153	230.8973	227.6947	235.7653	252.9469	274.6354	295.0197	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	37.5789	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	-116.6312	(71)
Water heating gains (Table 5)													
	92.5410	90.1514	85.1890	78.4427	73.5906	66.7148	61.4728	68.8978	71.7562	78.7389	86.6234	90.1614	(72)
Total internal gains													
	500.5189	498.0220	480.0787	450.9560	420.3279	391.1831	373.1460	380.6782	396.5175	425.8765	459.5371	485.3441	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1900	10.6334	0.6300	0.7000	0.7700	26.6151	(74)
South	10.3400	46.7521	0.6300	0.7000	0.7700	147.7383	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	178.6751	301.2742	408.5616	507.4763	574.8933	575.0106	552.4877	500.5952	442.0699	331.5506	213.3420	153.4011	(83)
Total gains	679.1940	799.2961	888.6403	958.4324	995.2213	966.1937	925.6336	881.2734	838.5874	757.4271	672.8791	638.7452	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9145	63.0569	63.1972	63.8643	63.9907	64.5856	64.5856	64.6970	64.3552	63.9907	63.7355	63.4709	
alpha	5.1943	5.2038	5.2131	5.2576	5.2660	5.3057	5.3057	5.3131	5.2903	5.2660	5.2490	5.2314	
util living area													
	0.9993	0.9981	0.9949	0.9839	0.9465	0.8381	0.6737	0.7225	0.9157	0.9888	0.9983	0.9995	(86)
MIT	19.7155	19.8625	20.0911	20.3931	20.6834	20.8982	20.9757	20.9650	20.8160	20.4383	20.0197	19.6907	(87)
Th 2	19.9977	19.9998	20.0018	20.0112	20.0129	20.0211	20.0211	20.0226	20.0180	20.0129	20.0094	20.0056	(88)
util rest of house													
	0.9990	0.9974	0.9930	0.9770	0.9207	0.7604	0.5427	0.5960	0.8648	0.9828	0.9976	0.9993	(89)
MIT 2	18.2697	18.4860	18.8212	19.2653	19.6727	19.9436	20.0109	20.0061	19.8534	19.3347	18.7232	18.2391	(90)
Living area fraction									fLA = Living area / (4) =			0.2010	(91)
MIT	18.5604	18.7628	19.0765	19.4920	19.8759	20.1356	20.2049	20.1989	20.0470	19.5566	18.9838	18.5310	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5604	18.7628	19.0765	19.4920	19.8759	20.1356	20.2049	20.1989	20.0470	19.5566	18.9838	18.5310	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9962	0.9904	0.9721	0.9162	0.7708	0.5690	0.6209	0.8667	0.9788	0.9965	0.9989	(94)
Useful gains	678.1292	796.2263	880.0710	931.6740	911.8562	744.7898	526.6769	547.2060	726.7876	741.3507	670.4912	638.0180	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2192.9646	2127.0034	1925.3632	1604.6186	1236.1463	829.2328	540.0182	568.0992	894.0521	1354.1828	1803.9552	2184.4977	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1127.0375	894.2822	777.6974	484.5201	241.2719	0.0000	0.0000	0.0000	0.0000	455.9471	816.0941	1150.5809	(98)
Space heating												5947.4311	(98)
Space heating per m2											(98) / (4) =	42.6890	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6367.6993	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1127.0375	894.2822	777.6974	484.5201	241.2719	0.0000	0.0000	0.0000	0.0000	455.9471	816.0941	1150.5809	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1206.6783	957.4756	832.6524	518.7581	258.3211	0.0000	0.0000	0.0000	0.0000	488.1660	873.7624	1231.8854	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.7132	193.6210	203.2623	182.0968	176.9611	155.8575	149.3233	166.4605	167.6180	188.8295	199.8117	214.3885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5823	88.4207	88.1038	87.3972	85.8321	80.3000	80.3000	80.3000	80.3000	87.1884	88.2176	88.6487	(217)
Fuel for water heating, kWh/month													
	248.0329	218.9771	230.7077	208.3555	206.1712	194.0940	185.9568	207.2983	208.7397	216.5765	226.4986	241.8405	(219)
Water heating fuel used												2593.2488	(219)
Annual totals kWh/year													
Space heating fuel - main system												6367.6993	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												522.8085	(232)
Total delivered energy for all uses												9558.7566	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6367.6993	0.2160	1375.4230	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2593.2488	0.2160	560.1417	(264)
Space and water heating			1935.5648	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	522.8085	0.5190	271.3376	(268)
Total CO2, kg/m2/year			2245.8274	(272)
Emissions per m2 for space and water heating			13.8929	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9476	(272b)
Emissions per m2 for pumps and fans			0.2794	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8929 * 1.00) + 1.9476 + 0.2794, rounded to 2 d.p.			16.1200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 171 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 171	**Prop Type Ref**	Opp
Property	L472-R - Det SG, Plot 171, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	16.12
Environmental	96 A	**% DER<TER**	64.89		
CO_2 Emissions (t/year)	0.21	**DFEE**	41.01	**TFEE**	53.72
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.59 m	69.66 m²	2.31 m
1st Storey:	34.59 m	69.66 m²	2.63 m

7.0 Living Area	28.01	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	195.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.68	147.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	69.66	69.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	69.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.03	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.24	0.065	No
Independently assessed	E3 Sill	13.39	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	34.59	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	34.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.37	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	22.21	0.051	No
Independently assessed	E16 Corner (normal)	29.61	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.87	-0.092	No

Y-value	0.017	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 171 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 171	**Prop Type Ref**	Opp
Property	L472-R - Det SG, Plot 171, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.66	**TER**	16.12
Environmental	96 A	**% DER<TER**	64.89		
CO_2 Emissions (t/year)	0.21	**DFEE**	41.01	**TFEE**	53.72
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	139.32	m^2	
DER	5.66	$kgCO_2/yr/m^2$	
TER	16.12	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.66	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.89	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.01	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	139.32	m^2	
DER	16.68	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.16	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.16	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.55	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.13	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.36	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.03	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.03	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	29	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 172 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 172	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 172, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.76 m², No overhang
Windows facing North East: 1.07 m², No overhang
Windows facing East: 7.51 m², No overhang
Windows facing South: 9.16 m², No overhang
Windows facing West: 0.48 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access           Gains
                                           m2          Table 6a      Specific data  Specific data      factor               W
                                                          W/m2      or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.7600           10.6334          0.7200         0.7000          0.7700         25.1063 (74)
Northeast                                1.0700           11.2829          0.7200         0.7000          0.7700          4.2167 (75)
East                                     7.5100           19.6403          0.7200         0.7000          0.7700         51.5171 (76)
South                                    9.1600           46.7521          0.7200         0.7000          0.7700        149.5754 (78)
West                                     0.4800           19.6403          0.7200         0.7000          0.7700          3.2927 (80)
Northwest                                1.0700           11.2829          0.7200         0.7000          0.7700          4.2167 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   237.9247  417.3311  601.0753  791.9500  927.8021  938.3989  897.5603  793.9724  667.0406  469.5355  287.2223  202.1367 (83)
Total gains   708.0830  885.2151 1051.9030 1214.9709 1322.0460 1305.3046 1246.9500 1149.9466 1037.5092  868.0461  717.9962  657.6281 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9962    0.9902    0.9744    0.9269    0.8215    0.6470    0.4906    0.5456    0.7938    0.9580    0.9921    0.9972 (86)

MIT           19.3880   19.6256   19.9753   20.4202   20.7535   20.9386   20.9852   20.9773   20.8473   20.3894   19.8176   19.3719 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9951    0.9874    0.9671    0.9059    0.7725    0.5631    0.3841    0.4363    0.7217    0.9417    0.9894    0.9964 (89)
MIT 2         17.7675   18.1169   18.6258   19.2718   19.7132   19.9437   19.9818   19.9827   19.8479   19.2448   18.4160   17.7579 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1191 (91)
MIT           17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9920    0.9813    0.9564    0.8923    0.7659    0.5697    0.3964    0.4485    0.7208    0.9295    0.9842    0.9940 (94)
Useful gains 702.4418  868.6956 1005.9894 1084.0839 1012.4943  743.5904  494.2287  515.7354  747.8626  806.8828  706.6872  653.7031 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              2102.1554 2050.1625 1869.8504 1554.6389 1196.8832  780.2414  500.1460  525.5457  848.0212 1291.6166 1708.5378 2069.2310 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              1041.3869  793.9457  642.7125  338.7996  137.1853    0.0000    0.0000    0.0000    0.0000  360.6419  721.3325 1053.1528 (98)
Space heating                                                                                                         5089.1573 (98)
Space heating per m2                                                                                  (98) / (4) =    39.7342 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5454.6166	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1041.3869	793.9457	642.7125	338.7996	137.1853	0.0000	0.0000	0.0000	0.0000	360.6419	721.3325	1053.1528	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1116.1703	850.9601	688.8666	363.1293	147.0368	0.0000	0.0000	0.0000	0.0000	386.5401	773.1323	1128.7811	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7519	89.6839	89.5471	89.1987	88.4556	86.7000	86.7000	86.7000	86.7000	89.2179	89.6209	89.7708	(217)
Fuel for water heating, kWh/month													
	200.0837	175.4933	182.2411	160.7369	156.4434	139.1090	130.2717	147.5475	148.7340	166.7991	179.6696	194.1330	(219)
Water heating fuel used												1981.2624	(219)
Annual totals kWh/year													
Space heating fuel - main system												5454.6166	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 908 * 1.00) =											-2353.1582	-2353.1582	(233)
Total delivered energy for all uses												5625.2927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5454.6166	0.2160	1178.1972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.2624	0.2160	427.9527	(264)
Space and water heating			1606.1499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2353.1582	0.5190	-1221.2891	(269)
Total CO2, kg/year			666.4556	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.2000	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.3373	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3373	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019 (64)
Heat gains from water heating, kWh/month												
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7600	10.6334	0.6300	0.7000	0.7700	21.9680	(74)
Northeast	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(75)
East	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774	(76)
South	9.1600	46.7521	0.6300	0.7000	0.7700	130.8784	(78)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	208.1841	365.1647	525.9409	692.9562	811.8269	821.0991	785.3653	694.7258	583.6606	410.8435	251.3195	176.8696 (83)
Total gains	691.4906	846.2008	989.9284	1129.1475	1218.6796	1199.9219	1146.6798	1063.3161	967.3100	822.5240	695.2510	645.5130 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9987	0.9964	0.9891	0.9627	0.8857	0.7297	0.5610	0.6211	0.8608	0.9801	0.9971	0.9991	(86)
MIT	19.6287	19.8100	20.0910	20.4500	20.7567	20.9355	20.9858	20.9772	20.8467	20.4359	19.9611	19.5977	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9983	0.9952	0.9851	0.9480	0.8412	0.6364	0.4344	0.4924	0.7907	0.9697	0.9959	0.9988	(89)
MIT 2	18.0844	18.3507	18.7605	19.2796	19.6899	19.8959	19.9340	19.9313	19.8107	19.2688	18.5791	18.0448	(90)
Living area fraction									fLA = Living area / (4) =			0.1191	(91)
MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9927	0.9798	0.9389	0.8356	0.6442	0.4493	0.5073	0.7905	0.9625	0.9938	0.9980	(94)
Useful gains	689.5797	840.0031	969.8948	1060.1725	1018.2913	772.9630	515.2167	539.3682	764.6892	791.6387	690.9120	644.2224	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2157.9449	2100.2331	1910.2881	1601.7058	1233.5985	816.3431	521.0607	549.7577	881.8035	1338.5872	1776.4184	2149.0641	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating												5497.1800	(98)
Space heating per m2											(98) / (4) =	42.9199	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5885.6317	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1169.6614	906.7179	749.0928	417.4560	171.5081	0.0000	0.0000	0.0000	0.0000	435.6849	836.7930	1198.7176	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5424	88.3400	87.9192	86.9295	84.8165	80.3000	80.3000	80.3000	80.3000	86.9442	88.1506	88.6155	(217)
Fuel for water heating, kWh/month													
	247.0095	218.1819	230.1603	208.5666	207.3972	192.9379	184.8492	206.0635	207.8622	216.2403	225.6538	240.8324	(219)
Water heating fuel used												2585.7547	(219)
Annual totals kWh/year													
Space heating fuel - main system												5885.6317	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												9013.9583	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5885.6317	0.2160	1271.2965	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.7547	0.2160	558.5230	(264)
Space and water heating			1829.8195	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2111.4143	(272)
Emissions per m2 for space and water heating			14.2865	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2865 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.4900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 172 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 172	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 172, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.48	100
W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		2.05	100
D2	Half Glazed Door	[1] External Wall	West				2.14	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.07	100
W15	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 172 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 172	**Prop Type Ref**	Opp
Property	L467-R - Det SG, Plot 172, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.20	$kgCO_2/yr/m^2$	
TER	16.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.20	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.46	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.26	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 173 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 173	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 173, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.03	**TER**	17.92
Environmental	95 A	**% DER<TER**	60.77		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.81	**TFEE**	54.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 5.90 m², No overhang
Windows facing South: 0.72 m², No overhang
Windows facing West: 7.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.6100	1.2357	18.0542			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.2100	26.6301			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8964	(36)
Total fabric heat loss					(33) + (36) =		62.7206	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	116.9976	116.3301	115.6626	112.3251	111.6576	108.3202	108.3202	107.6527	109.6552	111.6576	112.9926	114.3276	(39)
Average = Sum(39)m / 12 =												112.1583	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1715	1.1648	1.1312	1.1244	1.0908	1.0908	1.0841	1.1043	1.1244	1.1379	1.1513	(40)
HLP (average)												1.1295	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8169 10.6637 11.7839 11.3667 11.7162 11.3045 11.6603 11.6966 11.3384 11.7548 11.4100 11.8062 (61)
Total heat required for water heating calculated for each month
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (64)
Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)
Heat gains from water heating, kWh/month
56.7099 49.6809 51.4612 45.1385 43.5138 37.8477 35.3677 40.1640 40.5192 46.8565 50.7922 55.0110 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.1477 21.4477 17.4425 13.2051 9.8709 8.3335 9.0046 11.7045 15.7098 19.9472 23.2813 24.8188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
255.1911 257.8392 251.1661 236.9599 219.0271 202.1728 190.9131 188.2650 194.9381 209.1443 227.0771 243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
76.2229 73.9299 69.1683 62.6923 58.4863 52.5663 47.5372 53.9839 56.2767 62.9792 70.5448 73.9395 (72)
Total internal gains
422.5560 420.2112 404.7712 379.8515 354.3787 330.0668 314.4492 320.9477 333.9189 359.0650 387.8975 409.6840 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.7200	0.7000	0.7700	3.5654	(74)
East	5.9000	19.6403	0.7200	0.7000	0.7700	40.4728	(76)
South	0.7200	46.7521	0.7200	0.7000	0.7700	11.7570	(78)
West	7.0300	19.6403	0.7200	0.7000	0.7700	48.2244	(80)

Solar gains	104.0195	199.5790	321.8524	463.0635	564.6761	577.4490	549.9567	473.8082	371.8778	234.7638	128.9293	86.0716	(83)
Total gains	526.5755	619.7902	726.6236	842.9150	919.0547	907.5158	864.4059	794.7559	705.7967	593.8287	516.8268	495.7556	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.1520	47.4225	47.6962	49.1134	49.4070	50.9293	50.9293	51.2450	50.3092	49.4070	48.8232	48.2531	
alpha	4.1435	4.1615	4.1797	4.2742	4.2938	4.3953	4.3953	4.4163	4.3539	4.2938	4.2549	4.2169	

util living area
0.9968 0.9933 0.9826 0.9464 0.8571 0.6918 0.5325 0.5916 0.8404 0.9718 0.9941 0.9975 (86)

MIT	19.4044	19.5941	19.9215	20.3667	20.7168	20.9256	20.9815	20.9715	20.8145	20.3401	19.8096	19.3983	(87)
Th 2	19.9375	19.9429	19.9483	19.9755	19.9809	20.0083	20.0083	20.0138	19.9973	19.9809	19.9700	19.9591	(88)

util rest of house
0.9959 0.9914 0.9774 0.9299 0.8135 0.6086 0.4212 0.4786 0.7760 0.9602 0.9921 0.9969 (89)

MIT 2	17.8031	18.0832	18.5620	19.2152	19.6882	19.9525	19.9999	19.9994	19.8329	19.1912	18.4168	17.8084	(90)

Living area fraction fLA = Living area / (4) = 0.1233 (91)

MIT	18.0005	18.2694	18.7295	19.3571	19.8150	20.0725	20.1209	20.1192	19.9539	19.3329	18.5885	18.0044	(92)

Temperature adjustment 0.0000
adjusted MIT 18.0005 18.2694 18.7295 19.3571 19.8150 20.0725 20.1209 20.1192 19.9539 19.3329 18.5885 18.0044 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9868	0.9690	0.9172	0.8053	0.6144	0.4344	0.4914	0.7727	0.9499	0.9879	0.9948	(94)
Useful gains	523.0538	611.6153	704.0787	773.1599	740.1119	557.6199	375.4641	390.5230	545.3927	564.0661	510.5970	493.1741	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W
1602.9199 1555.2664 1414.5012 1174.5956 906.0972 592.7769 381.3796 400.3829 641.9076 975.0895 1298.1168 1578.2216 (97)

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh
803.4204 634.1335 528.5543 289.0337 123.4931 0.0000 0.0000 0.0000 0.0000 305.8014 567.0142 807.2754 (98)
Space heating 4058.7260 (98)
Space heating per m2 (98) / (4) = 40.8734 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4350.1887	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	803.4204	634.1335	528.5543	289.0337	123.4931	0.0000	0.0000	0.0000	0.0000	305.8014	567.0142	807.2754	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	861.1151	679.6715	566.5105	309.7896	132.3613	0.0000	0.0000	0.0000	0.0000	327.7614	607.7323	865.2469	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6390	89.5806	89.4465	89.1010	88.3915	86.7000	86.7000	86.7000	86.7000	89.1163	89.4998	89.6575	(217)
Fuel for water heating, kWh/month													
	193.5407	169.7491	176.3002	155.5258	151.3445	134.5243	126.0233	142.6715	143.8012	161.4054	173.8435	187.7991	(219)
Water heating fuel used												1916.5286	(219)
Annual totals kWh/year													
Space heating fuel - main system												4350.1887	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												5003.3038	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4350.1887	0.2160	939.6408	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.5286	0.2160	413.9702	(264)
Space and water heating			1353.6109	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			697.8993	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.0300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.0300	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		24.1176	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1176	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.1800	22.8258			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.6721			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7119	(36)
Total fabric heat loss (33) + (36) =	68.3840	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	115.4425	115.1867	114.9359	113.7580	113.5376	112.5116	112.5116	112.3217	112.9068	113.5376	113.9834	114.4495	(39)
Average = Sum(39)m / 12 =												113.7569	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1626	1.1600	1.1575	1.1456	1.1434	1.1330	1.1330	1.1311	1.1370	1.1434	1.1479	1.1526	(40)
HLP (average)												1.1456	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.1477	21.4477	17.4425	13.2051	9.8709	8.3335	9.0046	11.7045	15.7098	19.9472	23.2813	24.8188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.7085	433.3673	417.9348	392.5359	366.3940	341.4150	325.8045	332.9697	346.6130	372.2384	401.0589	422.8401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137	(76)
South	0.7200	46.7521	0.6300	0.7000	0.7700	10.2874	(78)
West	7.0300	19.6403	0.6300	0.7000	0.7700	42.1963	(80)

Solar gains	91.0171	174.6316	281.6208	405.1805	494.0916	505.2679	481.2121	414.5821	325.3931	205.4183	112.8132	75.3127	(83)
Total gains	526.7256	607.9989	699.5557	797.7164	860.4856	846.6829	807.0167	747.5518	672.0061	577.6567	513.8721	498.1528	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7339	59.8666	59.9972	60.6185	60.7361	61.2900	61.2900	61.3936	61.0754	60.7361	60.4986	60.2522	
alpha	4.9823	4.9911	4.9998	5.0412	5.0491	5.0860	5.0860	5.0929	5.0717	5.0491	5.0332	5.0168	
util living area													
	0.9989	0.9974	0.9924	0.9721	0.9073	0.7614	0.5926	0.6548	0.8904	0.9860	0.9977	0.9992	(86)
MIT	19.6773	19.8217	20.0816	20.4311	20.7394	20.9285	20.9841	20.9742	20.8287	20.4212	19.9860	19.6529	(87)
Th 2	19.9501	19.9521	19.9542	19.9638	19.9656	19.9739	19.9739	19.9755	19.9707	19.9656	19.9619	19.9581	(88)
util rest of house													
	0.9985	0.9965	0.9895	0.9607	0.8687	0.6718	0.4650	0.5265	0.8295	0.9785	0.9967	0.9989	(89)
MIT 2	18.1800	18.3925	18.7726	19.2814	19.7007	19.9242	19.9678	19.9643	19.8244	19.2747	18.6401	18.1500	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3645	18.5687	18.9340	19.4231	19.8287	20.0480	20.0931	20.0888	19.9482	19.4160	18.8060	18.3352	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3645	18.5687	18.9340	19.4231	19.8287	20.0480	20.0931	20.0888	19.9482	19.4160	18.8060	18.3352	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9947	0.9855	0.9528	0.8625	0.6790	0.4805	0.5417	0.8279	0.9727	0.9949	0.9981	(94)
Useful gains	525.4197	604.7559	689.3774	760.0852	742.1522	574.9058	387.7578	404.9298	556.3356	561.8671	511.2703	497.2163	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1623.6443	1574.4532	1429.1089	1197.0906	922.9159	612.9620	393.0152	414.3325	660.2961	1000.9528	1334.2867	1617.7692	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	817.0791	651.6365	550.3602	314.6438	134.4882	0.0000	0.0000	0.0000	0.0000	326.6798	592.5718	833.6914	(98)
Space heating												4221.1508	(98)
Space heating per m2											(98) / (4) =	42.5091	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4519.4334	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	817.0791	651.6365	550.3602	314.6438	134.4882	0.0000	0.0000	0.0000	0.0000	326.6798	592.5718	833.6914	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	874.8171	697.6837	589.2507	336.8778	143.9916	0.0000	0.0000	0.0000	0.0000	349.7642	634.4452	892.6032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1115	87.9296	87.5004	86.5096	84.4750	80.3000	80.3000	80.3000	80.3000	86.4933	87.6852	88.1892	(217)
Fuel for water heating, kWh/month													
	241.3191	213.1546	224.9927	202.4121	200.6905	185.9471	178.1515	198.5972	200.7905	211.6262	220.6698	235.3222	(219)
Water heating fuel used												2513.6737	(219)
Annual totals kWh/year													
Space heating fuel - main system												4519.4334	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Total delivered energy for all uses												7534.5623	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4519.4334	0.2160	976.1976	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.6737	0.2160	542.9535	(264)
Space and water heating			1519.1511	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Total CO2, kg/m2/year			1779.4064	(272)
Emissions per m2 for space and water heating			15.2986	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2289	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2986 * 1.00) + 2.2289 + 0.3920, rounded to 2 d.p.			17.9200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 173 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 173	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 173, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.03	**TER**	17.92
Environmental	95 A	**% DER<TER**	60.77		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.81	**TFEE**	54.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.09 m	49.65 m²	2.31 m
1st Storey:	29.09 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	143.56	126.81

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.26	0.065	No
Independently assessed	E3 Sill	9.65	0.004	No
Independently assessed	E4 Jamb	28.80	0.005	No
Independently assessed	E5 Ground floor (normal)	29.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	29.09	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.94	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.15	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 173 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 173	**Prop Type Ref**	Opp
Property	L363-1-R Det SG, Plot 173, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.03	**TER**	17.92
Environmental	95 A	**% DER<TER**	60.77		
CO_2 Emissions (t/year)	0.25	**DFEE**	42.81	**TFEE**	54.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	7.03	$kgCO_2/yr/m^2$	
TER	17.92	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.03	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.77	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.81	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	18.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.47	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.47	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 174 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 174	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 174, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.06	**TER**	17.69
Environmental	94 A	**% DER<TER**	54.45		
CO_2 Emissions (t/year)	0.42	**DFEE**	44.15	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 113 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.69 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.72 m², No overhang
Windows facing East: 6.98 m², No overhang
Windows facing South: 0.48 m², No overhang
Windows facing West: 8.65 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1797	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4047	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3440	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4386	0.4300	0.4214	0.3784	0.3698	0.3268	0.3268	0.3182	0.3440	0.3698	0.3870	0.4042	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6886	0.6800	0.6714	0.6284	0.6198	0.5768	0.5768	0.5682	0.5940	0.6198	0.6370	0.6542	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.8300	1.2357	20.7975			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			56.3100	0.1200	6.7572			(28a)
External Wall	148.5900	21.1100	127.4800	0.2100	26.7708			(29a)
Main Roof	56.3100		56.3100	0.0700	3.9417			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.6872			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4210	(36)
Total fabric heat loss (33) + (36) =	70.1082	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.2150	62.4255	61.6360	57.6883	56.8988	52.9512	52.9512	52.1617	54.5302	56.8988	58.4779	60.0569	(38)
Heat transfer coeff	133.3232	132.5337	131.7442	127.7966	127.0070	123.0594	123.0594	122.2699	124.6384	127.0070	128.5861	130.1651	(39)
Average = Sum(39)m / 12 =												127.5992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1768	1.1698	1.1348	1.1277	1.0927	1.0927	1.0857	1.1067	1.1277	1.1418	1.1558	(40)
HLP (average)												1.1330	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8248 10.6705 11.7910 11.3788 11.7274 11.3137 11.6688 11.7068 11.3492 11.7612 11.4170 11.8139 (61)
Total heat required for water heating calculated for each month
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (64)
Total per year (kWh/year) = Sum(64)m = 1733.9139 (64)
Heat gains from water heating, kWh/month
57.9578 50.7724 52.5875 46.1219 44.4573 38.6617 36.1220 41.0297 41.3954 47.8761 51.9051 56.2195 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.9618	23.0591	18.7529	14.1971	10.6125	8.9595	9.6811	12.5839	16.8900	21.4458	25.0304	26.6834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.2678	278.1242	270.9261	255.6022	236.2586	218.0783	205.9328	203.0764	210.2745	225.5983	244.9419	263.1222	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	(71)
Water heating gains (Table 5)													
	77.9002	75.5541	70.6821	64.0581	59.7545	53.6969	48.5511	55.1475	57.4936	64.3495	72.0905	75.5639	(72)
Total internal gains													
	447.5749	445.1824	428.8062	402.3026	375.0707	349.1798	332.6101	339.2528	353.1032	379.8387	410.5079	433.8146	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.7200	0.7000	0.7700	2.6740	(74)
East	6.9800	19.6403	0.7200	0.7000	0.7700	47.8814	(76)
South	0.4800	46.7521	0.7200	0.7000	0.7700	7.8380	(78)
West	8.6500	19.6403	0.7200	0.7000	0.7700	59.3372	(80)

Solar gains	117.7306	227.6892	370.4508	536.1970	655.4342	670.6531	638.5824	549.3316	429.2543	268.8055	146.2785	97.1733	(83)
Total gains	565.3055	672.8716	799.2570	938.4996	1030.5049	1019.8329	971.1925	888.5844	782.3575	648.6442	556.7863	530.9879	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.2246	46.5000	46.7787	48.2237	48.5234	50.0800	50.0800	50.4034	49.4456	48.5234	47.9276	47.3461	
alpha	4.0816	4.1000	4.1186	4.2149	4.2349	4.3387	4.3387	4.3602	4.2964	4.2349	4.1952	4.1564	
util living area													
	0.9972	0.9940	0.9837	0.9483	0.8598	0.6957	0.5371	0.5984	0.8475	0.9743	0.9948	0.9979	(86)
MIT	19.3465	19.5409	19.8788	20.3402	20.7029	20.9208	20.9798	20.9688	20.8008	20.3065	19.7621	19.3422	(87)
Th 2	19.9330	19.9386	19.9442	19.9725	19.9782	20.0068	20.0068	20.0125	19.9954	19.9782	19.9669	19.9555	(88)
util rest of house													
	0.9964	0.9923	0.9789	0.9324	0.8170	0.6128	0.4252	0.4849	0.7849	0.9638	0.9931	0.9973	(89)
MIT 2	17.7177	18.0051	18.4996	19.1776	19.6694	19.9468	19.9974	19.9965	19.8165	19.1437	18.3476	17.7262	(90)
Living area fraction									fLA = Living area / (4) =			0.2606	(91)
MIT	18.1421	18.4053	18.8591	19.4806	19.9387	20.2006	20.2535	20.2499	20.0730	19.4468	18.7162	18.1473	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1421	18.4053	18.8591	19.4806	19.9387	20.2006	20.2535	20.2499	20.0730	19.4468	18.7162	18.1473	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9886	0.9721	0.9229	0.8151	0.6301	0.4540	0.5136	0.7905	0.9563	0.9900	0.9957	(94)
Useful gains	562.1632	665.2148	776.9586	866.1197	839.9692	642.6465	440.9081	456.3792	618.4755	620.2801	551.1916	528.7155	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1845.4801	1789.9111	1628.2350	1352.1613	1046.3751	689.2082	449.5938	470.7215	744.4708	1123.6013	1493.6878	1815.4564	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	954.7878	755.7959	633.3497	349.9499	153.5659	0.0000	0.0000	0.0000	0.0000	374.4710	678.5973	957.3352	(98)
Space heating												4857.8526	(98)
Space heating per m2											(98) / (4) =	43.1349	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5206.7016	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	954.7878	755.7959	633.3497	349.9499	153.5659	0.0000	0.0000	0.0000	0.0000	374.4710	678.5973	957.3352	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1023.3524	810.0707	678.8314	375.0803	164.5937	0.0000	0.0000	0.0000	0.0000	401.3622	727.3283	1026.0827	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2431	155.3464	161.0835	141.5357	136.6160	119.0831	111.5330	126.3024	127.3134	146.9063	158.9384	172.0126	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7167	89.6652	89.5461	89.2330	88.5686	86.7000	86.7000	86.7000	86.7000	89.2557	89.5940	89.7325	(217)
Fuel for water heating, kWh/month													
	197.5585	173.2516	179.8889	158.6136	154.2488	137.3507	128.6424	145.6775	146.8436	164.5904	177.3985	191.6949	(219)
Water heating fuel used												1955.7594	(219)
Annual totals kWh/year													
Space heating fuel - main system												5206.7016	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												5931.0865	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5206.7016	0.2160	1124.6476	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1955.7594	0.2160	422.4440	(264)
Space and water heating			1547.0916	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			908.0082	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.0600	ZC1
Total Floor Area	TFA	112.6200	
Assumed number of occupants	N	2.8297	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4839	ZC2
CO2 emissions from cooking, equation (L16)		1.6597	ZC3
Total CO2 emissions		24.2036	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.2036	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1438	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3938	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4268	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3766	0.3933	(22b)
Effective ac	0.5911	0.5875	0.5841	0.5678	0.5647	0.5506	0.5506	0.5479	0.5560	0.5647	0.5709	0.5773	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			16.8300	1.3258	22.3125			(27)
Ground floor			56.3100	0.1300	7.3203			(28a)
External Wall	148.5900	21.1100	127.4800	0.1800	22.9464			(29a)
Main Roof	56.3100		56.3100	0.1300	7.3203			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.0355			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6013	(36)
Total fabric heat loss (33) + (36) =	76.6368	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2581	53.9335	53.6153	52.1208	51.8411	50.5394	50.5394	50.2984	51.0408	51.8411	52.4068	52.9982	(38)
Heat transfer coeff	130.8949	130.5703	130.2521	128.7576	128.4779	127.1762	127.1762	126.9352	127.6776	128.4779	129.0436	129.6350	(39)
Average = Sum(39)m / 12 =												128.7562	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1623	1.1594	1.1566	1.1433	1.1408	1.1293	1.1293	1.1271	1.1337	1.1408	1.1458	1.1511	(40)
HLP (average)												1.1433	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.0076	48.5742	45.0070	46.5072	48.5742	49.0076	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
								Total per year (kWh/year) = Sum(64)m =				2181.3467	(64)
Heat gains from water heating, kWh/month													
	67.7413	59.6116	62.3795	55.5291	53.6690	47.0851	44.8316	50.2466	50.8100	57.6755	61.3796	66.0058	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.9618	23.0591	18.7529	14.1971	10.6125	8.9595	9.6811	12.5839	16.8900	21.4458	25.0304	26.6834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.2678	278.1242	270.9261	255.6022	236.2586	218.0783	205.9328	203.0764	210.2745	225.5983	244.9419	263.1222	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	(71)
Water heating gains (Table 5)													
	91.0501	88.7077	83.8434	77.1237	72.1358	65.3959	60.2576	67.5357	70.5695	77.5208	85.2495	88.7175	(72)
Total internal gains													
	460.7248	458.3360	441.9675	415.3681	387.4520	360.8789	344.3166	351.6410	366.1790	393.0100	423.6669	446.9682	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.6300	0.7000	0.7700	2.3398	(74)
East	6.9800	19.6403	0.6300	0.7000	0.7700	41.8962	(76)
South	0.4800	46.7521	0.6300	0.7000	0.7700	6.8583	(78)
West	8.6500	19.6403	0.6300	0.7000	0.7700	51.9201	(80)

Solar gains	103.0143	199.2280	324.1445	469.1724	573.5049	586.8214	558.7596	480.6651	375.5975	235.2048	127.9937	85.0267	(83)
Total gains	563.7391	657.5640	766.1119	884.5405	960.9569	947.7003	903.0761	832.3062	741.7766	628.2148	551.6606	531.9948	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7489	59.8975	60.0438	60.7408	60.8730	61.4960	61.4960	61.6128	61.2545	60.8730	60.6061	60.3296	
alpha	4.9833	4.9932	5.0029	5.0494	5.0582	5.0997	5.0997	5.1075	5.0836	5.0582	5.0404	5.0220	
util living area													
	0.9991	0.9979	0.9935	0.9744	0.9112	0.7666	0.5979	0.6629	0.8984	0.9882	0.9982	0.9994	(86)
MIT	19.6498	19.7962	20.0608	20.4188	20.7334	20.9268	20.9836	20.9730	20.8205	20.4025	19.9626	19.6275	(87)
Th 2	19.9503	19.9526	19.9549	19.9656	19.9676	19.9770	19.9770	19.9788	19.9734	19.9676	19.9636	19.9593	(88)
util rest of house													
	0.9988	0.9972	0.9910	0.9638	0.8738	0.6775	0.4699	0.5343	0.8401	0.9818	0.9974	0.9991	(89)
MIT 2	18.1400	18.3557	18.7431	19.2658	19.6954	19.9258	19.9707	19.9670	19.8182	19.2498	18.6071	18.1136	(90)
Living area fraction									fLA = Living area / (4) =			0.2606	(91)
MIT	18.5335	18.7311	19.0865	19.5663	19.9659	20.1867	20.2347	20.2292	20.0794	19.5502	18.9604	18.5082	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5335	18.7311	19.0865	19.5663	19.9659	20.1867	20.2347	20.2292	20.0794	19.5502	18.9604	18.5082	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9959	0.9880	0.9585	0.8737	0.6975	0.5035	0.5678	0.8474	0.9781	0.9963	0.9987	(94)
Useful gains	562.7209	654.8631	756.9423	847.8335	839.5826	661.0367	454.7024	472.5892	628.5894	614.4709	549.5964	531.2780	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1863.0901	1805.9309	1639.4202	1373.3686	1061.9835	710.4941	462.2450	486.0560	763.4370	1149.9016	1530.5061	1854.8389	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	967.4747	773.5176	656.5636	378.3853	165.4663	0.0000	0.0000	0.0000	0.0000	398.3604	706.2550	984.7293	(98)
Space heating												5030.7520	(98)
Space heating per m2											(98) / (4) =	44.6701	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5386.2442	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	967.4747	773.5176	656.5636	378.3853	165.4663	0.0000	0.0000	0.0000	0.0000	398.3604	706.2550	984.7293	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1035.8401	828.1773	702.9588	405.1234	177.1587	0.0000	0.0000	0.0000	0.0000	426.5101	756.1617	1054.3140	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3685	88.2058	87.8185	86.8882	84.9326	80.3000	80.3000	80.3000	80.3000	86.9189	87.9879	88.4360	(217)
Fuel for water heating, kWh/month													
	244.8578	216.2027	228.0289	206.2013	204.2358	190.2570	182.2807	203.2003	205.4444	214.1123	223.7087	238.7690	(219)
Water heating fuel used												2557.2987	(219)
Annual totals kWh/year													
Space heating fuel - main system												5386.2442	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Total delivered energy for all uses												8477.0370	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5386.2442	0.2160	1163.4287	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2557.2987	0.2160	552.3765	(264)
Space and water heating			1715.8053	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Total CO2, kg/m2/year			1992.6887	(272)
Emissions per m2 for space and water heating			15.2354	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1129	(272b)
Emissions per m2 for pumps and fans			0.3456	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2354 * 1.00) + 2.1129 + 0.3456, rounded to 2 d.p.			17.6900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 174 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 174	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 174, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.06	**TER**	17.69
Environmental	94 A	**% DER<TER**	54.45		
CO_2 Emissions (t/year)	0.42	**DFEE**	44.15	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	30.11 m	56.31 m²	2.31 m
1st Storey:	30.11 m	56.31 m²	2.63 m

7.0 Living Area	29.35	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	148.59	127.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	56.31	56.31

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	56.31

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	West							2.14	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	15.11	0.065	No
Independently assessed	E3 Sill	11.25	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	30.11	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.11	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.24	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.87	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 174 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 174	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 174, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.06	**TER**	17.69
Environmental	94 A	**% DER<TER**	54.45		
CO_2 Emissions (t/year)	0.42	**DFEE**	44.15	**TFEE**	56.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	112.62	m^2	
DER	8.06	$kgCO_2/yr/m^2$	
TER	17.69	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.06	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.45	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.15	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	112.62	m^2	
DER	18.34	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.48	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.48	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.34	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.34	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	24	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 175 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 175	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 175, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.03	**TER**	17.66
Environmental	94 A	**% DER<TER**	54.54		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.01	**TFEE**	56.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 113 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.66 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.48 m², No overhang
Windows facing East: 8.65 m², No overhang
Windows facing South: 0.72 m², No overhang
Windows facing West: 6.98 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1797	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4047	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3440	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4386	0.4300	0.4214	0.3784	0.3698	0.3268	0.3268	0.3182	0.3440	0.3698	0.3870	0.4042	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6886	0.6800	0.6714	0.6284	0.6198	0.5768	0.5768	0.5682	0.5940	0.6198	0.6370	0.6542	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.8300	1.2357	20.7975			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			56.3100	0.1200	6.7572			(28a)
External Wall	148.5900	21.1100	127.4800	0.2100	26.7708			(29a)
Main Roof	56.3100		56.3100	0.0700	3.9417			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.6872			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4210	(36)
Total fabric heat loss (33) + (36) =	70.1082	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.2150	62.4255	61.6360	57.6883	56.8988	52.9512	52.9512	52.1617	54.5302	56.8988	58.4779	60.0569	(38)
Heat transfer coeff	133.3232	132.5337	131.7442	127.7966	127.0070	123.0594	123.0594	122.2699	124.6384	127.0070	128.5861	130.1651	(39)
Average = Sum(39)m / 12 =												127.5992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1768	1.1698	1.1348	1.1277	1.0927	1.0927	1.0857	1.1067	1.1277	1.1418	1.1558	(40)
HLP (average)												1.1330	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8248 10.6705 11.7910 11.3788 11.7274 11.3137 11.6688 11.7068 11.3492 11.7612 11.4170 11.8139 (61)
Total heat required for water heating calculated for each month
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (64)
Total per year (kWh/year) = Sum(64)m = 1733.9139 (64)
Heat gains from water heating, kWh/month
57.9578 50.7724 52.5875 46.1219 44.4573 38.6617 36.1220 41.0297 41.3954 47.8761 51.9051 56.2195 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
25.9618 23.0591 18.7529 14.1971 10.6125 8.9595 9.6811 12.5839 16.8900 21.4458 25.0304 26.6834 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
275.2678 278.1242 270.9261 255.6022 236.2586 218.0783 205.9328 203.0764 210.2745 225.5983 244.9419 263.1222 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 37.1484 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 -113.1868 (71)
Water heating gains (Table 5)
77.9002 75.5541 70.6821 64.0581 59.7545 53.6969 48.5511 55.1475 57.4936 64.3495 72.0905 75.5639 (72)
Total internal gains
447.5749 445.1824 428.8062 402.3026 375.0707 349.1798 332.6101 339.2528 353.1032 379.8387 410.5079 433.8146 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.4800	10.6334	0.7200	0.7000	0.7700	1.7827	(74)
East	8.6500	19.6403	0.7200	0.7000	0.7700	59.3372	(76)
South	0.7200	46.7521	0.7200	0.7000	0.7700	11.7570	(78)
West	6.9800	19.6403	0.7200	0.7000	0.7700	47.8814	(80)

Solar gains 120.7583 232.4041 375.7321 540.7881 658.8002 673.2150 641.3767 553.1580 434.3148 273.7006 149.8242 99.8166 (83)
Total gains 568.3332 677.5865 804.5383 943.0907 1033.8709 1022.3948 973.9868 892.4109 787.4180 653.5393 560.3321 533.6312 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.2246	46.5000	46.7787	48.2237	48.5234	50.0800	50.0800	50.4034	49.4456	48.5234	47.9276	47.3461	
alpha	4.0816	4.1000	4.1186	4.2149	4.2349	4.3387	4.3387	4.3602	4.2964	4.2349	4.1952	4.1564	

util living area
0.9972 0.9938 0.9834 0.9475 0.8587 0.6945 0.5357 0.5963 0.8451 0.9737 0.9947 0.9978 (86)

MIT	19.3494	19.5455	19.8837	20.3438	20.7046	20.9213	20.9800	20.9692	20.8033	20.3109	19.7656	19.3448	(87)
Th 2	19.9330	19.9386	19.9442	19.9725	19.9782	20.0068	20.0068	20.0125	19.9954	19.9782	19.9669	19.9555	(88)

util rest of house
0.9964 0.9921 0.9785 0.9314 0.8157 0.6116 0.4240 0.4830 0.7821 0.9629 0.9929 0.9972 (89)

MIT 2	17.7220	18.0117	18.5066	19.1825	19.6715	19.9472	19.9975	19.9967	19.8192	19.1498	18.3527	17.7300	(90)

Living area fraction fLA = Living area / (4) = 0.2606 (91)

MIT	18.1461	18.4114	18.8655	19.4852	19.9407	20.2011	20.2536	20.2501	20.0756	19.4524	18.7209	18.1508	(92)

Temperature adjustment 0.0000
adjusted MIT 18.1461 18.4114 18.8655 19.4852 19.9407 20.2011 20.2536 20.2501 20.0756 19.4524 18.7209 18.1508 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9884	0.9715	0.9219	0.8139	0.6290	0.4528	0.5117	0.7880	0.9553	0.9897	0.9956	(94)
Useful gains	565.1152	669.6962	781.6404	869.4280	841.4697	643.0400	441.0104	456.6189	620.4503	624.3295	554.5788	531.3068	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W
1846.0107 1790.7183 1629.0841 1352.7498 1046.6292 689.2676 449.6088 470.7565 744.7936 1124.3176 1494.2833 1815.9131 (97)

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh
952.9862 753.3269 630.4981 347.9917 152.6386 0.0000 0.0000 0.0000 0.0000 371.9911 676.5872 955.7471 (98)
Space heating 4841.7670 (98)
Space heating per m2 (98) / (4) = 42.9921 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5189.4609	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	952.9862	753.3269	630.4981	347.9917	152.6386	0.0000	0.0000	0.0000	0.0000	371.9911	676.5872	955.7471	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1021.4215	807.4243	675.7750	372.9815	163.5998	0.0000	0.0000	0.0000	0.0000	398.7043	725.1739	1024.3806	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2431	155.3464	161.0835	141.5357	136.6160	119.0831	111.5330	126.3024	127.3134	146.9063	158.9384	172.0126	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7158	89.6635	89.5434	89.2288	88.5632	86.7000	86.7000	86.7000	86.7000	89.2508	89.5923	89.7317	(217)
Fuel for water heating, kWh/month													
	197.5606	173.2549	179.8943	158.6211	154.2583	137.3507	128.6424	145.6775	146.8436	164.5995	177.4018	191.6966	(219)
Water heating fuel used												1955.8013	(219)
Annual totals kWh/year													
Space heating fuel - main system												5189.4609	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												5913.8876	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5189.4609	0.2160	1120.9235	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1955.8013	0.2160	422.4531	(264)
Space and water heating			1543.3766	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			904.2932	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.0300	ZC1
Total Floor Area	TFA	112.6200	
Assumed number of occupants	N	2.8297	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4839	ZC2
CO2 emissions from cooking, equation (L16)		1.6597	ZC3
Total CO2 emissions		24.1736	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1736	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1438	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3938	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4268	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3766	0.3933	(22b)
Effective ac	0.5911	0.5875	0.5841	0.5678	0.5647	0.5506	0.5506	0.5479	0.5560	0.5647	0.5709	0.5773	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			16.8300	1.3258	22.3125			(27)
Ground floor			56.3100	0.1300	7.3203			(28a)
External Wall	148.5900	21.1100	127.4800	0.1800	22.9464			(29a)
Main Roof	56.3100		56.3100	0.1300	7.3203			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.0355			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6013	(36)
Total fabric heat loss (33) + (36) =	76.6368	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2581	53.9335	53.6153	52.1208	51.8411	50.5394	50.5394	50.2984	51.0408	51.8411	52.4068	52.9982	(38)
Heat transfer coeff	130.8949	130.5703	130.2521	128.7576	128.4779	127.1762	127.1762	126.9352	127.6776	128.4779	129.0436	129.6350	(39)
Average = Sum(39)m / 12 =												128.7562	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1623	1.1594	1.1566	1.1433	1.1408	1.1293	1.1293	1.1271	1.1337	1.1408	1.1458	1.1511	(40)
HLP (average)												1.1433	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.0076	48.5742	45.0070	46.5072	48.5742	49.0076	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
								Total per year (kWh/year) = Sum(64)m =				2181.3467	(64)
Heat gains from water heating, kWh/month													
	67.7413	59.6116	62.3795	55.5291	53.6690	47.0851	44.8316	50.2466	50.8100	57.6755	61.3796	66.0058	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.9618	23.0591	18.7529	14.1971	10.6125	8.9595	9.6811	12.5839	16.8900	21.4458	25.0304	26.6834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.2678	278.1242	270.9261	255.6022	236.2586	218.0783	205.9328	203.0764	210.2745	225.5983	244.9419	263.1222	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	(71)
Water heating gains (Table 5)													
	91.0501	88.7077	83.8434	77.1237	72.1358	65.3959	60.2576	67.5357	70.5695	77.5208	85.2495	88.7175	(72)
Total internal gains													
	460.7248	458.3360	441.9675	415.3681	387.4520	360.8789	344.3166	351.6410	366.1790	393.0100	423.6669	446.9682	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.4800	10.6334	0.6300	0.7000	0.7700	1.5599	(74)
East	8.6500	19.6403	0.6300	0.7000	0.7700	51.9201	(76)
South	0.7200	46.7521	0.6300	0.7000	0.7700	10.2874	(78)
West	6.9800	19.6403	0.6300	0.7000	0.7700	41.8962	(80)

Solar gains	105.6635	203.3536	328.7656	473.1896	576.4502	589.0631	561.2046	484.0133	380.0254	239.4880	131.0962	87.3396	(83)
Total gains	566.3883	661.6896	770.7331	888.5578	963.9022	949.9420	905.5212	835.6543	746.2045	632.4980	554.7631	534.3077	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7489	59.8975	60.0438	60.7408	60.8730	61.4960	61.4960	61.6128	61.2545	60.8730	60.6061	60.3296	
alpha	4.9833	4.9932	5.0029	5.0494	5.0582	5.0997	5.0997	5.1075	5.0836	5.0582	5.0404	5.0220	
util living area													
	0.9991	0.9979	0.9933	0.9739	0.9104	0.7654	0.5965	0.6607	0.8965	0.9879	0.9981	0.9993	(86)
MIT	19.6520	19.7996	20.0645	20.4217	20.7349	20.9273	20.9838	20.9734	20.8227	20.4058	19.9652	19.6294	(87)
Th 2	19.9503	19.9526	19.9549	19.9656	19.9676	19.9770	19.9770	19.9788	19.9734	19.9676	19.9636	19.9593	(88)
util rest of house													
	0.9988	0.9971	0.9907	0.9632	0.8727	0.6763	0.4687	0.5323	0.8377	0.9813	0.9973	0.9991	(89)
MIT 2	18.1432	18.3606	18.7485	19.2699	19.6972	19.9262	19.9708	19.9672	19.8205	19.2545	18.6109	18.1165	(90)
Living area fraction									fLA = Living area / (4) =			0.2606	(91)
MIT	18.5364	18.7356	19.0915	19.5701	19.9677	20.1871	20.2348	20.2294	20.0817	19.5546	18.9638	18.5107	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5364	18.7356	19.0915	19.5701	19.9677	20.1871	20.2348	20.2294	20.0817	19.5546	18.9638	18.5107	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9958	0.9877	0.9579	0.8727	0.6963	0.5023	0.5658	0.8452	0.9776	0.9962	0.9986	(94)
Useful gains	565.3443	658.8993	761.2885	851.1111	841.1749	661.4694	454.7981	472.8272	630.6674	618.3063	552.6372	533.5738	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1863.4753	1806.5244	1640.0630	1373.8531	1062.2118	710.5507	462.2574	486.0865	763.7271	1150.4651	1530.9489	1855.1732	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	965.8095	771.2040	653.8082	376.3743	164.4515	0.0000	0.0000	0.0000	0.0000	395.9261	704.3844	983.2699	(98)
Space heating												5015.2280	(98)
Space heating per m2											(98) / (4) =	44.5323	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5369.6232	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	965.8095	771.2040	653.8082	376.3743	164.4515	0.0000	0.0000	0.0000	0.0000	395.9261	704.3844	983.2699	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1034.0573	825.7003	700.0088	402.9703	176.0722	0.0000	0.0000	0.0000	0.0000	423.9038	754.1589	1052.7515	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3657	88.2006	87.8104	86.8759	84.9172	80.3000	80.3000	80.3000	80.3000	86.9049	87.9830	88.4336	(217)
Fuel for water heating, kWh/month													
	244.8655	216.2153	228.0499	206.2303	204.2729	190.2570	182.2807	203.2003	205.4444	214.1467	223.7211	238.7753	(219)
Water heating fuel used												2557.4594	(219)
Annual totals kWh/year													
Space heating fuel - main system												5369.6232	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Total delivered energy for all uses												8460.5766	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5369.6232	0.2160	1159.8386	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2557.4594	0.2160	552.4112	(264)
Space and water heating			1712.2498	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Total CO2, kg/m2/year			1989.1333	(272)
Emissions per m2 for space and water heating			15.2038	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1129	(272b)
Emissions per m2 for pumps and fans			0.3456	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2038 * 1.00) + 2.1129 + 0.3456, rounded to 2 d.p.			17.6600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 175 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 175	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 175, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.03	**TER**	17.66
Environmental	94 A	**% DER<TER**	54.54		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.01	**TFEE**	56.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	30.11 m	56.31 m²	2.31 m
1st Storey:	30.11 m	56.31 m²	2.63 m

7.0 Living Area	29.35	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	148.59	127.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	56.31	56.31

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	56.31

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	15.11	0.065	No
Independently assessed	E3 Sill	11.25	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	30.11	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.11	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.24	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.87	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 175 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 175	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 175, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.03	**TER**	17.66
Environmental	94 A	**% DER<TER**	54.54		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.01	**TFEE**	56.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	112.62	m^2	
DER	8.03	$kgCO_2/yr/m^2$	
TER	17.66	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.03	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.54	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.01	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	112.62	m^2	
DER	18.30	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.44	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.44	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.17	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.31	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.31	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	24	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 176 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 176	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 176, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.23	**TER**	18.06
Environmental	93 A	**% DER<TER**	48.90		
CO_2 Emissions (t/year)	0.43	**DFEE**	37.83	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.06 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.23 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.85 m², No overhang
Windows facing South West: 2.44 m², No overhang
Windows facing North West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Southeast                                7.8500           36.7938           0.7200           0.7000           0.7700          100.8808 (77)
Southwest                                2.4400           36.7938           0.7200           0.7000           0.7700           31.3566 (79)
Northwest                                3.4900           11.2829           0.7200           0.7000           0.7700           13.7534 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   145.9908  253.2447  358.6348  464.7048  539.0726  543.3402  520.4397  463.7096  395.1715  283.1611  175.6953  124.3994 (83)
Total gains   520.9814  626.1107  717.9300  802.1348  854.3062  837.2053  800.4442  749.7272  692.4435  602.5103  520.3916  488.1009 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha          4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
                0.9929    0.9842    0.9638    0.9078    0.7935    0.6127    0.4584    0.5044    0.7477    0.9374    0.9859    0.9946 (86)

MIT           19.5767   19.8027   20.1234   20.5220   20.8066   20.9564   20.9904   20.9857   20.8925   20.5096   19.9840   19.5607 (87)
Th 2          19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
                0.9911    0.9801    0.9541    0.8837    0.7430    0.5334    0.3619    0.4054    0.6740    0.9157    0.9816    0.9931 (89)
MIT 2         18.0742   18.4055   18.8697   19.4452   19.8163   20.0044   20.0316   20.0344   19.9361   19.4438   18.6891   18.0653 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2505 (91)
MIT           18.4506   18.7555   19.1838   19.7149   20.0644   20.2429   20.2718   20.2727   20.1757   19.7108   19.0135   18.4399 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.4506   18.7555   19.1838   19.7149   20.0644   20.2429   20.2718   20.2727   20.1757   19.7108   19.0135   18.4399 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9871    0.9735    0.9446    0.8754    0.7461    0.5511    0.3860    0.4299    0.6864    0.9076    0.9756    0.9899 (94)
Useful gains  514.2481  609.4901  678.1607  702.2266  637.4175  461.3954  308.9593  322.3259  475.2977  546.8237  507.7051  483.1727 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1298.8187 1264.4128 1150.7820  952.6469  732.3695  479.1692  311.7938  326.8038  522.3405  797.7206 1055.7129 1276.9186 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              583.7205  440.1080  351.6303  180.3026   70.6443    0.0000    0.0000    0.0000    0.0000  186.6673  394.5656  590.5469 (98)
Space heating                                                                                                         2798.1854 (98)
Space heating per m2                                                                                  (98) / (4) =     34.8380 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2999.1270	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	583.7205	440.1080	351.6303	180.3026	70.6443	0.0000	0.0000	0.0000	0.0000	186.6673	394.5656	590.5469	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	625.6383	471.7128	376.8813	193.2504	75.7173	0.0000	0.0000	0.0000	0.0000	200.0721	422.8999	632.9549	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4880	89.3893	89.2006	88.7527	87.9596	86.7000	86.7000	86.7000	86.7000	88.7504	89.2964	89.5137	(217)
Fuel for water heating, kWh/month													
	182.4119	160.0772	166.3971	147.0311	143.2738	126.8093	118.8742	134.4666	135.4969	152.6184	163.9965	177.0099	(219)
Water heating fuel used												1808.4630	(219)
Annual totals kWh/year													
Space heating fuel - main system												2999.1270	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												4234.9322	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2999.1270	0.2160	647.8114	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.4630	0.2160	390.6280	(264)
Space and water heating			1038.4394	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			741.2301	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.2300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.2300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		27.6883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.6883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.8500	36.7938	0.6300	0.7000	0.7700	88.2707	(77)
Southwest	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(79)
Northwest	3.4900	11.2829	0.6300	0.7000	0.7700	12.0343	(81)

Solar gains	127.7420	221.5891	313.8054	406.6167	471.6886	475.4227	455.3847	405.7459	345.7751	247.7659	153.7334	108.8495	(83)
Total gains	515.8923	607.3471	685.3672	755.6897	797.9379	779.6780	745.7857	702.7851	654.6987	579.3904	511.3266	485.7141	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9973	0.9935	0.9831	0.9499	0.8623	0.6958	0.5266	0.5771	0.8194	0.9670	0.9941	0.9980	(86)
MIT	19.7731	19.9463	20.2066	20.5339	20.8034	20.9526	20.9905	20.9852	20.8892	20.5354	20.0916	19.7432	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9964	0.9913	0.9772	0.9316	0.8138	0.6044	0.4093	0.4575	0.7428	0.9513	0.9917	0.9973	(89)
MIT 2	18.3165	18.5704	18.9486	19.4191	19.7727	19.9420	19.9697	19.9690	19.8827	19.4308	18.7914	18.2795	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6814	18.9150	19.2637	19.6983	20.0309	20.1951	20.2254	20.2235	20.1348	19.7075	19.1171	18.6462	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6814	18.9150	19.2637	19.6983	20.0309	20.1951	20.2254	20.2235	20.1348	19.7075	19.1171	18.6462	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9882	0.9720	0.9259	0.8174	0.6254	0.4388	0.4875	0.7567	0.9462	0.9889	0.9960	(94)
Useful gains	513.1871	600.1903	666.1695	699.6720	652.2585	487.6395	327.2723	342.6374	495.3797	548.2403	505.6729	483.7907	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1349.6834	1311.9167	1191.7661	996.2575	766.8799	509.6310	330.2213	347.5830	551.9320	838.3691	1111.2582	1342.2306	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	622.3532	478.2801	391.0439	213.5416	85.2783	0.0000	0.0000	0.0000	0.0000	215.8558	436.0214	638.6793	(98)
Space heating												3081.0537	(98)
Space heating per m2											(98) / (4) =	38.3597	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3298.7726	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	622.3532	478.2801	391.0439	213.5416	85.2783	0.0000	0.0000	0.0000	0.0000	215.8558	436.0214	638.6793	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	666.3311	512.0772	418.6765	228.6313	91.3044	0.0000	0.0000	0.0000	0.0000	231.1090	466.8324	683.8108	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6932	87.4208	86.8910	85.7163	83.5618	80.3000	80.3000	80.3000	80.3000	85.6243	87.1521	87.7907	(217)
Fuel for water heating, kWh/month													
	230.8048	203.3217	212.8330	191.3591	190.0462	174.1812	166.8789	186.0308	188.0853	200.8548	210.6501	225.1055	(219)
Water heating fuel used												2380.1515	(219)
Annual totals kWh/year													
Space heating fuel - main system												3298.7726	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6110.7527	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3298.7726	0.2160	712.5349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2380.1515	0.2160	514.1127	(264)
Space and water heating			1226.6476	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1450.7666	(272)
Emissions per m2 for space and water heating			15.2720	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2720 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.0600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 176 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 176	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 176, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.23	**TER**	18.06
Environmental	93 A	**% DER<TER**	48.90		
CO_2 Emissions (t/year)	0.43	**DFEE**	37.83	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.14	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 92	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 176 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 176	**Prop Type Ref**	Opp
Property	Type 2 - Semi SG, Plot 176, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.23	**TER**	18.06
Environmental	93 A	**% DER<TER**	48.90		
CO_2 Emissions (t/year)	0.43	**DFEE**	37.83	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	9.23	$kgCO_2/yr/m^2$	
TER	18.06	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.23	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.90	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.73	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.19	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.19	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	18	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 177 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 177	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 177, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.40	**TER**	18.35
Environmental	95 A	**% DER<TER**	59.68		
CO_2 Emissions (t/year)	0.25	**DFEE**	39.09	**TFEE**	51.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.35 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.40 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 2.44 m², No overhang
Windows facing South East: 7.85 m², No overhang
Windows facing North West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.2100	15.5232			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7937			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4079	(36)
Total fabric heat loss (33) + (36) =	48.2016	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	91.7857	91.2572	90.7288	88.0864	87.5580	84.9156	84.9156	84.3872	85.9726	87.5580	88.6149	89.6718	(39)

Average = Sum(39)m / 12 = 87.9543 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1428	1.1362	1.1296	1.0967	1.0901	1.0572	1.0572	1.0506	1.0704	1.0901	1.1033	1.1164	(40)
HLP (average)												1.0950	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)

Energy content (annual) Total = Sum(45)m = 1460.6794 (45)

Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
    53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)
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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m     123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    20.2051   17.9460   14.5947   11.0491    8.2593    6.9729    7.5344    9.7935   13.1449   16.6904   19.4802   20.7667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans  3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
   -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
    71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
   374.9906  372.8660  359.2952  337.4300  315.2335  293.8651  280.0045  286.0176  297.2720  319.3492  344.6963  363.7015 (73)
```

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6. Solar gains

```
[Jan]                                    Area         Solar flux              g              FF            Access            Gains
                                           m2          Table 6a     Specific data  Specific data          factor                W
                                                          W/m2     or Table 6b    or Table 6c         Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                2.4400           11.2829          0.7200          0.7000          0.7700           9.6156 (75)
Southeast                                7.8500           36.7938          0.7200          0.7000          0.7700         100.8808 (77)
Northwest                                3.4900           11.2829          0.7200          0.7000          0.7700          13.7534 (81)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains  124.2498  219.4057  320.8183  432.0682  515.4961  525.6433  501.0021  436.6399  359.0106  248.0491  150.2362  105.4173 (83)
Total gains  499.2405  592.2717  680.1135  769.4982  830.7296  819.5084  781.0066  722.6575  656.2826  567.3983  494.9326  469.1188 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau        48.1295   48.4082   48.6902   50.1507   50.4534   52.0234   52.0234   52.3492   51.3838   50.4534   49.8517   49.2641
alpha       4.2086    4.2272    4.2460    4.3434    4.3636    4.4682    4.4682    4.4899    4.4256    4.3636    4.3234    4.2843
util living area
    0.9940    0.9871    0.9697    0.9181    0.8053    0.6233    0.4690    0.5214    0.7723    0.9481    0.9883    0.9953 (86)

MIT        19.5471   19.7583   20.0778   20.4912   20.7940   20.9533   20.9895   20.9837   20.8770   20.4716   19.9501   19.5346 (87)
Th 2       19.9661   19.9714   19.9767   20.0035   20.0089   20.0359   20.0359   20.0413   20.0251   20.0089   19.9982   19.9874 (88)
util rest of house
    0.9924    0.9836    0.9615    0.8958    0.7560    0.5435    0.3707    0.4199    0.7004    0.9293    0.9846    0.9941 (89)
MIT 2      18.0313   18.3416   18.8057   19.4048   19.8023   20.0020   20.0312   20.0333   19.9214   19.3930   18.6405   18.0273 (90)
Living area fraction                                                                 fLA = Living area / (4) =     0.2505 (91)
MIT        18.4110   18.6965   19.1243   19.6770   20.0507   20.2403   20.2713   20.2714   20.1608   19.6632   18.9686   18.4049 (92)
Temperature adjustment                                                                                           0.0000
adjusted MIT  18.4110   18.6965   19.1243   19.6770   20.0507   20.2403   20.2713   20.2714   20.1608   19.6632   18.9686   18.4049 (93)
```

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8. Space heating requirement

```
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation  0.9888    0.9777    0.9525    0.8872    0.7583    0.5612    0.3952    0.4450    0.7114    0.9210    0.9793    0.9912 (94)
Useful gains  493.6502  579.0742  647.8051  682.6845  629.9075  459.8825  308.6334  321.5621  466.8990  522.5727  484.6773  464.9935 (95)
Ext temp.     4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
 1295.1883 1259.0279 1145.3907  949.3031  731.1699  478.9512  311.7470  326.6951  521.0585  793.5571 1051.7321 1273.7785 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   596.3444  456.9289  370.2037  191.9654   75.3392    0.0000    0.0000    0.0000    0.0000  201.6124  408.2794  601.7361 (98)
Space heating                                                                                                   2902.4095 (98)
Space heating per m2                                                                                 (98) / (4) =    36.1356 (99)
```

8c. Space cooling requirement

```
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3110.8355	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	596.3444	456.9289	370.2037	191.9654	75.3392	0.0000	0.0000	0.0000	0.0000	201.6124	408.2794	601.7361	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	639.1687	489.7416	396.7885	205.7507	80.7494	0.0000	0.0000	0.0000	0.0000	216.0904	437.5985	644.9476	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5013	89.4146	89.2395	88.8077	88.0128	86.7000	86.7000	86.7000	86.7000	88.8180	89.3209	89.5252	(217)
Fuel for water heating, kWh/month													
	182.3846	160.0319	166.3246	146.9400	143.1872	126.8093	118.8742	134.4666	135.4969	152.5023	163.9515	176.9872	(219)
Water heating fuel used												1807.9563	(219)
Annual totals kWh/year													
Space heating fuel - main system												3110.8355	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4016.7943	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3110.8355	0.2160	671.9405	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.9563	0.2160	390.5186	(264)
Space and water heating			1062.4590	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			594.3223	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.4000	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		25.8583	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.8583	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.7800	1.3258	18.2689			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.9200	73.9200	0.1800	13.3056			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5841			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.7866	(36)
Total fabric heat loss (33) + (36) =	54.3707	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8492	93.6079	93.3714	92.2605	92.0526	91.0851	91.0851	90.9059	91.4577	92.0526	92.4731	92.9127	(39)
Average = Sum(39)m / 12 =												92.2595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1684	1.1654	1.1625	1.1487	1.1461	1.1340	1.1340	1.1318	1.1387	1.1461	1.1513	1.1568	(40)
HLP (average)												1.1486	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2051	17.9460	14.5947	11.0491	8.2593	6.9729	7.5344	9.7935	13.1449	16.6904	19.4802	20.7667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1504	385.7580	371.5618	349.0730	326.2493	304.2553	290.4009	297.0392	308.9236	331.6245	357.5932	376.8647	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.4400	11.2829	0.6300	0.7000	0.7700	8.4136	(75)
Southeast	7.8500	36.7938	0.6300	0.7000	0.7700	88.2707	(77)
Northwest	3.4900	11.2829	0.6300	0.7000	0.7700	12.0343	(81)

Solar gains	108.7186	191.9799	280.7160	378.0597	451.0591	459.9379	438.3768	382.0599	314.1343	217.0430	131.4567	92.2401	(83)
Total gains	496.8690	577.7379	652.2778	727.1327	777.3084	764.1932	728.7778	679.0991	623.0579	548.6674	489.0499	469.1048	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4334	59.5866	59.7376	60.4569	60.5934	61.2370	61.2370	61.3577	60.9875	60.5934	60.3178	60.0325	
alpha	4.9622	4.9724	4.9825	5.0305	5.0396	5.0825	5.0825	5.0905	5.0658	5.0396	5.0212	5.0022	
util living area													
	0.9977	0.9947	0.9862	0.9564	0.8719	0.7062	0.5378	0.5946	0.8404	0.9733	0.9951	0.9983	(86)
MIT	19.7513	19.9128	20.1710	20.5077	20.7913	20.9493	20.9896	20.9832	20.8741	20.5046	20.0663	19.7240	(87)
Th 2	19.9453	19.9478	19.9501	19.9613	19.9634	19.9731	19.9731	19.9750	19.9694	19.9634	19.9592	19.9547	(88)
util rest of house													
	0.9969	0.9929	0.9813	0.9400	0.8253	0.6148	0.4185	0.4726	0.7673	0.9601	0.9932	0.9977	(89)
MIT 2	18.2847	18.5219	18.8979	19.3840	19.7591	19.9395	19.9693	19.9680	19.8686	19.3890	18.7548	18.2515	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6520	18.8703	19.2168	19.6654	20.0177	20.1925	20.2249	20.2223	20.1205	19.6685	19.0833	18.6203	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6520	18.8703	19.2168	19.6654	20.0177	20.1925	20.2249	20.2223	20.1205	19.6685	19.0833	18.6203	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9903	0.9766	0.9342	0.8281	0.6357	0.4486	0.5033	0.7796	0.9551	0.9907	0.9966	(94)
Useful gains	494.6388	572.1444	636.9927	679.2516	643.6623	485.7705	326.9196	341.7747	485.7340	524.0277	484.5214	467.5015	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.9269	1307.7324	1187.3860	993.2252	765.6662	509.3893	330.1751	347.4714	550.6215	834.7747	1108.1351	1339.8326	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	634.1023	494.3151	409.4926	226.0610	90.7709	0.0000	0.0000	0.0000	0.0000	231.1958	449.0019	649.0143	(98)
Space heating												3183.9539	(98)
Space heating per m2											(98) / (4) =	39.6409	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3408.9442	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	634.1023	494.3151	409.4926	226.0610	90.7709	0.0000	0.0000	0.0000	0.0000	231.1958	449.0019	649.0143	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	678.9104	529.2453	438.4289	242.0353	97.1851	0.0000	0.0000	0.0000	0.0000	247.5330	480.7300	694.8762	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7301	87.4896	86.9958	85.8591	83.7012	80.3000	80.3000	80.3000	80.3000	85.7968	87.2164	87.8216	(217)
Fuel for water heating, kWh/month													
	230.7078	203.1618	212.5766	191.0409	189.7298	174.1812	166.8789	186.0308	188.0853	200.4511	210.4948	225.0261	(219)
Water heating fuel used												2378.3653	(219)
Annual totals kWh/year													
Space heating fuel - main system												3408.9442	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8285	(232)
Total delivered energy for all uses												6219.1380	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3408.9442	0.2160	736.3319	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.3653	0.2160	513.7269	(264)
Space and water heating			1250.0588	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8285	0.5190	185.1940	(268)
Total CO2, kg/m2/year			1474.1778	(272)
Emissions per m2 for space and water heating			15.5635	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3057	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5635 * 1.00) + 2.3057 + 0.4846, rounded to 2 d.p.			18.3500	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 177 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 177	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 177, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.40	**TER**	18.35
Environmental	95 A	**% DER<TER**	59.68		
CO_2 Emissions (t/year)	0.25	**DFEE**	39.09	**TFEE**	51.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.92

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.14	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.59	0.065	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 177 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 177	**Prop Type Ref**	As
Property	Type 2 - Semi SG, Plot 177, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.40	**TER**	18.35
Environmental	95 A	**% DER<TER**	59.68		
CO_2 Emissions (t/year)	0.25	**DFEE**	39.09	**TFEE**	51.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.40	$kgCO_2/yr/m^2$	
TER	18.35	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.40	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.68	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.09	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.53	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.99	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.99	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.37	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.37	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 178 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 178	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 178, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.76 m², No overhang
Windows facing North East: 1.07 m², No overhang
Windows facing East: 0.48 m², No overhang
Windows facing South: 9.16 m², No overhang
Windows facing West: 7.51 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600 (1b)	x	2.3100 (2b)	=	149.3646	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3257	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4152	0.4071	0.3990	0.3582	0.3501	0.3094	0.3094	0.3013	0.3257	0.3501	0.3664	0.3827	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6652	0.6571	0.6490	0.6082	0.6001	0.5594	0.5594	0.5513	0.5757	0.6001	0.6164	0.6327	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.0500	1.2357	32.1911			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.6600	0.1200	7.7592			(28a)
External Wall	160.5600	30.3300	130.2300	0.2100	27.3483			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.3564			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1228	(36)
Total fabric heat loss					(33) + (36) =		84.4791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4058	68.5564	67.7069	63.4596	62.6101	58.3628	58.3628	57.5133	60.0617	62.6101	64.3091	66.0080	(38)
Heat transfer coeff	153.8850	153.0355	152.1861	147.9387	147.0893	142.8419	142.8419	141.9925	144.5409	147.0893	148.7882	150.4871	(39)
Average = Sum(39)m / 12 =												147.7264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2015	1.1948	1.1882	1.1550	1.1484	1.1153	1.1153	1.1086	1.1285	1.1484	1.1617	1.1749	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898	(42)
Average daily hot water use (litres/day)	102.8336	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8297   10.6748   11.7954   11.3844   11.7345   11.3196   11.6743   11.7133   11.3542   11.7652   11.4214   11.8186 (61)
Total heat required for water heating calculated for each month
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
              179.5788  157.3893  163.1916  143.3752  138.3829  120.6075  112.9456  127.9237  128.9524  148.8147  161.0215  174.2747 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m = 1756.4579 (64)
Heat gains from water heating, kWh/month
               58.7340   51.4513   53.2881   46.7331   45.0442   39.1681   36.5913   41.5683   41.9400   48.5102   52.5974   56.9713 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917  144.4917 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.4759   23.5156   19.1242   14.4782   10.8227    9.1369    9.8728   12.8330   17.2245   21.8704   25.5260   27.2117 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              295.3913  298.4565  290.7322  274.2881  253.5304  234.0210  220.9876  217.9223  225.6466  242.0907  262.8485  282.3578 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492   37.4492 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 -115.5934 (71)
Water heating gains (Table 5)
               78.9436   76.5644   71.6238   64.9070   60.5433   54.4002   49.1818   55.8713   58.2499   65.2019   73.0519   76.5743 (72)
Total internal gains
              470.1582  467.8840  450.8277  423.0209  394.2438  366.9057  349.3897  355.9742  370.4685  398.5106  430.7739  455.4914 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.7600           10.6334           0.7200           0.7000           0.7700           25.1063 (74)
Northeast                                1.0700           11.2829           0.7200           0.7000           0.7700            4.2167 (75)
East                                     0.4800           19.6403           0.7200           0.7000           0.7700            3.2927 (76)
South                                    9.1600           46.7521           0.7200           0.7000           0.7700          149.5754 (78)
West                                     7.5100           19.6403           0.7200           0.7000           0.7700           51.5171 (80)
Northwest                                1.0700           11.2829           0.7200           0.7000           0.7700            4.2167 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   237.9247  417.3311  601.0753  791.9500  927.8021  938.3989  897.5603  793.9724  667.0406  469.5355  287.2223  202.1367 (83)
Total gains   708.0830  885.2151 1051.9030 1214.9709 1322.0460 1305.3046 1246.9500 1149.9466 1037.5092  868.0461  717.9962  657.6281 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.0082   46.2636   46.5219   47.8575   48.1339   49.5651   49.5651   49.8616   48.9825   48.1339   47.5843   47.0471
alpha          4.0672    4.0842    4.1015    4.1905    4.2089    4.3043    4.3043    4.3241    4.2655    4.2089    4.1723    4.1365
util living area
               0.9962    0.9902    0.9744    0.9269    0.8215    0.6470    0.4906    0.5456    0.7938    0.9580    0.9921    0.9972 (86)

MIT           19.3880   19.6256   19.9753   20.4202   20.7535   20.9386   20.9852   20.9773   20.8473   20.3894   19.8176   19.3719 (87)
Th 2          19.9188   19.9241   19.9294   19.9561   19.9615   19.9884   19.9884   19.9938   19.9776   19.9615   19.9508   19.9401 (88)
util rest of house
               0.9951    0.9874    0.9671    0.9059    0.7725    0.5631    0.3841    0.4363    0.7217    0.9417    0.9894    0.9964 (89)
MIT 2         17.7675   18.1169   18.6258   19.2718   19.7132   19.9437   19.9818   19.9827   19.8479   19.2448   18.4160   17.7579 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1191 (91)
MIT           17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  17.9606   18.2966   18.7866   19.4087   19.8371   20.0623   20.1014   20.1012   19.9670   19.3812   18.5830   17.9502 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9920    0.9813    0.9564    0.8923    0.7659    0.5697    0.3964    0.4485    0.7208    0.9295    0.9842    0.9940 (94)
Useful gains 702.4418  868.6956 1005.9894 1084.0839 1012.4943  743.5904  494.2287  515.7354  747.8626  806.8828  706.6872  653.7031 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              2102.1554 2050.1625 1869.8504 1554.6389 1196.8832  780.2414  500.1460  525.5457  848.0212 1291.6166 1708.5378 2069.2310 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              1041.3869  793.9457  642.7125  338.7996  137.1853    0.0000    0.0000    0.0000    0.0000  360.6419  721.3325 1053.1528 (98)
Space heating                                                                                                          5089.1573 (98)
Space heating per m2                                                                                  (98) / (4) =   39.7342 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5454.6166	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1041.3869	793.9457	642.7125	338.7996	137.1853	0.0000	0.0000	0.0000	0.0000	360.6419	721.3325	1053.1528	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1116.1703	850.9601	688.8666	363.1293	147.0368	0.0000	0.0000	0.0000	0.0000	386.5401	773.1323	1128.7811	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5788	157.3893	163.1916	143.3752	138.3829	120.6075	112.9456	127.9237	128.9524	148.8147	161.0215	174.2747	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7519	89.6839	89.5471	89.1987	88.4556	86.7000	86.7000	86.7000	86.7000	89.2179	89.6209	89.7708	(217)
Fuel for water heating, kWh/month													
	200.0837	175.4933	182.2411	160.7369	156.4434	139.1090	130.2717	147.5475	148.7340	166.7991	179.6696	194.1330	(219)
Water heating fuel used												1981.2624	(219)
Annual totals kWh/year													
Space heating fuel - main system												5454.6166	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 908 * 1.00) =											-2353.1582	-2353.1582	(233)
Total delivered energy for all uses												5625.2927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5454.6166	0.2160	1178.1972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.2624	0.2160	427.9527	(264)
Space and water heating			1606.1499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Energy saving/generation technologies				
PV Unit	-2353.1582	0.5190	-1221.2891	(269)
Total CO2, kg/year			666.4556	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.2000	ZC1
Total Floor Area	TFA	128.0800	
Assumed number of occupants	N	2.8898	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6667	ZC2
CO2 emissions from cooking, equation (L16)		1.4706	ZC3
Total CO2 emissions		20.3373	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3373	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.6600	(1b)	x 2.3100	(2b) =	149.3646	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.1592	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1265	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3765	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4081	0.4001	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5833	0.5800	0.5769	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			26.0500	1.3258	34.5360			(27)
Ground floor			64.6600	0.1300	8.4058			(28a)
External Wall	160.5600	30.3300	130.2300	0.1800	23.4414			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			289.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.9250			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7104	(36)
Total fabric heat loss (33) + (36) =	93.6354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8523	60.5150	60.1844	58.6315	58.3410	56.9885	56.9885	56.7380	57.5095	58.3410	58.9287	59.5432	(38)
Heat transfer coeff	154.4877	154.1504	153.8198	152.2669	151.9764	150.6239	150.6239	150.3734	151.1448	151.9764	152.5641	153.1786	(39)
Average = Sum(39)m / 12 =												152.2655	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2062	1.2035	1.2010	1.1888	1.1866	1.1760	1.1760	1.1741	1.1801	1.1866	1.1912	1.1960	(40)
HLP (average)												1.1888	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8898 (42)
Average daily hot water use (litres/day)	102.8336 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1169	109.0036	104.8902	100.7769	96.6636	92.5502	92.5502	96.6636	100.7769	104.8902	109.0036	113.1169	(44)
Energy conte	167.7491	146.7145	151.3962	131.9909	126.6484	109.2879	101.2713	116.2103	117.5982	137.0494	149.6002	162.4561	(45)
Energy content (annual)										Total = Sum(45)m =		1617.9725	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1624	22.0072	22.7094	19.7986	18.9973	16.3932	15.1907	17.4315	17.6397	20.5574	22.4400	24.3684	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2587	45.6412	47.1626	49.2587	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
								Total per year (kWh/year) = Sum(64)m =				2207.1019	(64)
Heat gains from water heating, kWh/month													
	68.5163	60.2894	63.0790	56.2157	54.4253	47.7485	45.4634	50.9546	51.4302	58.3087	62.0708	66.7564	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	144.4917	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.4759	23.5156	19.1242	14.4782	10.8227	9.1369	9.8728	12.8330	17.2245	21.8704	25.5260	27.2117	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.3913	298.4565	290.7322	274.2881	253.5304	234.0210	220.9876	217.9223	225.6466	242.0907	262.8485	282.3578	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	37.4492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	-115.5934	(71)
Water heating gains (Table 5)													
	92.0918	89.7164	84.7835	78.0774	73.1522	66.3174	61.1067	68.4874	71.4308	78.3719	86.2095	89.7263	(72)
Total internal gains													
	483.3065	481.0361	463.9875	436.1913	406.8528	378.8229	361.3145	368.5902	383.6494	411.6805	443.9315	468.6434	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7600	10.6334	0.6300	0.7000	0.7700	21.9680	(74)
Northeast	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(75)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	9.1600	46.7521	0.6300	0.7000	0.7700	130.8784	(78)
West	7.5100	19.6403	0.6300	0.7000	0.7700	45.0774	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	208.1841	365.1647	525.9409	692.9562	811.8269	821.0991	785.3653	694.7258	583.6606	410.8435	251.3195	176.8696	(83)
Total gains	691.4906	846.2008	989.9284	1129.1475	1218.6796	1199.9219	1146.6798	1063.3161	967.3100	822.5240	695.2510	645.5130	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.5738	57.6998	57.8238	58.4135	58.5252	59.0507	59.0507	59.1490	58.8472	58.5252	58.2997	58.0658	
alpha	4.8383	4.8467	4.8549	4.8942	4.9017	4.9367	4.9367	4.9433	4.9231	4.9017	4.8866	4.8711	
util living area													
	0.9987	0.9964	0.9891	0.9627	0.8857	0.7297	0.5610	0.6211	0.8608	0.9801	0.9971	0.9991	(86)
MIT	19.6287	19.8100	20.0910	20.4500	20.7567	20.9355	20.9858	20.9772	20.8467	20.4359	19.9611	19.5977	(87)
Th 2	19.9151	19.9172	19.9192	19.9289	19.9308	19.9392	19.9392	19.9408	19.9360	19.9308	19.9271	19.9232	(88)
util rest of house													
	0.9983	0.9952	0.9851	0.9480	0.8412	0.6364	0.4344	0.4924	0.7907	0.9697	0.9959	0.9988	(89)
MIT 2	18.0844	18.3507	18.7605	19.2796	19.6899	19.8959	19.9340	19.9313	19.8107	19.2688	18.5791	18.0448	(90)
Living area fraction									fLA = Living area / (4) =			0.1191	(91)
MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2684	18.5246	18.9190	19.4191	19.8170	20.0197	20.0593	20.0559	19.9342	19.4079	18.7437	18.2298	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9927	0.9798	0.9389	0.8356	0.6442	0.4493	0.5073	0.7905	0.9625	0.9938	0.9980	(94)
Useful gains	689.5797	840.0031	969.8948	1060.1725	1018.2913	772.9630	515.2167	539.3682	764.6892	791.6387	690.9120	644.2224	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2157.9449	2100.2331	1910.2881	1601.7058	1233.5985	816.3431	521.0607	549.7577	881.8035	1338.5872	1776.4184	2149.0641	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating												5497.1800	(98)
Space heating per m2											(98) / (4) =	42.9199	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5885.6317	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1092.4637	846.8746	699.6526	389.9039	160.1886	0.0000	0.0000	0.0000	0.0000	406.9297	781.5646	1119.6022	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1169.6614	906.7179	749.0928	417.4560	171.5081	0.0000	0.0000	0.0000	0.0000	435.6849	836.7930	1198.7176	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7080	192.7419	202.3551	181.3059	175.9071	154.9291	148.4339	165.4690	166.9133	188.0083	198.9152	213.4150	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5424	88.3400	87.9192	86.9295	84.8165	80.3000	80.3000	80.3000	80.3000	86.9442	88.1506	88.6155	(217)
Fuel for water heating, kWh/month													
	247.0095	218.1819	230.1603	208.5666	207.3972	192.9379	184.8492	206.0635	207.8622	216.2403	225.6538	240.8324	(219)
Water heating fuel used												2585.7547	(219)
Annual totals kWh/year													
Space heating fuel - main system												5885.6317	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												467.5719	(232)
Total delivered energy for all uses												9013.9583	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5885.6317	0.2160	1271.2965	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.7547	0.2160	558.5230	(264)
Space and water heating			1829.8195	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	467.5719	0.5190	242.6698	(268)
Total CO2, kg/m2/year			2111.4143	(272)
Emissions per m2 for space and water heating			14.2865	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8947	(272b)
Emissions per m2 for pumps and fans			0.3039	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2865 * 1.00) + 1.8947 + 0.3039, rounded to 2 d.p.			16.4900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 178 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 178	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 178, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.85 m	64.66 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.26	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	199.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	160.56	130.23

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.66

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.07	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.48	100
W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		2.05	100
D2	Half Glazed Door	[1] External Wall	East				2.14	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.07	100
W15	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.09	0.065	No
Independently assessed	E3 Sill	18.23	0.004	No
Independently assessed	E4 Jamb	49.50	0.005	No
Independently assessed	E5 Ground floor (normal)	32.85	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 178 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 178	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 178, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.20	**TER**	16.49
Environmental	96 A	**% DER<TER**	68.46		
CO_2 Emissions (t/year)	0.12	**DFEE**	42.08	**TFEE**	55.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.08	m^2	
DER	5.20	$kgCO_2/yr/m^2$	
TER	16.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.20	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.46	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.08	m^2	
DER	16.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.94	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.26	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.67	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.40	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 179 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 179	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 179, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.81 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.21 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 7.93 m², No overhang
Windows facing West: 0.72 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2          Table 6a      Specific data  Specific data      factor              W
                                                         W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                   7.2100           10.6334            0.7200         0.7000          0.7700      26.7776 (74)
Northeast                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (75)
East                                    1.4400           19.6403            0.7200         0.7000          0.7700       9.8781 (76)
South                                   7.9300           46.7521            0.7200         0.7000          0.7700     129.4905 (78)
West                                    0.7200           19.6403            0.7200         0.7000          0.7700       4.9391 (80)
Northwest                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   179.2821  308.9158  434.8941  563.9803  657.9963  665.6994  636.5533  563.9149  478.8922  344.4388  215.3130  153.0937 (83)
Total gains   657.9342  785.1137  893.5159  994.0736 1058.5894 1038.4074  991.5246  925.6634  855.6470  749.9580  653.8292  616.8666 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9977    0.9947    0.9871    0.9631    0.8974    0.7517    0.5886    0.6426    0.8669    0.9764    0.9954    0.9983 (86)

MIT           19.4526   19.6418   19.9354   20.3366   20.6772   20.9080   20.9768   20.9660   20.8061   20.3600   19.8502   19.4461 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9971    0.9932    0.9833    0.9510    0.8622    0.6726    0.4737    0.5289    0.8091    0.9666    0.9938    0.9978 (89)
MIT 2         17.8987   18.1784   18.6092   19.2040   19.6752   19.9750   20.0361   20.0346   19.8596   19.2476   18.5016   17.9036 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1959 (91)
MIT           18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9953    0.9899    0.9772    0.9417    0.8558    0.6827    0.4956    0.5499    0.8098    0.9589    0.9909    0.9965 (94)
Useful gains 654.8371  777.1491  873.1301  936.0967  905.9451  708.9032  491.4174  509.0341  692.8608  719.1338  647.8593  614.6773 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2087.4508 2024.9131 1835.6163 1516.3560 1170.0875  771.6827  502.6753  526.6711  835.7753 1269.4621 1690.7179 2054.1822 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1065.8645  838.4974  716.0897  417.7867  196.5220    0.0000    0.0000    0.0000    0.0000  409.4442  750.8582 1070.9916 (98)
Space heating                                                                                                         5466.0543 (98)
Space heating per m2                                                                                  (98) / (4) =   41.0796 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5858.5791	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1065.8645	838.4974	716.0897	417.7867	196.5220	0.0000	0.0000	0.0000	0.0000	409.4442	750.8582	1070.9916	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1142.4057	898.7110	767.5131	447.7885	210.6345	0.0000	0.0000	0.0000	0.0000	438.8470	804.7783	1147.9010	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7613	89.7100	89.6079	89.3502	88.7745	86.7000	86.7000	86.7000	86.7000	89.3095	89.6413	89.7771	(217)
Fuel for water heating, kWh/month													
	200.6108	175.9221	182.6130	160.8977	156.3007	139.4795	130.6150	147.9414	149.1319	167.0782	180.1183	194.6502	(219)
Water heating fuel used												1985.3589	(219)
Annual totals kWh/year													
Space heating fuel - main system												5858.5791	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =											-2098.5959	-2098.5959	(233)
Total delivered energy for all uses												6325.0575	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5858.5791	0.2160	1265.4531	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.3589	0.2160	428.8375	(264)
Space and water heating			1694.2906	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			905.9916	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.8100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.8100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		21.6494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		21.6494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.2100	10.6334	0.6300	0.7000	0.7700	23.4304	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	7.9300	46.7521	0.6300	0.7000	0.7700	113.3041	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	156.8718	270.3013	380.5323	493.4827	575.7467	582.4870	556.9841	493.4255	419.0307	301.3839	188.3989	133.9570 (83)
Total gains	648.6718	759.6509	852.3136	936.7462	988.9967	967.1581	923.9263	867.8381	808.9661	720.0728	640.0723	610.8815 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9981	0.9949	0.9829	0.9410	0.8250	0.6607	0.7163	0.9167	0.9893	0.9983	0.9995	(86)
MIT	19.6822	19.8273	20.0639	20.3821	20.6854	20.9016	20.9764	20.9643	20.8069	20.4148	19.9901	19.6582	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9990	0.9975	0.9929	0.9755	0.9130	0.7440	0.5284	0.5879	0.8657	0.9835	0.9976	0.9993	(89)
MIT 2	18.2065	18.4203	18.7670	19.2345	19.6583	19.9279	19.9917	19.9864	19.8256	19.2863	18.6657	18.1772	(90)
Living area fraction										fLA = Living area / (4) =		0.1959	(91)
MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9962	0.9902	0.9702	0.9083	0.7549	0.5543	0.6125	0.8669	0.9794	0.9965	0.9988	(94)
Useful gains	647.6285	756.7635	843.9831	908.8096	898.3418	730.0702	512.1056	531.5433	701.3288	705.2595	637.8127	610.1600	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2131.9030	2067.1650	1871.9493	1562.0452	1204.6412	807.1895	524.3046	551.6293	868.7059	1315.0585	1752.8642	2123.7564	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating												5830.5567	(98)
Space heating per m2											(98) / (4) =	43.8190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6242.5661	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1182.3343	942.8156	818.8510	503.5650	243.9901	0.0000	0.0000	0.0000	0.0000	485.7500	859.5687	1205.6913	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5553	88.3997	88.0781	87.3388	85.6966	80.3000	80.3000	80.3000	80.3000	87.1824	88.1934	88.6208	(217)
Fuel for water heating, kWh/month													
	247.5280	218.5203	230.2482	208.0315	205.8681	193.5027	185.3903	206.6667	208.2909	216.1096	226.0408	241.3548	(219)
Water heating fuel used												2587.5520	(219)
Annual totals kWh/year													
Space heating fuel - main system												6242.5661	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9409.8334	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6242.5661	0.2160	1348.3943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.5520	0.2160	558.9112	(264)
Space and water heating			1907.3055	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2208.1778	(272)
Emissions per m2 for space and water heating			14.3342	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3342 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 179 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 179	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 179, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 179 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 179	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 179, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	6.81	$kgCO_2/yr/m^2$	
TER	16.60	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.81	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.96	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.32	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 180 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 180	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 180, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 133 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.81 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.21 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 7.93 m², No overhang
Windows facing West: 0.72 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1522	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3772	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3206	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4088	0.4008	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3206	0.3447	0.3607	0.3768	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6588	0.6508	0.6428	0.6027	0.5947	0.5546	0.5546	0.5466	0.5706	0.5947	0.6107	0.6268	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.3800	1.2357	23.9487			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			67.1500	0.1200	8.0580			(28a)
External Wall	167.1400	23.6600	143.4800	0.2100	30.1308			(29a)
Main Roof	65.9100		65.9100	0.0700	4.6137			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.3696			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							202.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3633	(36)
Total fabric heat loss					(33) + (36) =		78.7329	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.4105	70.5416	69.6727	65.3283	64.4595	60.1151	60.1151	59.2462	61.8529	64.4595	66.1972	67.9350	(38)
Heat transfer coeff	150.1433	149.2745	148.4056	144.0612	143.1924	138.8480	138.8480	137.9791	140.5857	143.1924	144.9301	146.6679	(39)
Average = Sum(39)m / 12 =												143.8440	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1284	1.1219	1.1153	1.0827	1.0761	1.0435	1.0435	1.0370	1.0566	1.0761	1.0892	1.1023	(40)
HLP (average)												1.0810	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025	(42)
Average daily hot water use (litres/day)	103.1346	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8307   10.6757   11.7963   11.3852   11.7360   11.3209   11.6754   11.7147   11.3549   11.7661   11.4223   11.8196 (61)
Total heat required for water heating calculated for each month
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              180.0709  157.8197  163.6357  143.7624  138.7552  120.9287  113.2432  128.2652  129.2974  149.2167  161.4604  174.7512 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1761.2067 (64)
Heat gains from water heating, kWh/month
               58.8976   51.5943   53.4357   46.8617   45.1679   39.2748   36.6901   41.6817   42.0546   48.6438   52.7432   57.1297 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255  145.1255 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               28.5791   25.3837   20.6434   15.6284   11.6824    9.8628   10.6571   13.8525   18.5927   23.6078   27.5538   29.3734 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              301.3720  304.4993  296.6187  279.8416  258.6636  238.7592  225.4619  222.3346  230.2153  246.9923  268.1704  288.0747 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125   37.5125 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 -116.1004 (71)
Water heating gains (Table 5)
               79.1634   76.7772   71.8221   65.0857   60.7095   54.5484   49.3147   56.0238   58.4092   65.3815   73.2545   76.7872 (72)
Total internal gains
              478.6521  476.1979  458.6218  430.0934  400.5931  372.7080  354.9713  361.7485  376.7548  405.5193  438.5162  463.7729 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2          Table 6a      Specific data  Specific data      factor              W
                                                         W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                   7.2100           10.6334            0.7200         0.7000          0.7700      26.7776 (74)
Northeast                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (75)
East                                    1.4400           19.6403            0.7200         0.7000          0.7700       9.8781 (76)
South                                   7.9300           46.7521            0.7200         0.7000          0.7700     129.4905 (78)
West                                    0.7200           19.6403            0.7200         0.7000          0.7700       4.9391 (80)
Northwest                               1.0400           11.2829            0.7200         0.7000          0.7700       4.0984 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   179.2821  308.9158  434.8941  563.9803  657.9963  665.6994  636.5533  563.9149  478.8922  344.4388  215.3130  153.0937 (83)
Total gains   657.9342  785.1137  893.5159  994.0736 1058.5894 1038.4074  991.5246  925.6634  855.6470  749.9580  653.8292  616.8666 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.7268   50.0162   50.3090   51.8262   52.1407   53.7721   53.7721   54.1107   53.1074   52.1407   51.5155   50.9051
alpha          4.3151    4.3344    4.3539    4.4551    4.4760    4.5848    4.5848    4.6074    4.5405    4.4760    4.4344    4.3937
util living area
               0.9977    0.9947    0.9871    0.9631    0.8974    0.7517    0.5886    0.6426    0.8669    0.9764    0.9954    0.9983 (86)

MIT           19.4526   19.6418   19.9354   20.3366   20.6772   20.9080   20.9768   20.9660   20.8061   20.3600   19.8502   19.4461 (87)
Th 2          19.9777   19.9830   19.9883   20.0150   20.0204   20.0472   20.0472   20.0526   20.0365   20.0204   20.0097   19.9990 (88)
util rest of house
               0.9971    0.9932    0.9833    0.9510    0.8622    0.6726    0.4737    0.5289    0.8091    0.9666    0.9938    0.9978 (89)
MIT 2         17.8987   18.1784   18.6092   19.2040   19.6752   19.9750   20.0361   20.0346   19.8596   19.2476   18.5016   17.9036 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.1959 (91)
MIT           18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.2031   18.4650   18.8689   19.4258   19.8714   20.1578   20.2203   20.2170   20.0450   19.4654   18.7657   18.2057 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9953    0.9899    0.9772    0.9417    0.8558    0.6827    0.4956    0.5499    0.8098    0.9589    0.9909    0.9965 (94)
Useful gains 654.8371  777.1491  873.1301  936.0967  905.9451  708.9032  491.4174  509.0341  692.8608  719.1338  647.8593  614.6773 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2087.4508 2024.9131 1835.6163 1516.3560 1170.0875  771.6827  502.6753  526.6711  835.7753 1269.4621 1690.7179 2054.1822 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1065.8645  838.4974  716.0897  417.7867  196.5220    0.0000    0.0000    0.0000    0.0000  409.4442  750.8582 1070.9916 (98)
Space heating                                                                                                         5466.0543 (98)
Space heating per m2                                                                                  (98) / (4) =   41.0796 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5858.5791	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1065.8645	838.4974	716.0897	417.7867	196.5220	0.0000	0.0000	0.0000	0.0000	409.4442	750.8582	1070.9916	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1142.4057	898.7110	767.5131	447.7885	210.6345	0.0000	0.0000	0.0000	0.0000	438.8470	804.7783	1147.9010	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	180.0709	157.8197	163.6357	143.7624	138.7552	120.9287	113.2432	128.2652	129.2974	149.2167	161.4604	174.7512	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7613	89.7100	89.6079	89.3502	88.7745	86.7000	86.7000	86.7000	86.7000	89.3095	89.6413	89.7771	(217)
Fuel for water heating, kWh/month													
	200.6108	175.9221	182.6130	160.8977	156.3007	139.4795	130.6150	147.9414	149.1319	167.0782	180.1183	194.6502	(219)
Water heating fuel used												1985.3589	(219)
Annual totals kWh/year													
Space heating fuel - main system												5858.5791	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =											-2098.5959	-2098.5959	(233)
Total delivered energy for all uses												6325.0575	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5858.5791	0.2160	1265.4531	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.3589	0.2160	428.8375	(264)
Space and water heating			1694.2906	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			905.9916	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.8100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.8100	ZC1
Total Floor Area	TFA	133.0600	
Assumed number of occupants	N	2.9025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.4215	ZC2
CO2 emissions from cooking, equation (L16)		1.4179	ZC3
Total CO2 emissions		21.6494	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		21.6494	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.1500	(1b)	x 2.3100	(2b) =	155.1165	(1b) - (3b)
First floor	65.9100	(1c)	x 2.6300	(2c) =	173.3433	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	133.0600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	328.4598	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.3800	1.3258	25.6932			(27)
Ground floor			67.1500	0.1300	8.7295			(28a)
External Wall	167.1400	23.6600	143.4800	0.1800	25.8264			(29a)
Main Roof	65.9100		65.9100	0.1300	8.5683			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			301.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.1146			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0725	(36)
Total fabric heat loss (33) + (36) =	87.1871	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9941	62.6525	62.3176	60.7447	60.4504	59.0804	59.0804	58.8267	59.6081	60.4504	61.0457	61.6681	(38)
Heat transfer coeff	150.1812	149.8396	149.5047	147.9318	147.6375	146.2675	146.2675	146.0138	146.7952	147.6375	148.2328	148.8552	(39)
Average = Sum(39)m / 12 =												147.9304	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1261	1.1236	1.1118	1.1096	1.0993	1.0993	1.0974	1.1032	1.1096	1.1140	1.1187	(40)
HLP (average)												1.1118	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9025 (42)
Average daily hot water use (litres/day)	103.1346 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.4481	109.3227	105.1973	101.0719	96.9465	92.8211	92.8211	96.9465	101.0719	105.1973	109.3227	113.4481	(44)
Energy conte	168.2402	147.1439	151.8394	132.3772	127.0191	109.6078	101.5678	116.5505	117.9425	137.4506	150.0381	162.9316	(45)
Energy content (annual)										Total = Sum(45)m =		1622.7088	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2360	22.0716	22.7759	19.8566	19.0529	16.4412	15.2352	17.4826	17.6914	20.6176	22.5057	24.4397	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.4029	45.7748	47.3006	49.4029	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905 (64)
								Total per year (kWh/year) = Sum(64)m =				2212.3983 (64)
Heat gains from water heating, kWh/month												
	68.6796	60.4322	63.2263	56.3442	54.5846	47.8883	45.5964	51.1038	51.5446	58.4421	62.2164	66.9145 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	145.1255	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5791	25.3837	20.6434	15.6284	11.6824	9.8628	10.6571	13.8525	18.5927	23.6078	27.5538	29.3734	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.3720	304.4993	296.6187	279.8416	258.6636	238.7592	225.4619	222.3346	230.2153	246.9923	268.1704	288.0747	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	37.5125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	-116.1004	(71)
Water heating gains (Table 5)													
	92.3113	89.9289	84.9816	78.2558	73.3664	66.5115	61.2855	68.6879	71.5898	78.5511	86.4117	89.9388	(72)
Total internal gains													
	491.8000	489.3496	471.7813	443.2634	413.2500	384.6712	366.9421	374.4125	389.9354	418.6889	451.6735	476.9246	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.2100	10.6334	0.6300	0.7000	0.7700	23.4304	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	7.9300	46.7521	0.6300	0.7000	0.7700	113.3041	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	156.8718	270.3013	380.5323	493.4827	575.7467	582.4870	556.9841	493.4255	419.0307	301.3839	188.3989	133.9570 (83)
Total gains	648.6718	759.6509	852.3136	936.7462	988.9967	967.1581	923.9263	867.8381	808.9661	720.0728	640.0723	610.8815 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5275	61.6678	61.8059	62.4631	62.5876	63.1738	63.1738	63.2836	62.9467	62.5876	62.3362	62.0756	
alpha	5.1018	5.1112	5.1204	5.1642	5.1725	5.2116	5.2116	5.2189	5.1964	5.1725	5.1557	5.1384	
util living area													
	0.9993	0.9981	0.9949	0.9829	0.9410	0.8250	0.6607	0.7163	0.9167	0.9893	0.9983	0.9995	(86)
MIT	19.6822	19.8273	20.0639	20.3821	20.6854	20.9016	20.9764	20.9643	20.8069	20.4148	19.9901	19.6582	(87)
Th 2	19.9775	19.9796	19.9816	19.9912	19.9930	20.0014	20.0014	20.0030	19.9982	19.9930	19.9894	19.9856	(88)
util rest of house													
	0.9990	0.9975	0.9929	0.9755	0.9130	0.7440	0.5284	0.5879	0.8657	0.9835	0.9976	0.9993	(89)
MIT 2	18.2065	18.4203	18.7670	19.2345	19.6583	19.9279	19.9917	19.9864	19.8256	19.2863	18.6657	18.1772	(90)
Living area fraction										fLA = Living area / (4) =		0.1959	(91)
MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4955	18.6959	19.0210	19.4592	19.8595	20.1186	20.1846	20.1779	20.0178	19.5073	18.9251	18.4673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9962	0.9902	0.9702	0.9083	0.7549	0.5543	0.6125	0.8669	0.9794	0.9965	0.9988	(94)
Useful gains	647.6285	756.7635	843.9831	908.8096	898.3418	730.0702	512.1056	531.5433	701.3288	705.2595	637.8127	610.1600	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2131.9030	2067.1650	1871.9493	1562.0452	1204.6412	807.1895	524.3046	551.6293	868.7059	1315.0585	1752.8642	2123.7564	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating												5830.5567	(98)
Space heating per m2											(98) / (4) =	43.8190	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6242.5661	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1104.3003	880.5898	764.8069	470.3297	227.8868	0.0000	0.0000	0.0000	0.0000	453.6905	802.8371	1126.1157	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1182.3343	942.8156	818.8510	503.5650	243.9901	0.0000	0.0000	0.0000	0.0000	485.7500	859.5687	1205.6913	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.1991	193.1713	202.7983	181.6923	176.4220	155.3827	148.8684	165.9534	167.2576	188.4095	199.3532	213.8905	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5553	88.3997	88.0781	87.3388	85.6966	80.3000	80.3000	80.3000	80.3000	87.1824	88.1934	88.6208	(217)
Fuel for water heating, kWh/month													
	247.5280	218.5203	230.2482	208.0315	205.8681	193.5027	185.3903	206.6667	208.2909	216.1096	226.0408	241.3548	(219)
Water heating fuel used												2587.5520	(219)
Annual totals kWh/year													
Space heating fuel - main system												6242.5661	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.7154	(232)
Total delivered energy for all uses												9409.8334	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6242.5661	0.2160	1348.3943	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.5520	0.2160	558.9112	(264)
Space and water heating			1907.3055	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.7154	0.5190	261.9473	(268)
Total CO2, kg/m2/year			2208.1778	(272)
Emissions per m2 for space and water heating			14.3342	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9686	(272b)
Emissions per m2 for pumps and fans			0.2925	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3342 * 1.00) + 1.9686 + 0.2925, rounded to 2 d.p.			16.6000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 180 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 180	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 180, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.18 m	67.15 m²	2.31 m
1st Storey:	33.59 m	65.91 m²	2.63 m

7.0 Living Area	26.06	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	202.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.14	143.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	65.91	65.91
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	67.15

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	East							2.14	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.83	0.065	No
Independently assessed	E3 Sill	12.98	0.004	No
Independently assessed	E4 Jamb	41.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.18	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.78	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	20.81	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal		
Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 180 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 180	**Prop Type Ref**	Opp
Property	L470-R - Det SG, Plot 180, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.81	**TER**	16.60
Environmental	95 A	**% DER<TER**	58.96		
CO_2 Emissions (t/year)	0.36	**DFEE**	42.32	**TFEE**	55.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	133.06	m^2	
DER	6.81	$kgCO_2/yr/m^2$	
TER	16.60	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.81	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.96	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.32	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	133.06	m^2	
DER	16.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	31.75	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.42	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.42	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	23.56	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 181 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 181	**Prop Type Ref**	As
Property	L363-1-R Det SG, Plot 181, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.83	**TER**	17.68
Environmental	95 A	**% DER<TER**	61.37		
CO_2 Emissions (t/year)	0.25	**DFEE**	41.30	**TFEE**	53.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.68 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.83 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 5.90 m², No overhang
Windows facing East: 0.96 m², No overhang
Windows facing South: 7.03 m², No overhang
Windows facing West: 0.72 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.6100	1.2357	18.0542			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.2100	26.6301			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.8243			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8964	(36)
Total fabric heat loss					(33) + (36) =		62.7206	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	116.9976	116.3301	115.6626	112.3251	111.6576	108.3202	108.3202	107.6527	109.6552	111.6576	112.9926	114.3276	(39)
Average = Sum(39)m / 12 =												112.1583	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1715	1.1648	1.1312	1.1244	1.0908	1.0908	1.0841	1.1043	1.1244	1.1379	1.1513	(40)
HLP (average)												1.1295	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8169 10.6637 11.7839 11.3667 11.7162 11.3045 11.6603 11.6966 11.3384 11.7548 11.4100 11.8062 (61)
Total heat required for water heating calculated for each month
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (64)
Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)
Heat gains from water heating, kWh/month
56.7099 49.6809 51.4612 45.1385 43.5138 37.8477 35.3677 40.1640 40.5192 46.8565 50.7922 55.0110 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.1477 21.4477 17.4425 13.2051 9.8709 8.3335 9.0046 11.7045 15.7098 19.9472 23.2813 24.8188 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
255.1911 257.8392 251.1661 236.9599 219.0271 202.1728 190.9131 188.2650 194.9381 209.1443 227.0771 243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
76.2229 73.9299 69.1683 62.6923 58.4863 52.5663 47.5372 53.9839 56.2767 62.9792 70.5448 73.9395 (72)
Total internal gains
422.5560 420.2112 404.7712 379.8515 354.3787 330.0668 314.4492 320.9477 333.9189 359.0650 387.8975 409.6840 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9000	10.6334	0.7200	0.7000	0.7700	21.9123	(74)
East	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(76)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)
West	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(80)

Solar gains 148.2309 252.4231 347.7668 439.1113 502.3796 504.1948 483.7704 435.1990 378.9020 279.3772 177.4715 126.9371 (83)
Total gains 570.7869 672.6342 752.5379 818.9629 856.7583 834.2616 798.2197 756.1467 712.8209 638.4422 565.3690 536.6211 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.1520	47.4225	47.6962	49.1134	49.4070	50.9293	50.9293	51.2450	50.3092	49.4070	48.8232	48.2531	
alpha	4.1435	4.1615	4.1797	4.2742	4.2938	4.3953	4.3953	4.4163	4.3539	4.2938	4.2549	4.2169	

util living area
0.9957 0.9909 0.9803 0.9510 0.8800 0.7324 0.5705 0.6161 0.8366 0.9640 0.9917 0.9967 (86)

MIT	19.4529	19.6510	19.9481	20.3454	20.6787	20.9065	20.9759	20.9666	20.8182	20.3834	19.8625	19.4436	(87)
Th 2	19.9375	19.9429	19.9483	19.9755	19.9809	20.0083	20.0083	20.0138	19.9973	19.9809	19.9700	19.9591	(88)

util rest of house
0.9945 0.9884 0.9746 0.9357 0.8407 0.6503 0.4540 0.5009 0.7716 0.9497 0.9889 0.9957 (89)

MIT 2	17.8737	18.1657	18.6000	19.1862	19.6428	19.9361	19.9970	19.9966	19.8367	19.2511	18.4934	17.8744	(90)

Living area fraction fLA = Living area / (4) = 0.1233 (91)

MIT	18.0684	18.3488	18.7662	19.3290	19.7705	20.0557	20.1176	20.1162	19.9577	19.3907	18.6621	18.0678	(92)

Temperature adjustment 0.0000
adjusted MIT 18.0684 18.3488 18.7662 19.3290 19.7705 20.0557 20.1176 20.1162 19.9577 19.3907 18.6621 18.0678 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9828	0.9655	0.9232	0.8310	0.6546	0.4675	0.5136	0.7686	0.9386	0.9837	0.9931	(94)
Useful gains	565.7566	661.0541	726.6068	756.0835	711.9586	546.1206	373.1671	388.3588	547.8740	599.2123	556.1704	532.9250	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W
1610.8680 1564.5003 1418.7376 1171.4442 901.1279 590.9657 381.0319 400.0553 642.3272 981.5477 1306.4347 1585.4775 (97)

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh
777.5629 607.1159 514.9453 299.0597 140.7419 0.0000 0.0000 0.0000 0.0000 284.4575 540.1903 783.0991 (98)
Space heating 3947.1726 (98)
Space heating per m2 (98) / (4) = 39.7500 (99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4230.6245	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	777.5629	607.1159	514.9453	299.0597	140.7419	0.0000	0.0000	0.0000	0.0000	284.4575	540.1903	783.0991	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	833.4007	650.7137	551.9243	320.5356	150.8488	0.0000	0.0000	0.0000	0.0000	304.8848	578.9821	839.3345	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6212	89.5552	89.4294	89.1282	88.5091	86.7000	86.7000	86.7000	86.7000	89.0581	89.4693	89.6413	(217)
Fuel for water heating, kWh/month													
	193.5792	169.7972	176.3339	155.4784	151.1435	134.5243	126.0233	142.6715	143.8012	161.5108	173.9029	187.8330	(219)
Water heating fuel used												1916.5994	(219)
Annual totals kWh/year													
Space heating fuel - main system												4230.6245	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1080 * 1.00) =										-1753.1480		-1753.1480	(233)
Total delivered energy for all uses												4895.5311	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4230.6245	0.2160	913.8149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.5994	0.2160	413.9855	(264)
Space and water heating			1327.8004	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Energy saving/generation technologies				
PV Unit	-1753.1480	0.5190	-909.8838	(269)
Total CO2, kg/year			678.1718	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.8300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.8300	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		23.9176	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.9176	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.7500	126.8100	0.1800	22.8258			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.6721			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7119	(36)
Total fabric heat loss (33) + (36) =	68.3840	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	115.4425	115.1867	114.9359	113.7580	113.5376	112.5116	112.5116	112.3217	112.9068	113.5376	113.9834	114.4495	(39)
Average = Sum(39)m / 12 =												113.7569	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1626	1.1600	1.1575	1.1456	1.1434	1.1330	1.1330	1.1311	1.1370	1.1434	1.1479	1.1526	(40)
HLP (average)												1.1456	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.1477	21.4477	17.4425	13.2051	9.8709	8.3335	9.0046	11.7045	15.7098	19.9472	23.2813	24.8188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.7085	433.3673	417.9348	392.5359	366.3940	341.4150	325.8045	332.9697	346.6130	372.2384	401.0589	422.8401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9000	10.6334	0.6300	0.7000	0.7700	19.1732	(74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(76)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	129.7021	220.8702	304.2959	384.2224	439.5822	441.1705	423.2991	380.7991	331.5393	244.4550	155.2876	111.0699	(83)
Total gains	565.4106	654.2375	722.2308	776.7583	805.9762	782.5855	749.1037	713.7688	678.1523	616.6934	556.3465	533.9101	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7339	59.8666	59.9972	60.6185	60.7361	61.2900	61.2900	61.3936	61.0754	60.7361	60.4986	60.2522	
alpha	4.9823	4.9911	4.9998	5.0412	5.0491	5.0860	5.0860	5.0929	5.0717	5.0491	5.0332	5.0168	
util living area													
	0.9984	0.9964	0.9913	0.9749	0.9248	0.7990	0.6312	0.6791	0.8874	0.9817	0.9966	0.9988	(86)
MIT	19.7135	19.8647	20.1021	20.4139	20.7059	20.9101	20.9789	20.9696	20.8320	20.4551	20.0256	19.6865	(87)
Th 2	19.9501	19.9521	19.9542	19.9638	19.9656	19.9739	19.9739	19.9755	19.9707	19.9656	19.9619	19.9581	(88)
util rest of house													
	0.9979	0.9952	0.9880	0.9645	0.8912	0.7129	0.4987	0.5491	0.8256	0.9721	0.9953	0.9984	(89)
MIT 2	18.2329	18.4550	18.8021	19.2575	19.6602	19.9090	19.9656	19.9620	19.8278	19.3223	18.6976	18.1991	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.4154	18.6288	18.9624	19.4001	19.7891	20.0324	20.0905	20.0862	19.9515	19.4619	18.8613	18.3824	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4154	18.6288	18.9624	19.4001	19.7891	20.0324	20.0905	20.0862	19.9515	19.4619	18.8613	18.3824	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9928	0.9836	0.9568	0.8841	0.7185	0.5147	0.5643	0.8242	0.9655	0.9930	0.9975	(94)
Useful gains	563.5150	649.5282	710.3645	743.2333	712.5390	562.2531	385.5831	402.7795	558.9394	595.4350	552.4363	532.5543	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1629.5170	1581.3746	1432.3756	1194.4650	918.4177	611.2067	392.7227	414.0438	660.6792	1006.1597	1340.5958	1623.1737	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	793.1055	626.2008	537.1763	324.8869	153.1737	0.0000	0.0000	0.0000	0.0000	305.5792	567.4749	811.4208	(98)
Space heating												4119.0181	(98)
Space heating per m2										(98) / (4) =		41.4805	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4410.0836	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	793.1055	626.2008	537.1763	324.8869	153.1737	0.0000	0.0000	0.0000	0.0000	305.5792	567.4749	811.4208	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	849.1494	670.4506	575.1352	347.8446	163.9976	0.0000	0.0000	0.0000	0.0000	327.1726	607.5748	868.7589	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0584	87.8545	87.4500	86.5859	84.7969	80.3000	80.3000	80.3000	80.3000	86.3322	87.5984	88.1420	(217)
Fuel for water heating, kWh/month													
	241.4648	213.3368	225.1224	202.2337	199.9289	185.9471	178.1515	198.5972	200.7905	212.0212	220.8884	235.4480	(219)
Water heating fuel used												2513.9302	(219)
Annual totals kWh/year													
Space heating fuel - main system												4410.0836	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.4552	(232)
Total delivered energy for all uses												7425.4690	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4410.0836	0.2160	952.5781	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.9302	0.2160	543.0089	(264)
Space and water heating			1495.5870	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	426.4552	0.5190	221.3302	(268)
Total CO2, kg/m2/year			1755.8422	(272)
Emissions per m2 for space and water heating			15.0613	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2289	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0613 * 1.00) + 2.2289 + 0.3920, rounded to 2 d.p.			17.6800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 181 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 181	**Prop Type Ref**	As
Property	L363-1-R Det SG, Plot 181, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.83	**TER**	17.68
Environmental	95 A	**% DER<TER**	61.37		
CO_2 Emissions (t/year)	0.25	**DFEE**	41.30	**TFEE**	53.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.09 m	49.65 m²	2.31 m
1st Storey:	29.09 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	143.56	126.81

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.26	0.065	No
Independently assessed	E3 Sill	9.65	0.004	No
Independently assessed	E4 Jamb	28.80	0.005	No
Independently assessed	E5 Ground floor (normal)	29.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	29.09	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.94	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.15	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 181 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 181	**Prop Type Ref**	As
Property	L363-1-R Det SG, Plot 181, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.83	**TER**	17.68
Environmental	95 A	**% DER<TER**	61.37		
CO_2 Emissions (t/year)	0.25	**DFEE**	41.30	**TFEE**	53.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	6.83	$kgCO_2/yr/m^2$	
TER	17.68	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.83	$kgCO_2/yr/m^2$	
Reduction DER/TER	61.37	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.30	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.15	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.24	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.24	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 182 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 182	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 182, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.14	**TER**	17.98
Environmental	95 A	**% DER<TER**	60.29		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.51	**TFEE**	60.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.75 m², No overhang
Windows facing North East: 1.07 m², No overhang
Windows facing East: 6.92 m², No overhang
Windows facing West: 9.05 m², No overhang
Windows facing North West: 1.07 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1722	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3972	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3376	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6804	0.6720	0.6636	0.6214	0.6129	0.5707	0.5707	0.5623	0.5876	0.6129	0.6298	0.6467	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			24.8600	1.2357	30.7205			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.4500	0.1200	7.1340			(28a)
External Wall	167.0900	27.0000	140.0900	0.2100	29.4189			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7558			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7370	(36)
Total fabric heat loss					(33) + (36) =		80.4928	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2072	64.3984	63.5895	59.5455	58.7367	54.6926	54.6926	53.8838	56.3102	58.7367	60.3543	61.9719	(38)
Heat transfer coeff	145.7000	144.8912	144.0824	140.0383	139.2295	135.1854	135.1854	134.3766	136.8030	139.2295	140.8471	142.4647	(39)
Average = Sum(39)m / 12 =												139.8361	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2315	1.2247	1.1903	1.1834	1.1490	1.1490	1.1422	1.1628	1.1834	1.1972	1.2109	(40)
HLP (average)												1.1886	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538	(42)
Average daily hot water use (litres/day)	101.9768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8268    10.6723    11.7927    11.3819    11.7303    11.3161    11.6710    11.7094    11.3519    11.7628    11.4187    11.8158 (61)
Total heat required for water heating calculated for each month
              178.1782   156.1643   161.9275   142.2730   137.3234   119.6934   112.0985   126.9515   127.9704   147.6704   159.7724   172.9183 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1782   156.1643   161.9275   142.2730   137.3234   119.6934   112.0985   126.9515   127.9704   147.6704   159.7724   172.9183 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1742.9413 (64)
Heat gains from water heating, kWh/month
               58.2686    51.0442    52.8680    46.3668    44.6923    38.8645    36.3099    41.2453    41.6136    48.1300    52.1823    56.5205 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879   142.6879 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                25.2097    22.3911    18.2096    13.7859    10.3051     8.7000     9.4007    12.2193    16.4008    20.8245    24.3053    25.9104 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               282.1215   285.0490   277.6717   261.9663   242.1411   223.5081   211.0602   208.1327   215.5100   231.2154   251.0406   269.6735 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688    37.2688 (69)
Pumps, fans      3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503  -114.1503 (71)
Water heating gains (Table 5)
                78.3179    75.9586    71.0591    64.3983    60.0703    53.9785    48.8036    55.4373    57.7967    64.6908    72.4754    75.9684 (72)
Total internal gains
               454.4556   452.2051   435.7469   408.9569   381.3228   354.9930   338.0709   344.5956   358.5138   385.5371   416.6277   440.3588 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g              FF          Access          Gains
                                           m2           Table 6a     Specific data  Specific data      factor              W
                                                           W/m2     or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                    6.7500           10.6334          0.7200         0.7000          0.7700         25.0691 (74)
Northeast                                1.0700           11.2829          0.7200         0.7000          0.7700          4.2167 (75)
East                                     6.9200           19.6403          0.7200         0.7000          0.7700         47.4698 (76)
West                                     9.0500           19.6403          0.7200         0.7000          0.7700         62.0811 (80)
Northwest                                1.0700           11.2829          0.7200         0.7000          0.7700          4.2167 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains    143.0534   279.3795   465.2659   696.2820   875.2414   907.1150   858.9328   722.0527   546.0371   332.2980   178.1344   117.8753 (83)
Total gains    597.5089   731.5846   901.0127  1105.2389  1256.5643  1262.1080  1197.0037  1066.6483   904.5509   717.8351   594.7621   558.2341 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            47.3274    47.5916    47.8587    49.2408    49.5269    51.0084    51.0084    51.3155    50.4053    49.5269    48.9580    48.4021
alpha           4.1552     4.1728     4.1906     4.2827     4.3018     4.4006     4.4006     4.4210     4.3604     4.3018     4.2639     4.2268
util living area
                0.9978     0.9946     0.9830     0.9377     0.8234     0.6385     0.4851     0.5565     0.8304     0.9747     0.9957     0.9984 (86)

MIT            19.3575    19.5628    19.9209    20.4058    20.7647    20.9459    20.9871    20.9776    20.8249    20.3233    19.7686    19.3490 (87)
Th 2           19.8894    19.8948    19.9003    19.9278    19.9333    19.9610    19.9610    19.9665    19.9499    19.9333    19.9223    19.9113 (88)
util rest of house
                0.9971     0.9929     0.9777     0.9182     0.7724     0.5518     0.3762     0.4420     0.7605     0.9636     0.9941     0.9979 (89)
MIT 2          17.6951    17.9982    18.5216    19.2274    19.7005    19.9233    19.9557    19.9561    19.8004    19.1283    18.3180    17.6971 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.2533 (91)
MIT            18.1161    18.3945    18.8760    19.5259    19.9700    20.1823    20.2169    20.2149    20.0599    19.4310    18.6854    18.1155 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT   18.1161    18.3945    18.8760    19.5259    19.9700    20.1823    20.2169    20.2149    20.0599    19.4310    18.6854    18.1155 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9955     0.9896     0.9708     0.9091     0.7743     0.5713     0.4037     0.4706     0.7689     0.9564     0.9914     0.9966 (94)
Useful gains  594.8026   723.9652   874.7413  1004.8122   973.0053   720.9891   483.2847   501.9948   695.5433   686.5245   589.6253   556.3401 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             2013.0115  1955.2358  1783.1681  1488.0323  1151.4313   754.6445   488.9555   512.6292   815.3350  1229.5375  1631.7710  1982.4712 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             1055.1475   827.4138   675.8695   347.9185   132.7489     0.0000     0.0000     0.0000     0.0000   404.0017   750.3449  1061.0415 (98)
Space heating                                                                                                                 5254.4862 (98)
Space heating per m2                                                                                                 (98) / (4) =     44.6620 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5631.8180	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1055.1475	827.4138	675.8695	347.9185	132.7489	0.0000	0.0000	0.0000	0.0000	404.0017	750.3449	1061.0415	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1130.9190	886.8315	724.4047	372.9030	142.2818	0.0000	0.0000	0.0000	0.0000	433.0136	804.2282	1137.2364	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1782	156.1643	161.9275	142.2730	137.3234	119.6934	112.0985	126.9515	127.9704	147.6704	159.7724	172.9183	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7615	89.7086	89.5811	89.2247	88.4329	86.7000	86.7000	86.7000	86.7000	89.3074	89.6465	89.7776	(217)
Fuel for water heating, kWh/month													
	198.5017	174.0795	180.7608	159.4547	155.2854	138.0547	129.2947	146.4262	147.6013	165.3507	178.2249	192.6073	(219)
Water heating fuel used												1965.6420	(219)
Annual totals kWh/year													
Space heating fuel - main system												5631.8180	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 908 * 1.00) =										-2062.6448		-2062.6448	(233)
Total delivered energy for all uses												6055.0270	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5631.8180	0.2160	1216.4727	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.6420	0.2160	424.5787	(264)
Space and water heating			1641.0514	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Energy saving/generation technologies				
PV Unit	-2062.6448	0.5190	-1070.5127	(269)
Total CO2, kg/year			840.5286	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1400	ZC1
Total Floor Area	TFA	117.6500	
Assumed number of occupants	N	2.8538	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2099	ZC2
CO2 emissions from cooking, equation (L16)		1.5936	ZC3
Total CO2 emissions		22.9435	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9435	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.4500 (1b)	x	2.3100 (2b)	=	137.3295	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.3955	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3296	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3049	0.3296	0.3543	0.3708	0.3873	(22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			24.8600	1.3258	32.9583			(27)
Ground floor			59.4500	0.1300	7.7285			(28a)
External Wall	167.0900	27.0000	140.0900	0.1800	25.2162			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			285.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.1982			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5378	(36)
Total fabric heat loss (33) + (36) =	89.7360	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.3762	56.0477	55.7256	54.2130	53.9300	52.6125	52.6125	52.3686	53.1200	53.9300	54.5025	55.1011	(38)
Heat transfer coeff	146.1123	145.7837	145.4617	143.9490	143.6660	142.3486	142.3486	142.1046	142.8560	143.6660	144.2386	144.8371	(39)
Average = Sum(39)m / 12 =												143.9477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2419	1.2391	1.2364	1.2235	1.2211	1.2099	1.2099	1.2079	1.2142	1.2211	1.2260	1.2311	(40)
HLP (average)												1.2235	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8538 (42)
Average daily hot water use (litres/day)	101.9768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1744	108.0954	104.0163	99.9372	95.8582	91.7791	91.7791	95.8582	99.9372	104.0163	108.0954	112.1744	(44)
Energy conte	166.3515	145.4920	150.1348	130.8911	125.5931	108.3773	100.4275	115.2421	116.6184	135.9075	148.3537	161.1025	(45)
Energy content (annual)										Total = Sum(45)m =		1604.4916	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9527	21.8238	22.5202	19.6337	18.8390	16.2566	15.0641	17.2863	17.4928	20.3861	22.2531	24.1654	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2841	48.8483	45.2609	46.7696	48.8483	49.2841	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614 (64)
									Total per year (kWh/year) = Sum(64)m =			2191.9649 (64)
Heat gains from water heating, kWh/month												
	68.0516	59.8830	62.6595	55.8423	53.9718	47.3507	45.0846	50.5301	51.0967	57.9290	61.6564	66.3063 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	142.6879	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.2097	22.3911	18.2096	13.7859	10.3051	8.7000	9.4007	12.2193	16.4008	20.8245	24.3053	25.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.1215	285.0490	277.6717	261.9663	242.1411	223.5081	211.0602	208.1327	215.5100	231.2154	251.0406	269.6735	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	37.2688	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	-114.1503	(71)
Water heating gains (Table 5)													
	91.4672	89.1115	84.2198	77.5588	72.5427	65.7649	60.5975	67.9167	70.9676	77.8615	85.6338	89.1214	(72)
Total internal gains													
	467.6048	465.3580	448.9075	422.1174	393.7953	366.7794	349.8647	357.0751	371.6847	398.7078	429.7861	453.5117	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7500	10.6334	0.6300	0.7000	0.7700	21.9355	(74)
Northeast	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(75)
East	6.9200	19.6403	0.6300	0.7000	0.7700	41.5361	(76)
West	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(80)
Northwest	1.0700	11.2829	0.6300	0.7000	0.7700	3.6896	(81)

Solar gains	125.1717	244.4571	407.1076	609.2467	765.8363	793.7256	751.5662	631.7961	477.7825	290.7608	155.8676	103.1409 (83)
Total gains	592.7765	709.8151	856.0152	1031.3641	1159.6315	1160.5050	1101.4310	988.8712	849.4671	689.4686	585.6538	556.6526 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9169	56.0429	56.1670	56.7572	56.8690	57.3953	57.3953	57.4938	57.1914	56.8690	56.6432	56.4092	
alpha	4.7278	4.7362	4.7445	4.7838	4.7913	4.8264	4.8264	4.8329	4.8128	4.7913	4.7762	4.7606	
util living area													
	0.9991	0.9976	0.9917	0.9651	0.8803	0.7156	0.5519	0.6278	0.8833	0.9866	0.9980	0.9993	(86)
MIT	19.5492	19.7125	20.0096	20.4120	20.7515	20.9364	20.9855	20.9740	20.8143	20.3586	19.8816	19.5235	(87)
Th 2	19.8866	19.8888	19.8910	19.9012	19.9031	19.9121	19.9121	19.9137	19.9086	19.9031	19.8993	19.8952	(88)
util rest of house													
	0.9987	0.9967	0.9886	0.9511	0.8339	0.6203	0.4239	0.4956	0.8181	0.9792	0.9972	0.9991	(89)
MIT 2	17.9486	18.1888	18.6229	19.2059	19.6591	19.8700	19.9068	19.9030	19.7528	19.1397	18.4437	17.9168	(90)
Living area fraction									fLA = Living area / (4) =			0.2533	(91)
MIT	18.3540	18.5747	18.9741	19.5114	19.9358	20.1401	20.1800	20.1743	20.0217	19.4485	18.8079	18.3238	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3540	18.5747	18.9741	19.5114	19.9358	20.1401	20.1800	20.1743	20.0217	19.4485	18.8079	18.3238	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9848	0.9447	0.8355	0.6418	0.4566	0.5291	0.8262	0.9749	0.9958	0.9985	(94)
Useful gains	591.5901	706.3712	843.0393	974.3025	968.9221	744.8571	502.9011	523.2116	701.8643	672.1424	583.2161	555.8266	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2053.4604	1993.5548	1814.5104	1527.4959	1183.2030	788.6317	509.6140	536.3418	845.9463	1271.2253	1688.7347	2045.6462	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1087.6314	864.9874	722.7745	398.2992	159.4250	0.0000	0.0000	0.0000	0.0000	445.7176	795.9733	1108.4258	(98)
Space heating												5583.2344	(98)
Space heating per m2											(98) / (4) =	47.4563	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5977.7670	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1087.6314	864.9874	722.7745	398.2992	159.4250	0.0000	0.0000	0.0000	0.0000	445.7176	795.9733	1108.4258	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1164.4876	926.1107	773.8485	426.4446	170.6906	0.0000	0.0000	0.0000	0.0000	477.2138	852.2198	1186.7514	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3104	191.5194	201.0937	180.1752	174.4414	153.6383	147.1971	164.0903	165.9025	186.8664	197.6688	212.0614	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5454	88.3848	87.9910	86.9920	84.8255	80.3000	80.3000	80.3000	80.3000	87.1615	88.1933	88.6101	(217)
Fuel for water heating, kWh/month													
	245.4227	216.6883	228.5388	207.1169	205.6475	191.3303	183.3090	204.3466	206.6034	214.3910	224.1313	239.3195	(219)
Water heating fuel used												2566.8454	(219)
Annual totals kWh/year													
Space heating fuel - main system												5977.7670	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												445.2118	(232)
Total delivered energy for all uses												9064.8242	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5977.7670	0.2160	1291.1977	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2566.8454	0.2160	554.4386	(264)
Space and water heating			1845.6363	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	445.2118	0.5190	231.0649	(268)
Total CO2, kg/m2/year			2115.6262	(272)
Emissions per m2 for space and water heating			15.6875	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9640	(272b)
Emissions per m2 for pumps and fans			0.3309	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6875 * 1.00) + 1.9640 + 0.3309, rounded to 2 d.p.			17.9800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 182 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 182	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 182, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.14	**TER**	17.98
Environmental	95 A	**% DER<TER**	60.29		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.51	**TFEE**	60.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.17 m	59.45 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	167.09	140.09

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.45

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.28	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.07	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.07	100
D2 W14	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.83	0.065	No
Independently assessed	E3 Sill	14.63	0.004	No
Independently assessed	E4 Jamb	47.10	0.005	No
Independently assessed	E5 Ground floor (normal)	34.17	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 182 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 182	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 182, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.14	**TER**	17.98
Environmental	95 A	**% DER<TER**	60.29		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.51	**TFEE**	60.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.31		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.65	m^2	
DER	7.14	$kgCO_2/yr/m^2$	
TER	17.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.14	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.29	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.51	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.65	m^2	
DER	18.37	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.17	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.17	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.27	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.07	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.07	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 183 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 183	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 183, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.49	**TER**	18.03
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	38.82	**TFEE**	51.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 84 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.03 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.49 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 5.27 m², No overhang
Windows facing West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3923	0.3844	0.3452	0.3373	0.2981	0.2981	0.2903	0.3138	0.3373	0.3530	0.3687	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6501	0.6423	0.6344	0.5952	0.5873	0.5481	0.5481	0.5403	0.5638	0.5873	0.6030	0.6187	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3300	1.2357	16.4724			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			42.1200	0.1200	5.0544			(28a)
External Wall	90.6000	15.4700	75.1300	0.2100	15.7773			(29a)
Main Roof	42.1200		42.1200	0.0700	2.9484			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4625			(33)
Party Wall			45.8900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	196.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3600	(36)
Total fabric heat loss (33) + (36) =	47.8226	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6384	44.0997	43.5611	40.8677	40.3290	37.6357	37.6357	37.0970	38.7130	40.3290	41.4064	42.4837	(38)
Heat transfer coeff	92.4610	91.9223	91.3836	88.6903	88.1516	85.4582	85.4582	84.9195	86.5356	88.1516	89.2289	90.3063	(39)
Average = Sum(39)m / 12 =												88.5556	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0976	1.0912	1.0848	1.0528	1.0464	1.0145	1.0145	1.0081	1.0273	1.0464	1.0592	1.0720	(40)
HLP (average)												1.0512	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8011	10.6498	11.7590	11.3430	11.6945	11.2865	11.6436	11.6766	11.3173	11.7323	11.3959	11.7909 (61)

Total heat required for water heating calculated for each month

	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614 (64)

Total per year (kWh/year) = Sum(64)m = 1624.7415 (64)

Heat gains from water heating, kWh/month

	54.1998	47.4856	49.1932	43.1607	41.6163	36.2105	33.8506	38.4229	38.7571	44.8034	48.5537	52.5802 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.2596	18.8826	15.3564	11.6258	8.6904	7.3368	7.9277	10.3047	13.8309	17.5615	20.4969	21.8505	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)

Water heating gains (Table 5)

	72.8492	70.6631	66.1199	59.9454	55.9359	50.2924	45.4981	51.6437	53.8293	60.2197	67.4357	70.6722	(72)

Total internal gains

	386.2585	384.0621	370.0287	347.4269	324.4549	302.3944	288.1278	294.2837	305.9596	328.7772	354.9558	374.6092	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.7200	0.7000	0.7700	3.5654	(74)
East	5.2700	19.6403	0.7200	0.7000	0.7700	36.1511	(76)
West	7.1000	19.6403	0.7200	0.7000	0.7700	48.7045	(80)

Solar gains	88.4210	172.8093	284.9493	417.2929	513.6687	527.0051	501.2365	428.9118	331.8626	205.0786	110.2034	72.7534	(83)
Total gains	474.6795	556.8714	654.9779	764.7198	838.1236	829.3995	789.3643	723.1956	637.8222	533.8557	465.1592	447.3626	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6036	49.8943	50.1884	51.7125	52.0286	53.6683	53.6683	54.0088	53.0002	52.0286	51.4004	50.7872	
alpha	4.3069	4.3263	4.3459	4.4475	4.4686	4.5779	4.5779	4.6006	4.5333	4.4686	4.4267	4.3858	
util living area	0.9957	0.9909	0.9758	0.9244	0.8080	0.6224	0.4679	0.5251	0.7912	0.9607	0.9918	0.9967	(86)
MIT	19.5427	19.7358	20.0644	20.4968	20.8038	20.9575	20.9907	20.9849	20.8723	20.4443	19.9315	19.5346	(87)
Th 2	20.0028	20.0080	20.0133	20.0395	20.0448	20.0713	20.0713	20.0766	20.0607	20.0448	20.0343	20.0238	(88)
util rest of house	0.9945	0.9884	0.9691	0.9039	0.7602	0.5451	0.3731	0.4265	0.7232	0.9460	0.9892	0.9958	(89)
MIT 2	18.0510	18.3356	18.8143	19.4424	19.8464	20.0400	20.0670	20.0690	19.9503	19.3848	18.6400	18.0534	(90)
Living area fraction									fLA = Living area / (4) =			0.1819	(91)
MIT	18.3223	18.5903	19.0417	19.6342	20.0205	20.2068	20.2350	20.2355	20.1180	19.5775	18.8749	18.3227	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3223	18.5903	19.0417	19.6342	20.0205	20.2068	20.2350	20.2355	20.1180	19.5775	18.8749	18.3227	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9834	0.9603	0.8934	0.7588	0.5569	0.3902	0.4440	0.7279	0.9366	0.9847	0.9934	(94)
Useful gains	470.6885	547.6279	629.0041	683.2254	636.0091	461.9302	307.9905	321.0978	464.2421	500.0077	458.0391	444.4172	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1296.5115	1258.4414	1146.1043	952.0167	733.4669	479.1513	310.6410	325.7128	520.7719	791.3812	1050.6579	1275.3725	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	614.4123	477.6666	384.7225	193.5297	72.5086	0.0000	0.0000	0.0000	0.0000	216.7819	426.6856	618.2307	(98)

Space heating 3004.5380 (98)

Space heating per m2 (98) / (4) = 35.6664 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3220.2979	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	614.4123	477.6666	384.7225	193.5297	72.5086	0.0000	0.0000	0.0000	0.0000	216.7819	426.6856	618.2307	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	658.5341	511.9685	412.3500	207.4273	77.7155	0.0000	0.0000	0.0000	0.0000	232.3493	457.3264	662.6267	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5097	89.4332	89.2560	88.8007	87.9678	86.7000	86.7000	86.7000	86.7000	88.8669	89.3406	89.5317	(217)
Fuel for water heating, kWh/month													
	185.3822	162.6425	169.0274	149.3468	145.5800	128.8399	120.7558	136.6261	137.6826	154.9038	166.6139	179.8932	(219)
Water heating fuel used												1837.2942	(219)
Annual totals kWh/year													
Space heating fuel - main system												3220.2979	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												375.4514	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4331.4644	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3220.2979	0.2160	695.5844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1837.2942	0.2160	396.8555	(264)
Space and water heating			1092.4399	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	375.4514	0.5190	194.8593	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			715.5796	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.4900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.4900	ZC1
Total Floor Area	TFA	84.2400	
Assumed number of occupants	N	2.5384	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0436	ZC2
CO2 emissions from cooking, equation (L16)		2.1358	ZC3
Total CO2 emissions		26.6695	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.6695	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3942	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3351	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4272	0.4188	0.4104	0.3686	0.3602	0.3183	0.3183	0.3099	0.3351	0.3602	0.3769	0.3937	(22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5710	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.3300	1.3258	17.6723			(27)
Ground floor			42.1200	0.1300	5.4756			(28a)
External Wall	90.6000	15.4700	75.1300	0.1800	13.5234			(29a)
Main Roof	42.1200		42.1200	0.1300	5.4756			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7149			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.5082	(36)
Total fabric heat loss (33) + (36) =	54.2231	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5974	40.3541	40.1156	38.9955	38.7859	37.8104	37.8104	37.6297	38.1861	38.7859	39.2099	39.6531	(38)
Heat transfer coeff	94.8205	94.5772	94.3388	93.2187	93.0091	92.0335	92.0335	91.8529	92.4093	93.0091	93.4331	93.8763	(39)
Average = Sum(39)m / 12 =												93.2177	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1256	1.1227	1.1199	1.1066	1.1041	1.0925	1.0925	1.0904	1.0970	1.1041	1.1091	1.1144	(40)
HLP (average)												1.1066	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1126	45.6645	45.2606	41.9368	43.3347	45.2606	45.6645	49.1126	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
								Total per year (kWh/year) = Sum(64)m =				2049.2581	(64)
Heat gains from water heating, kWh/month													
	63.9892	56.3300	58.5316	51.7410	50.0079	43.8731	41.7734	46.8189	47.3439	54.1485	58.0335	62.3721	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.2596	18.8826	15.3564	11.6258	8.6904	7.3368	7.9277	10.3047	13.8309	17.5615	20.4969	21.8505	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)
Water heating gains (Table 5)													
	86.0071	83.8244	78.6716	71.8625	67.2149	60.9348	56.1470	62.9286	65.7554	72.7803	80.6021	83.8335	(72)
Total internal gains													
	399.4163	397.2234	382.5803	359.3441	335.7338	313.0369	298.7767	305.5687	317.8857	341.3377	368.1222	387.7705	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	5.2700	19.6403	0.6300	0.7000	0.7700	31.6322	(76)
West	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(80)

Solar gains	77.3684	151.2081	249.3306	365.1313	449.4601	461.1294	438.5819	375.2979	290.3798	179.4438	96.4280	63.6593	(83)
Total gains	476.7847	548.4315	631.9109	724.4754	785.1940	774.1663	737.3586	680.8666	608.2654	520.7815	464.5502	451.4297	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6955	61.8542	62.0106	62.7557	62.8971	63.5638	63.5638	63.6888	63.3053	62.8971	62.6117	62.3161	
alpha	5.1130	5.1236	5.1340	5.1837	5.1931	5.2376	5.2376	5.2459	5.2204	5.1931	5.1741	5.1544	
util living area													
	0.9985	0.9966	0.9897	0.9615	0.8762	0.7077	0.5382	0.6003	0.8583	0.9811	0.9968	0.9989	(86)
MIT	19.7598	19.9063	20.1676	20.5152	20.8010	20.9537	20.9909	20.9844	20.8700	20.4869	20.0614	19.7362	(87)
Th 2	19.9800	19.9823	19.9846	19.9955	19.9975	20.0070	20.0070	20.0087	20.0033	19.9975	19.9934	19.9891	(88)
util rest of house													
	0.9980	0.9954	0.9859	0.9468	0.8312	0.6186	0.4225	0.4810	0.7903	0.9714	0.9955	0.9985	(89)
MIT 2	18.3218	18.5373	18.9189	19.4221	19.8014	19.9760	20.0036	20.0022	19.8965	19.3912	18.7724	18.2938	(90)
Living area fraction										fLA = Living area / (4) =		0.1819	(91)
MIT	18.5833	18.7863	19.1460	19.6209	19.9832	20.1538	20.1831	20.1808	20.0735	19.5905	19.0068	18.5561	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5833	18.7863	19.1460	19.6209	19.9832	20.1538	20.1831	20.1808	20.0735	19.5905	19.0068	18.5561	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9933	0.9816	0.9399	0.8305	0.6327	0.4435	0.5026	0.7959	0.9659	0.9936	0.9976	(94)
Useful gains	475.2978	544.7731	620.2959	680.9088	652.0706	489.7925	327.0548	342.2269	484.1325	503.0392	461.5860	450.3592	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1354.3546	1313.3273	1193.0076	999.3866	770.4117	511.1361	329.7665	347.2798	552.0079	836.1979	1112.4901	1347.7014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.0183	516.4684	426.0975	229.3040	88.0458	0.0000	0.0000	0.0000	0.0000	247.8701	468.6509	667.6226	(98)
Space heating												3298.0777	(98)
Space heating per m2											(98) / (4) =	39.1510	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3531.1324	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.0183	516.4684	426.0975	229.3040	88.0458	0.0000	0.0000	0.0000	0.0000	247.8701	468.6509	667.6226	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	700.2337	552.9641	456.2072	245.5075	94.2674	0.0000	0.0000	0.0000	0.0000	265.3855	501.7676	714.7994	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7647	87.5444	87.0455	85.8506	83.5935	80.3000	80.3000	80.3000	80.3000	85.9268	87.2720	87.8506	(217)
Fuel for water heating, kWh/month													
	233.6848	206.5624	216.2327	194.4568	193.3520	177.2782	169.8460	189.3385	191.4296	203.7066	214.0126	227.9202	(219)
Water heating fuel used												2417.8205	(219)
Annual totals kWh/year													
Space heating fuel - main system												3531.1324	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												375.4514	(232)
Total delivered energy for all uses												6399.4043	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3531.1324	0.2160	762.7246	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2417.8205	0.2160	522.2492	(264)
Space and water heating			1284.9738	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	375.4514	0.5190	194.8593	(268)
Total CO2, kg/m2/year			1518.7581	(272)
Emissions per m2 for space and water heating			15.2537	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3131	(272b)
Emissions per m2 for pumps and fans			0.4621	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2537 * 1.00) + 2.3131 + 0.4621, rounded to 2 d.p.			18.0300	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 183 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 183	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 183, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.49	**TER**	18.03
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	38.82	**TFEE**	51.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.36 m	42.12 m²	2.31 m
1st Storey:	18.36 m	42.12 m²	2.63 m

7.0 Living Area	15.32	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	196.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	90.60	75.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	45.89

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	42.12	42.12

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	42.12

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.55	0.065	No
Independently assessed	E3 Sill	7.72	0.004	No
Independently assessed	E4 Jamb	24.30	0.005	No
Independently assessed	E5 Ground floor (normal)	18.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	18.36	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.06	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.30	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.30	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.30	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.30	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£45	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 183 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 183	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 183, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.49	**TER**	18.03
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	38.82	**TFEE**	51.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	84.24	m^2	
DER	8.49	$kgCO_2/yr/m^2$	
TER	18.03	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.49	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.91	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	38.82	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	84.24	m^2	
DER	18.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.37	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.37	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.94	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.12	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.12	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 184 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 184	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 184, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.33	**TER**	17.87
Environmental	94 A	**% DER<TER**	53.38		
CO_2 Emissions (t/year)	0.36	**DFEE**	38.13	**TFEE**	50.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 84 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.87 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.33 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 5.27 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3923	0.3844	0.3452	0.3373	0.2981	0.2981	0.2903	0.3138	0.3373	0.3530	0.3687	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6501	0.6423	0.6344	0.5952	0.5873	0.5481	0.5481	0.5403	0.5638	0.5873	0.6030	0.6187	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3300	1.2357	16.4724			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			42.1200	0.1200	5.0544			(28a)
External Wall	90.6000	15.4700	75.1300	0.2100	15.7773			(29a)
Main Roof	42.1200		42.1200	0.0700	2.9484			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4625			(33)
Party Wall			45.8900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	196.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3600	(36)
Total fabric heat loss (33) + (36) =	47.8226	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6384	44.0997	43.5611	40.8677	40.3290	37.6357	37.6357	37.0970	38.7130	40.3290	41.4064	42.4837	(38)
Heat transfer coeff	92.4610	91.9223	91.3836	88.6903	88.1516	85.4582	85.4582	84.9195	86.5356	88.1516	89.2289	90.3063	(39)
Average = Sum(39)m / 12 =												88.5556	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0976	1.0912	1.0848	1.0528	1.0464	1.0145	1.0145	1.0081	1.0273	1.0464	1.0592	1.0720	(40)
HLP (average)												1.0512	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss  11.8011   10.6498   11.7590   11.3430   11.6945   11.2865   11.6436   11.6766   11.3173   11.7323   11.3959   11.7909 (61)
Total heat required for water heating calculated for each month
   165.9350  145.4563  150.8672  132.6209  128.0635  111.7042  104.6953  118.4548  119.3708  137.6582  148.8538  161.0614 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                          Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   165.9350  145.4563  150.8672  132.6209  128.0635  111.7042  104.6953  118.4548  119.3708  137.6582  148.8538  161.0614 (64)
                                                                            Total per year (kWh/year) = Sum(64)m =   1624.7415 (64)
Heat gains from water heating, kWh/month
    54.1998   47.4856   49.1932   43.1607   41.6163   36.2105   33.8506   38.4229   38.7571   44.8034   48.5537   52.5802 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m      126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
    21.2596   18.8826   15.3564   11.6258    8.6904    7.3368    7.9277   10.3047   13.8309   17.5615   20.4969   21.8505 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
   228.0736  230.4403  224.4763  211.7797  195.7525  180.6892  170.6260  168.2593  174.2233  186.9199  202.9471  218.0104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
    35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
  -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 (71)
Water heating gains (Table 5)
    72.8492   70.6631   66.1199   59.9454   55.9359   50.2924   45.4981   51.6437   53.8293   60.2197   67.4357   70.6722 (72)
Total internal gains
   386.2585  384.0621  370.0287  347.4269  324.4549  302.3944  288.1278  294.2837  305.9596  328.7772  354.9558  374.6092 (73)
```

---

6. Solar gains

```
[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                           m2          Table 6a    Specific data  Specific data      factor              W
                                                          W/m2    or Table 6b    or Table 6c    Table 6d
-----------------------------------------------------------------------------------------------------------------------------
East                                    5.2700           19.6403         0.7200         0.7000         0.7700      36.1511 (76)
South                                   0.9600           46.7521         0.7200         0.7000         0.7700      15.6760 (78)
West                                    7.1000           19.6403         0.7200         0.7000         0.7700      48.7045 (80)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains  100.5317  191.6689  306.0744  435.6573  527.1328  537.2527  512.4139  444.2177  352.1044  224.6589  124.3865   83.3267 (83)
Total gains  486.7902  575.7310  676.1031  783.0842  851.5877  839.6471  800.5417  738.5015  658.0640  553.4360  479.3423  457.9359 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          49.6036   49.8943   50.1884   51.7125   52.0286   53.6683   53.6683   54.0088   53.0002   52.0286   51.4004   50.7872
alpha         4.3069    4.3263    4.3459    4.4475    4.4686    4.5779    4.5779    4.6006    4.5333    4.4686    4.4267    4.3858
util living area
    0.9952    0.9896    0.9730    0.9189    0.8013    0.6163    0.4618    0.5153    0.7773    0.9556    0.9908    0.9963 (86)

MIT          19.5588   19.7603   20.0899   20.5142   20.8109   20.9591   20.9912   20.9860   20.8818   20.4664   19.9501   19.5489 (87)
Th 2         20.0028   20.0080   20.0133   20.0395   20.0448   20.0713   20.0713   20.0766   20.0607   20.0448   20.0343   20.0238 (88)
util rest of house
    0.9940    0.9869    0.9656    0.8973    0.7528    0.5393    0.3681    0.4181    0.7079    0.9395    0.9879    0.9954 (89)
MIT 2        18.0744   18.3711   18.8505   19.4654   19.8543   20.0413   20.0673   20.0696   19.9596   19.4148   18.6669   18.0741 (90)
Living area fraction                                                                  fLA = Living area / (4) =      0.1819 (91)
MIT          18.3444   18.6237   19.0759   19.6562   20.0283   20.2082   20.2353   20.2362   20.1273   19.6061   18.9003   18.3423 (92)
Temperature adjustment                                                                                               0.0000
adjusted MIT 18.3444   18.6237   19.0759   19.6562   20.0283   20.2082   20.2353   20.2362   20.1273   19.6061   18.9003   18.3423 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation   0.9908    0.9815    0.9564    0.8870    0.7519    0.5511    0.3849    0.4354    0.7134    0.9298    0.9830    0.9928 (94)
Useful gains 482.3188  565.0559  646.6205  694.5810  640.2940  462.7539  308.1571  321.5110  469.4640  514.6083  471.2116  454.6541 (95)
Ext temp.     4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
 1298.5567 1261.5171 1149.2327  953.9680  734.1535  479.2701  310.6648  325.7716  521.5786  793.8999 1052.9273 1277.1368 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
  607.2811  468.0219  373.9435  186.7587   69.8314    0.0000    0.0000    0.0000    0.0000  207.7930  418.8353  611.9271 (98)
Space heating                                                                                                       2944.3919 (98)
Space heating per m2                                                                                  (98) / (4) =     34.9524 (99)
```

8c. Space cooling requirement

```
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3155.8327	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.2811	468.0219	373.9435	186.7587	69.8314	0.0000	0.0000	0.0000	0.0000	207.7930	418.8353	611.9271	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	650.8907	501.6312	400.7969	200.1701	74.8461	0.0000	0.0000	0.0000	0.0000	222.7149	448.9124	655.8704	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5025	89.4197	89.2349	88.7694	87.9371	86.7000	86.7000	86.7000	86.7000	88.8302	89.3274	89.5255	(217)
Fuel for water heating, kWh/month													
	185.3972	162.6670	169.0676	149.3993	145.6309	128.8399	120.7558	136.6261	137.6826	154.9678	166.6384	179.9057	(219)
Water heating fuel used												1837.5782	(219)
Annual totals kWh/year													
Space heating fuel - main system												3155.8327	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												375.4514	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4267.2832	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3155.8327	0.2160	681.6599	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1837.5782	0.2160	396.9169	(264)
Space and water heating			1078.5768	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	375.4514	0.5190	194.8593	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			701.7165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.3300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.3300	ZC1
Total Floor Area	TFA	84.2400	
Assumed number of occupants	N	2.5384	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0436	ZC2
CO2 emissions from cooking, equation (L16)		2.1358	ZC3
Total CO2 emissions		26.5095	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5095	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3942	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3351	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4272	0.4188	0.4104	0.3686	0.3602	0.3183	0.3183	0.3099	0.3351	0.3602	0.3769	0.3937	(22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5710	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.3300	1.3258	17.6723			(27)
Ground floor			42.1200	0.1300	5.4756			(28a)
External Wall	90.6000	15.4700	75.1300	0.1800	13.5234			(29a)
Main Roof	42.1200		42.1200	0.1300	5.4756			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.7149			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.5082	(36)
Total fabric heat loss (33) + (36) =	54.2231	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5974	40.3541	40.1156	38.9955	38.7859	37.8104	37.8104	37.6297	38.1861	38.7859	39.2099	39.6531	(38)
Heat transfer coeff	94.8205	94.5772	94.3388	93.2187	93.0091	92.0335	92.0335	91.8529	92.4093	93.0091	93.4331	93.8763	(39)
Average = Sum(39)m / 12 =												93.2177	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1256	1.1227	1.1199	1.1066	1.1041	1.0925	1.0925	1.0904	1.0970	1.1041	1.1091	1.1144	(40)
HLP (average)												1.1066	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1126	45.6645	45.2606	41.9368	43.3347	45.2606	45.6645	49.1126	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
								Total per year (kWh/year) = Sum(64)m =				2049.2581	(64)
Heat gains from water heating, kWh/month													
	63.9892	56.3300	58.5316	51.7410	50.0079	43.8731	41.7734	46.8189	47.3439	54.1485	58.0335	62.3721	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.2596	18.8826	15.3564	11.6258	8.6904	7.3368	7.9277	10.3047	13.8309	17.5615	20.4969	21.8505	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)
Water heating gains (Table 5)													
	86.0071	83.8244	78.6716	71.8625	67.2149	60.9348	56.1470	62.9286	65.7554	72.7803	80.6021	83.8335	(72)
Total internal gains													
	399.4163	397.2234	382.5803	359.3441	335.7338	313.0369	298.7767	305.5687	317.8857	341.3377	368.1222	387.7705	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.2700	19.6403	0.6300	0.7000	0.7700	31.6322	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(80)

Solar gains	87.9652	167.7103	267.8151	381.2002	461.2412	470.0961	448.3621	388.6905	308.0913	196.5765	108.8381	72.9109	(83)
Total gains	487.3816	564.9337	650.3954	740.5442	796.9751	783.1329	747.1388	694.2592	625.9770	537.9143	476.9603	460.6813	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6955	61.8542	62.0106	62.7557	62.8971	63.5638	63.5638	63.6888	63.3053	62.8971	62.6117	62.3161	
alpha	5.1130	5.1236	5.1340	5.1837	5.1931	5.2376	5.2376	5.2459	5.2204	5.1931	5.1741	5.1544	
util living area													
	0.9983	0.9961	0.9883	0.9581	0.8708	0.7017	0.5317	0.5902	0.8469	0.9784	0.9964	0.9988	(86)
MIT	19.7716	19.9244	20.1872	20.5298	20.8078	20.9555	20.9914	20.9856	20.8790	20.5042	20.0751	19.7466	(87)
Th 2	19.9800	19.9823	19.9846	19.9955	19.9975	20.0070	20.0070	20.0087	20.0033	19.9975	19.9934	19.9891	(88)
util rest of house													
	0.9978	0.9947	0.9841	0.9425	0.8247	0.6125	0.4171	0.4722	0.7765	0.9675	0.9950	0.9983	(89)
MIT 2	18.3390	18.5637	18.9469	19.4418	19.8090	19.9774	20.0038	20.0027	19.9053	19.4152	18.7923	18.3089	(90)
Living area fraction										fLA = Living area / (4) =		0.1819	(91)
MIT	18.5995	18.8111	19.1724	19.6397	19.9907	20.1552	20.1834	20.1815	20.0823	19.6132	19.0256	18.5703	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5995	18.8111	19.1724	19.6397	19.9907	20.1552	20.1834	20.1815	20.0823	19.6132	19.0256	18.5703	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9925	0.9795	0.9355	0.8244	0.6267	0.4380	0.4936	0.7829	0.9618	0.9929	0.9974	(94)
Useful gains	485.7095	560.6713	637.0506	692.7490	657.0146	490.8160	327.2322	342.6892	490.1029	517.3516	473.5602	459.4863	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1355.8895	1315.6774	1195.5024	1001.1387	771.1084	511.2680	329.7895	347.3391	552.8246	838.3122	1114.2421	1349.0347	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	647.4139	507.3641	415.4882	222.0406	84.8858	0.0000	0.0000	0.0000	0.0000	238.7946	461.2910	661.8240	(98)
Space heating												3239.1022	(98)
Space heating per m2											(98) / (4) =	38.4509	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3467.9895	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	647.4139	507.3641	415.4882	222.0406	84.8858	0.0000	0.0000	0.0000	0.0000	238.7946	461.2910	661.8240	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	693.1626	543.2164	444.8481	237.7308	90.8842	0.0000	0.0000	0.0000	0.0000	255.6688	493.8876	708.5910	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7449	87.5079	86.9888	85.7700	83.5129	80.3000	80.3000	80.3000	80.3000	85.8336	87.2377	87.8340	(217)
Fuel for water heating, kWh/month													
	233.7376	206.6487	216.3737	194.6395	193.5386	177.2782	169.8460	189.3385	191.4296	203.9277	214.0967	227.9635	(219)
Water heating fuel used												2418.8183	(219)
Annual totals kWh/year													
Space heating fuel - main system												3467.9895	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												375.4514	(232)
Total delivered energy for all uses												6337.2592	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3467.9895	0.2160	749.0857	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2418.8183	0.2160	522.4648	(264)
Space and water heating			1271.5505	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	375.4514	0.5190	194.8593	(268)
Total CO2, kg/m2/year			1505.3348	(272)
Emissions per m2 for space and water heating			15.0944	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3131	(272b)
Emissions per m2 for pumps and fans			0.4621	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0944 * 1.00) + 2.3131 + 0.4621, rounded to 2 d.p.			17.8700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 184 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 184	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 184, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.33	**TER**	17.87
Environmental	94 A	**% DER<TER**	53.38		
CO_2 Emissions (t/year)	0.36	**DFEE**	38.13	**TFEE**	50.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.36 m	42.12 m²	2.31 m
1st Storey:	18.36 m	42.12 m²	2.63 m

7.0 Living Area	15.32	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	196.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	90.60	75.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	45.89

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	42.12	42.12

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	42.12

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
D2 W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.55	0.065	No
Independently assessed	E3 Sill	7.72	0.004	No
Independently assessed	E4 Jamb	24.30	0.005	No
Independently assessed	E5 Ground floor (normal)	18.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	18.36	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.06	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.30	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.30	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.30	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.30	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£45	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 184 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 184	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 184, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.33	**TER**	17.87
Environmental	94 A	**% DER<TER**	53.38		
CO_2 Emissions (t/year)	0.36	**DFEE**	38.13	**TFEE**	50.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	84.24	m^2	
DER	8.33	$kgCO_2/yr/m^2$	
TER	17.87	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.33	$kgCO_2/yr/m^2$	
Reduction DER/TER	53.38	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	38.13	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	84.24	m^2	
DER	18.02	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.20	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.20	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.77	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.95	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 185 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 185	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 185, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.82
Environmental	95 A	**% DER<TER**	59.94		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.58	**TFEE**	59.06
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 5.74 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 6.92 m², No overhang
Windows facing South: 5.07 m², No overhang
Windows facing West: 1.41 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2160	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4410	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4780	0.4686	0.4592	0.4124	0.4030	0.3561	0.3561	0.3468	0.3749	0.4030	0.4217	0.4405	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7280	0.7186	0.7092	0.6624	0.6530	0.6061	0.6061	0.5968	0.6249	0.6530	0.6717	0.6905	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2200	1.2357	26.2224			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			47.5100	0.1200	5.7012			(28a)
External Wall	138.2700	25.5000	112.7700	0.2100	23.6817			(29a)
Main Roof	46.2700		46.2700	0.0700	3.2389			(30)
Bay roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.4626			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3203	(36)
Total fabric heat loss					(33) + (36) =		70.7830	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5990	54.8832	54.1674	50.5885	49.8727	46.2937	46.2937	45.5779	47.7253	49.8727	51.3043	52.7358	(38)
Heat transfer coeff	126.3820	125.6662	124.9504	121.3714	120.6556	117.0767	117.0767	116.3609	118.5083	120.6556	122.0872	123.5188	(39)
Average = Sum(39)m / 12 =												121.1925	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3476	1.3400	1.3324	1.2942	1.2866	1.2484	1.2484	1.2408	1.2637	1.2866	1.3018	1.3171	(40)
HLP (average)												1.2923	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6740 (42)
Average daily hot water use (litres/day) 97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8122   10.6595   11.7785   11.3594   11.7095   11.2990   11.6551   11.6904   11.3319   11.7500   11.4057   11.8016 (61)
Total heat required for water heating calculated for each month
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              171.1996  150.0607  155.6281  136.7710  132.0449  115.1393  107.8784  122.1080  123.0683  141.9679  153.5488  166.1598 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1675.5748 (64)
Heat gains from water heating, kWh/month
               55.9494   49.0158   50.7746   44.5392   42.9389   37.3516   34.9080   39.6365   39.9853   46.2350   50.1140   54.2745 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004  133.7004 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9147   19.4644   15.8296   11.9840    8.9582    7.5629    8.1719   10.6222   14.2571   18.1027   21.1285   22.5238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              245.8627  248.4140  241.9848  228.2979  211.0207  194.7825  183.9343  181.3831  187.8122  201.4991  218.7764  235.0146 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700   36.3700 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 -106.9603 (71)
Water heating gains (Table 5)
               75.2007   72.9402   68.2455   61.8600   57.7136   51.8773   46.9194   53.2748   55.5352   62.1438   69.6028   72.9496 (72)
Total internal gains
              409.0883  406.9287  392.1700  368.2520  343.8025  320.3327  305.1358  311.3902  323.7146  347.8557  375.6178  396.5981 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
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North                                    5.7400           10.6334           0.7200           0.7000           0.7700           21.3180 (74)
Northeast                                1.0400           11.2829           0.7200           0.7000           0.7700            4.0984 (75)
East                                     6.9200           19.6403           0.7200           0.7000           0.7700           47.4698 (76)
South                                    5.0700           46.7521           0.7200           0.7000           0.7700           82.7890 (78)
West                                     1.4100           19.6403           0.7200           0.7000           0.7700            9.6723 (80)
Northwest                                1.0400           11.2829           0.7200           0.7000           0.7700            4.0984 (81)
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Solar gains   169.4460  304.7940  456.0910  624.2524  748.6039  763.6907  727.8383  632.7422  514.3864  347.7681  205.9950  142.9939 (83)
Total gains   578.5343  711.7227  848.2610  992.5044 1092.4065 1084.0235 1032.9741  944.1324  838.1010  695.6237  581.6128  539.5920 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           44.7283   44.9831   45.2408   46.5748   46.8511   48.2833   48.2833   48.5803   47.7001   46.8511   46.3017   45.7651
alpha          3.9819    3.9989    4.0161    4.1050    4.1234    4.2189    4.2189    4.2387    4.1800    4.1234    4.0868    4.0510
util living area
               0.9958    0.9900    0.9742    0.9249    0.8155    0.6386    0.4851    0.5436    0.7969    0.9589    0.9917    0.9968 (86)

MIT           19.3506   19.5805   19.9376   20.4019   20.7484   20.9375   20.9846   20.9758   20.8362   20.3605   19.7850   19.3377 (87)
Th 2          19.8037   19.8096   19.8156   19.8454   19.8514   19.8815   19.8815   19.8875   19.8694   19.8514   19.8394   19.8275 (88)
util rest of house
               0.9945    0.9870    0.9661    0.9013    0.7604    0.5462    0.3683    0.4229    0.7173    0.9412    0.9887    0.9959 (89)
MIT 2         17.6247   17.9630   18.4823   19.1550   19.6079   19.8393   19.8755   19.8770   19.7373   19.1160   18.2821   17.6213 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1913 (91)
MIT           17.9549   18.2724   18.7607   19.3936   19.8260   20.0494   20.0876   20.0872   19.9475   19.3540   18.5696   17.9496 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  17.9549   18.2724   18.7607   19.3936   19.8260   20.0494   20.0876   20.0872   19.9475   19.3540   18.5696   17.9496 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9914    0.9812    0.9562    0.8899    0.7591    0.5609    0.3905    0.4455    0.7236    0.9309    0.9837    0.9934 (94)
Useful gains  573.5581  698.3257  811.0968  883.2042  829.1915  608.0670  403.3606  420.6417  606.4741  647.5278  572.1268  536.0429 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1725.7282 1680.4582 1531.9818 1273.6173  980.4528  637.9941  408.3197  429.0461  692.9806 1056.2245 1400.2909 1698.3384 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              857.2145  659.9930  536.3385  281.0975  112.5384    0.0000    0.0000    0.0000    0.0000  304.0703  596.2781  864.7479 (98)
Space heating                                                                                                               4212.2782 (98)
Space heating per m2                                                                                        (98) / (4) =     44.9166 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4514.7676	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	857.2145	659.9930	536.3385	281.0975	112.5384	0.0000	0.0000	0.0000	0.0000	304.0703	596.2781	864.7479	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	918.7723	707.3880	574.8537	301.2835	120.6199	0.0000	0.0000	0.0000	0.0000	325.9060	639.0976	926.8466	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.1996	150.0607	155.6281	136.7710	132.0449	115.1393	107.8784	122.1080	123.0683	141.9679	153.5488	166.1598	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6801	89.6107	89.4645	89.0892	88.3201	86.7000	86.7000	86.7000	86.7000	89.1222	89.5387	89.6997	(217)
Fuel for water heating, kWh/month													
	190.9003	167.4584	173.9551	153.5213	149.5072	132.8019	124.4273	140.8397	141.9472	159.2959	171.4888	185.2401	(219)
Water heating fuel used												1891.3833	(219)
Annual totals kWh/year													
Space heating fuel - main system												4514.7676	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.0205	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =											-1764.8686	-1764.8686	(233)
Total delivered energy for all uses												5103.3028	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4514.7676	0.2160	975.1898	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1891.3833	0.2160	408.5388	(264)
Space and water heating			1383.7286	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.0205	0.5190	200.8636	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			707.5504	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5400	ZC1
Total Floor Area	TFA	93.7800	
Assumed number of occupants	N	2.6740	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5356	ZC2
CO2 emissions from cooking, equation (L16)		1.9533	ZC3
Total CO2 emissions		25.0289	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.0289	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.5100	(1b)	x 2.3100	(2b) =	109.7481	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		231.4382	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1296	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3796	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3227	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4114	0.4034	0.3953	0.3549	0.3469	0.3065	0.3065	0.2985	0.3227	0.3469	0.3630	0.3791	(22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5602	0.5470	0.5470	0.5445	0.5521	0.5602	0.5659	0.5719	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.1500	1.3258	25.3883			(27)
Ground floor			47.5100	0.1300	6.1763			(28a)
External Wall	138.2700	23.4300	114.8400	0.1800	20.6712			(29a)
Main Roof	46.2700		46.2700	0.1300	6.0151			(30)
Bay roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			233.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.5481			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0900	(36)
Total fabric heat loss (33) + (36) =	75.6381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6511	44.4001	44.1540	42.9985	42.7823	41.7758	41.7758	41.5894	42.1635	42.7823	43.2196	43.6769	(38)
Heat transfer coeff	120.2891	120.0381	119.7921	118.6365	118.4203	117.4139	117.4139	117.2275	117.8015	118.4203	118.8577	119.3150	(39)
Average = Sum(39)m / 12 =												118.6355	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2827	1.2800	1.2774	1.2651	1.2627	1.2520	1.2520	1.2500	1.2561	1.2627	1.2674	1.2723	(40)
HLP (average)												1.2650	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6740 (42)
Average daily hot water use (litres/day)	97.7077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.4784	103.5701	99.6618	95.7535	91.8452	87.9369	87.9369	91.8452	95.7535	99.6618	103.5701	107.4784	(44)
Energy conte	159.3874	139.4013	143.8496	125.4116	120.3354	103.8403	96.2233	110.4176	111.7364	130.2180	142.1431	154.3582	(45)
Energy content (annual)										Total = Sum(45)m =		1537.3221	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9081	20.9102	21.5774	18.8117	18.0503	15.5760	14.4335	16.5626	16.7605	19.5327	21.3215	23.1537	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7866	47.2209	46.8033	43.3661	44.8117	46.8033	47.2209	50.7866	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171 (64)
								Total per year (kWh/year) = Sum(64)m =				2112.3818 (64)
Heat gains from water heating, kWh/month												
	65.7360	57.8578	60.5266	53.5046	51.7123	45.3684	43.1972	48.4147	48.9576	55.9941	59.5913	64.0638 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	133.7004	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0285	19.5656	15.9118	12.0462	9.0047	7.6022	8.2144	10.6774	14.3312	18.1967	21.2382	22.6408	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	245.8627	248.4140	241.9848	228.2979	211.0207	194.7825	183.9343	181.3831	187.8122	201.4991	218.7764	235.0146	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	36.3700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	-106.9603	(71)
Water heating gains (Table 5)													
	88.3549	86.0979	81.3530	74.3119	69.5058	63.0117	58.0607	65.0735	67.9966	75.2609	82.7658	86.1073	(72)
Total internal gains													
	422.3563	420.1875	405.3597	380.7662	355.6413	331.5064	316.3196	323.2441	336.2501	361.0668	388.8905	409.8728	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.1800	10.6334	0.6300	0.7000	0.7700	16.8335	(74)
Northeast	0.9400	11.2829	0.6300	0.7000	0.7700	3.2413	(75)
East	6.2500	19.6403	0.6300	0.7000	0.7700	37.5145	(76)
South	4.5700	46.7521	0.6300	0.7000	0.7700	65.2963	(78)
West	1.2700	19.6403	0.6300	0.7000	0.7700	7.6229	(80)
Northwest	0.9400	11.2829	0.6300	0.7000	0.7700	3.2413	(81)

Solar gains	133.7499	240.6022	360.0740	492.8867	591.1093	603.0370	574.7207	499.6055	406.1155	274.5366	162.6026	112.8681 (83)
Total gains	556.1061	660.7897	765.4337	873.6529	946.7506	934.5435	891.0403	822.8495	742.3656	635.6034	551.4931	522.7409 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1404	54.2536	54.3650	54.8946	54.9948	55.4662	55.4662	55.5544	55.2837	54.9948	54.7924	54.5824	
alpha	4.6094	4.6169	4.6243	4.6596	4.6663	4.6977	4.6977	4.7036	4.6856	4.6663	4.6528	4.6388	
util living area													
	0.9981	0.9953	0.9872	0.9588	0.8796	0.7246	0.5601	0.6213	0.8593	0.9774	0.9960	0.9986	(86)
MIT	19.5784	19.7528	20.0395	20.4136	20.7365	20.9269	20.9827	20.9725	20.8281	20.4011	19.9187	19.5477	(87)
Th 2	19.8544	19.8565	19.8586	19.8683	19.8701	19.8786	19.8786	19.8802	19.8753	19.8701	19.8665	19.8626	(88)
util rest of house													
	0.9974	0.9937	0.9825	0.9426	0.8323	0.6273	0.4272	0.4864	0.7864	0.9656	0.9942	0.9980	(89)
MIT 2	17.9692	18.2249	18.6427	19.1820	19.6121	19.8303	19.8725	19.8691	19.7364	19.1744	18.4748	17.9298	(90)
Living area fraction									fLA = Living area / (4) =			0.1913	(91)
MIT	18.2770	18.5172	18.9099	19.4176	19.8272	20.0401	20.0849	20.0801	19.9452	19.4091	18.7510	18.2393	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2770	18.5172	18.9099	19.4176	19.8272	20.0401	20.0849	20.0801	19.9452	19.4091	18.7510	18.2393	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9908	0.9769	0.9343	0.8302	0.6426	0.4527	0.5120	0.7918	0.9588	0.9917	0.9969	(94)
Useful gains	553.8316	654.7394	747.7685	816.2535	786.0044	600.5420	403.3847	421.3145	587.7798	609.4205	546.8914	521.1179	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1681.2827	1634.5842	1486.6058	1247.7735	962.4284	638.7414	409.1698	431.4134	688.5768	1043.1739	1384.8126	1675.1005	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	838.8236	658.4557	549.6949	310.6944	131.2594	0.0000	0.0000	0.0000	0.0000	322.7126	603.3032	858.5631	(98)
Space heating												4273.5070	(98)
Space heating per m2											(98) / (4) =	45.5695	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4575.4893	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	838.8236	658.4557	549.6949	310.6944	131.2594	0.0000	0.0000	0.0000	0.0000	322.7126	603.3032	858.5631	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	898.0981	704.9847	588.5385	332.6492	140.5347	0.0000	0.0000	0.0000	0.0000	345.5167	645.9349	919.2325	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3463	185.4287	194.6362	172.6325	167.1387	147.2064	141.0350	157.2210	158.9573	181.0045	191.4582	205.3171	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1764	87.9688	87.5214	86.5134	84.4504	80.3000	80.3000	80.3000	80.3000	86.4909	87.7414	88.2576	(217)
Fuel for water heating, kWh/month													
	238.5516	210.7892	222.3869	199.5442	197.9135	183.3206	175.6351	195.7920	197.9543	209.2759	218.2073	232.6338	(219)
Water heating fuel used												2482.0043	(219)
Annual totals kWh/year													
Space heating fuel - main system												4575.4893	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												389.0310	(232)
Total delivered energy for all uses												7521.5245	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4575.4893	0.2160	988.3057	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2482.0043	0.2160	536.1129	(264)
Space and water heating			1524.4186	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.0310	0.5190	201.9071	(268)
Total CO2, kg/m2/year			1765.2507	(272)
Emissions per m2 for space and water heating			16.2553	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1530	(272b)
Emissions per m2 for pumps and fans			0.4151	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2553 * 1.00) + 2.1530 + 0.4151, rounded to 2 d.p.			18.8200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 185 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 185	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 185, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.82
Environmental	95 A	**% DER<TER**	59.94		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.58	**TFEE**	59.06
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.33 m	47.51 m²	2.31 m
1st Storey:	27.74 m	46.27 m²	2.63 m

7.0 Living Area	17.94	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	138.27	112.77

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.27	46.27
Bay roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	47.51

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.25	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100
D1	Half Glazed Door	[1] External Wall	East							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.20	100
D2 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	West							2.14	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.20	100

W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.19	0.065	No
Independently assessed	E3 Sill	14.56	0.004	No
Independently assessed	E4 Jamb	44.55	0.005	No
Independently assessed	E5 Ground floor (normal)	28.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	27.74	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.57	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.17	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.023	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 185 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 185	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 185, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.54	**TER**	18.82
Environmental	95 A	**% DER<TER**	59.94		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.58	**TFEE**	59.06
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.78	m^2	
DER	7.54	$kgCO_2/yr/m^2$	
TER	18.82	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.54	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.94	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.58	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.78	m^2	
DER	19.84	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.33	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.33	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.07	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.54	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.56	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.56	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 186 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 186	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 186, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.04	**TER**	17.63
Environmental	94 A	**% DER<TER**	54.41		
CO_2 Emissions (t/year)	0.43	**DFEE**	43.39	**TFEE**	56.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 113 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.63 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.04 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.65 m², No overhang
Windows facing East: 0.72 m², No overhang
Windows facing South: 6.98 m², No overhang
Windows facing West: 0.48 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1797	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4047	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3440	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4386	0.4300	0.4214	0.3784	0.3698	0.3268	0.3268	0.3182	0.3440	0.3698	0.3870	0.4042	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6886	0.6800	0.6714	0.6284	0.6198	0.5768	0.5768	0.5682	0.5940	0.6198	0.6370	0.6542	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.8300	1.2357	20.7975			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			56.3100	0.1200	6.7572			(28a)
External Wall	148.5900	21.1100	127.4800	0.2100	26.7708			(29a)
Main Roof	56.3100		56.3100	0.0700	3.9417			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.6872			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4210	(36)
Total fabric heat loss (33) + (36) =	70.1082	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.2150	62.4255	61.6360	57.6883	56.8988	52.9512	52.9512	52.1617	54.5302	56.8988	58.4779	60.0569	(38)
Heat transfer coeff	133.3232	132.5337	131.7442	127.7966	127.0070	123.0594	123.0594	122.2699	124.6384	127.0070	128.5861	130.1651	(39)
Average = Sum(39)m / 12 =												127.5992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1838	1.1768	1.1698	1.1348	1.1277	1.0927	1.0927	1.0857	1.1067	1.1277	1.1418	1.1558	(40)
HLP (average)												1.1330	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8248 10.6705 11.7910 11.3788 11.7274 11.3137 11.6688 11.7068 11.3492 11.7612 11.4170 11.8139 (61)
Total heat required for water heating calculated for each month
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
177.2431 155.3464 161.0835 141.5357 136.6160 119.0831 111.5330 126.3024 127.3134 146.9063 158.9384 172.0126 (64)
Total per year (kWh/year) = Sum(64)m = 1733.9139 (64)
Heat gains from water heating, kWh/month
57.9578 50.7724 52.5875 46.1219 44.4573 38.6617 36.1220 41.0297 41.3954 47.8761 51.9051 56.2195 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.9618	23.0591	18.7529	14.1971	10.6125	8.9595	9.6811	12.5839	16.8900	21.4458	25.0304	26.6834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.2678	278.1242	270.9261	255.6022	236.2586	218.0783	205.9328	203.0764	210.2745	225.5983	244.9419	263.1222	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	(71)
Water heating gains (Table 5)													
	77.9002	75.5541	70.6821	64.0581	59.7545	53.6969	48.5511	55.1475	57.4936	64.3495	72.0905	75.5639	(72)
Total internal gains													
	447.5749	445.1824	428.8062	402.3026	375.0707	349.1798	332.6101	339.2528	353.1032	379.8387	410.5079	433.8146	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.6500	10.6334	0.7200	0.7000	0.7700	32.1256	(74)
East	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(76)
South	6.9800	46.7521	0.7200	0.7000	0.7700	113.9777	(78)
West	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(80)

Solar gains	154.3351	264.1629	368.6219	474.9890	553.1778	559.6811	535.1327	474.4007	404.6620	293.5258	184.9976	132.0382	(83)
Total gains	601.9100	709.3454	797.4281	877.2915	928.2485	908.8609	867.7428	813.6535	757.7652	673.3645	595.5055	565.8527	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.2246	46.5000	46.7787	48.2237	48.5234	50.0800	50.0800	50.4034	49.4456	48.5234	47.9276	47.3461	
alpha	4.0816	4.1000	4.1186	4.2149	4.2349	4.3387	4.3387	4.3602	4.2964	4.2349	4.1952	4.1564	
util living area													
	0.9965	0.9927	0.9839	0.9581	0.8923	0.7503	0.5910	0.6418	0.8587	0.9709	0.9933	0.9973	(86)
MIT	19.3823	19.5761	19.8771	20.2906	20.6448	20.8928	20.9710	20.9591	20.7883	20.3284	19.7999	19.3767	(87)
Th 2	19.9330	19.9386	19.9442	19.9725	19.9782	20.0068	20.0068	20.0125	19.9954	19.9782	19.9669	19.9555	(88)
util rest of house													
	0.9955	0.9906	0.9791	0.9448	0.8557	0.6696	0.4723	0.5249	0.7985	0.9591	0.9912	0.9966	(89)
MIT 2	17.7700	18.0562	18.4972	19.1095	19.5992	19.9224	19.9928	19.9908	19.8032	19.1742	18.4024	17.7765	(90)
Living area fraction									fLA = Living area / (4) =			0.2606	(91)
MIT	18.1902	18.4523	18.8568	19.4173	19.8717	20.1753	20.2477	20.2431	20.0599	19.4750	18.7666	18.1935	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1902	18.4523	18.8568	19.4173	19.8717	20.1753	20.2477	20.2431	20.0599	19.4750	18.7666	18.1935	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9865	0.9723	0.9355	0.8512	0.6846	0.5026	0.5540	0.8030	0.9513	0.9874	0.9946	(94)
Useful gains	597.7597	699.7467	775.3348	820.7231	790.1539	622.2013	436.0953	450.7689	608.5111	640.5622	587.9980	562.8196	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1851.8830	1796.1364	1627.9406	1344.0789	1037.8622	686.0912	448.8865	469.8982	742.8362	1127.1901	1500.1662	1821.4713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	933.0677	736.7738	634.3387	376.8162	184.2950	0.0000	0.0000	0.0000	0.0000	362.0512	656.7611	936.4369	(98)
Space heating												4820.5406	(98)
Space heating per m2											(98) / (4) =	42.8036	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5166.7102	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	933.0677	736.7738	634.3387	376.8162	184.2950	0.0000	0.0000	0.0000	0.0000	362.0512	656.7611	936.4369	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1000.0726	789.6826	679.8914	403.8759	197.5295	0.0000	0.0000	0.0000	0.0000	388.0506	703.9240	1003.6837	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2431	155.3464	161.0835	141.5357	136.6160	119.0831	111.5330	126.3024	127.3134	146.9063	158.9384	172.0126	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7054	89.6518	89.5470	89.2877	88.7315	86.7000	86.7000	86.7000	86.7000	89.2306	89.5753	89.7219	(217)
Fuel for water heating, kWh/month													
	197.5835	173.2775	179.8870	158.5164	153.9656	137.3507	128.6424	145.6775	146.8436	164.6368	177.4356	191.7176	(219)
Water heating fuel used												1955.5344	(219)
Annual totals kWh/year													
Space heating fuel - main system												5166.7102	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1080 * 1.00) =										-1753.1480		-1753.1480	(233)
Total delivered energy for all uses												5902.5907	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5166.7102	0.2160	1116.0094	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1955.5344	0.2160	422.3954	(264)
Space and water heating			1538.4048	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Energy saving/generation technologies				
PV Unit	-1753.1480	0.5190	-909.8838	(269)
Total CO2, kg/year			905.4045	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.0400	ZC1
Total Floor Area	TFA	112.6200	
Assumed number of occupants	N	2.8297	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4839	ZC2
CO2 emissions from cooking, equation (L16)		1.6597	ZC3
Total CO2 emissions		24.1836	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1836	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	56.3100 (1b)	x	2.3100 (2b)	=	130.0761	(1b) - (3b)
First floor	56.3100 (1c)	x	2.6300 (2c)	=	148.0953	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	278.1714	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1438	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3938	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4268	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3766	0.3933	(22b)
Effective ac	0.5911	0.5875	0.5841	0.5678	0.5647	0.5506	0.5506	0.5479	0.5560	0.5647	0.5709	0.5773	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			16.8300	1.3258	22.3125			(27)
Ground floor			56.3100	0.1300	7.3203			(28a)
External Wall	148.5900	21.1100	127.4800	0.1800	22.9464			(29a)
Main Roof	56.3100		56.3100	0.1300	7.3203			(30)
Total net area of external elements Aum(A, m2)			261.2100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.0355			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6013	(36)
Total fabric heat loss (33) + (36) =	76.6368	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2581	53.9335	53.6153	52.1208	51.8411	50.5394	50.5394	50.2984	51.0408	51.8411	52.4068	52.9982	(38)
Heat transfer coeff	130.8949	130.5703	130.2521	128.7576	128.4779	127.1762	127.1762	126.9352	127.6776	128.4779	129.0436	129.6350	(39)
Average = Sum(39)m / 12 =												128.7562	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1623	1.1594	1.1566	1.1433	1.1408	1.1293	1.1293	1.1271	1.1337	1.1408	1.1458	1.1511	(40)
HLP (average)												1.1433	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8297 (42)
Average daily hot water use (litres/day)	101.4047 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5452	107.4890	103.4328	99.3766	95.3204	91.2642	91.2642	95.3204	99.3766	103.4328	107.4890	111.5452	(44)
Energy conte	165.4182	144.6759	149.2925	130.1568	124.8886	107.7694	99.8641	114.5956	115.9642	135.1451	147.5214	160.1987	(45)
Energy content (annual)										Total = Sum(45)m =		1595.4906	(45)
Distribution loss (46)m = 0.15 x (45)m	24.8127	21.7014	22.3939	19.5235	18.7333	16.1654	14.9796	17.1893	17.3946	20.2718	22.1282	24.0298	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.0076	48.5742	45.0070	46.5072	48.5742	49.0076	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
								Total per year (kWh/year) = Sum(64)m =				2181.3467	(64)
Heat gains from water heating, kWh/month													
	67.7413	59.6116	62.3795	55.5291	53.6690	47.0851	44.8316	50.2466	50.8100	57.6755	61.3796	66.0058	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	141.4836	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.9618	23.0591	18.7529	14.1971	10.6125	8.9595	9.6811	12.5839	16.8900	21.4458	25.0304	26.6834	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.2678	278.1242	270.9261	255.6022	236.2586	218.0783	205.9328	203.0764	210.2745	225.5983	244.9419	263.1222	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	37.1484	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	-113.1868	(71)
Water heating gains (Table 5)													
	91.0501	88.7077	83.8434	77.1237	72.1358	65.3959	60.2576	67.5357	70.5695	77.5208	85.2495	88.7175	(72)
Total internal gains													
	460.7248	458.3360	441.9675	415.3681	387.4520	360.8789	344.3166	351.6410	366.1790	393.0100	423.6669	446.9682	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.6500	10.6334	0.6300	0.7000	0.7700	28.1099	(74)
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(76)
South	6.9800	46.7521	0.6300	0.7000	0.7700	99.7305	(78)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(80)

Solar gains	135.0432	231.1426	322.5442	415.6153	484.0306	489.7209	468.2411	415.1006	354.0793	256.8351	161.8729	115.5334	(83)
Total gains	595.7680	689.4786	764.5117	830.9835	871.4826	850.5998	812.5577	766.7416	720.2583	649.8451	585.5398	562.5016	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7489	59.8975	60.0438	60.7408	60.8730	61.4960	61.4960	61.6128	61.2545	60.8730	60.6061	60.3296	
alpha	4.9833	4.9932	5.0029	5.0494	5.0582	5.0997	5.0997	5.1075	5.0836	5.0582	5.0404	5.0220	
util living area													
	0.9989	0.9974	0.9935	0.9800	0.9356	0.8171	0.6530	0.7058	0.9072	0.9864	0.9976	0.9992	(86)
MIT	19.6763	19.8225	20.0595	20.3792	20.6830	20.9005	20.9757	20.9642	20.8097	20.4193	19.9906	19.6528	(87)
Th 2	19.9503	19.9526	19.9549	19.9656	19.9676	19.9770	19.9770	19.9788	19.9734	19.9676	19.9636	19.9593	(88)
util rest of house													
	0.9985	0.9965	0.9911	0.9715	0.9055	0.7335	0.5187	0.5751	0.8520	0.9791	0.9966	0.9989	(89)
MIT 2	18.1787	18.3939	18.7412	19.2105	19.6336	19.9036	19.9672	19.9624	19.8065	19.2736	18.6479	18.1507	(90)
Living area fraction									fLA = Living area / (4) =			0.2606	(91)
MIT	18.5690	18.7662	19.0848	19.5151	19.9071	20.1634	20.2300	20.2235	20.0679	19.5722	18.9978	18.5422	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5690	18.7662	19.0848	19.5151	19.9071	20.1634	20.2300	20.2235	20.0679	19.5722	18.9978	18.5422	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9881	0.9666	0.9034	0.7507	0.5540	0.6090	0.8582	0.9752	0.9952	0.9983	(94)
Useful gains	594.4009	686.0261	755.4359	803.2090	787.2629	638.5856	450.1336	466.9802	618.1384	633.7323	582.7207	561.5322	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1867.7437	1810.5156	1639.1974	1366.7736	1054.4286	707.5326	461.6551	485.3364	761.9732	1152.7324	1535.3320	1859.2455	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	947.3671	755.6569	657.5186	405.7665	198.7713	0.0000	0.0000	0.0000	0.0000	386.1361	685.8802	965.4987	(98)
Space heating												5002.5953	(98)
Space heating per m2											(98) / (4) =	44.4201	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5356.0978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	947.3671	755.6569	657.5186	405.7665	198.7713	0.0000	0.0000	0.0000	0.0000	386.1361	685.8802	965.4987	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1014.3116	809.0545	703.9814	434.4395	212.8172	0.0000	0.0000	0.0000	0.0000	413.4219	734.3471	1033.7245	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3772	190.7033	200.2514	179.1645	173.4628	152.7764	146.3714	163.1698	164.9718	186.1040	196.8365	211.1576	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3342	88.1654	87.8212	87.0465	85.3947	80.3000	80.3000	80.3000	80.3000	86.8474	87.9337	88.4046	(217)
Fuel for water heating, kWh/month													
	244.9529	216.3018	228.0216	205.8263	203.1306	190.2570	182.2807	203.2003	205.4444	214.2884	223.8465	238.8538	(219)
Water heating fuel used												2556.4041	(219)
Annual totals kWh/year													
Space heating fuel - main system												5356.0978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												458.4941	(232)
Total delivered energy for all uses												8445.9960	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5356.0978	0.2160	1156.9171	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2556.4041	0.2160	552.1833	(264)
Space and water heating			1709.1004	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.4941	0.5190	237.9584	(268)
Total CO2, kg/m2/year			1985.9838	(272)
Emissions per m2 for space and water heating			15.1758	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1129	(272b)
Emissions per m2 for pumps and fans			0.3456	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1758 * 1.00) + 2.1129 + 0.3456, rounded to 2 d.p.			17.6300	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 186 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 186	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 186, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.04	**TER**	17.63
Environmental	94 A	**% DER<TER**	54.41		
CO_2 Emissions (t/year)	0.43	**DFEE**	43.39	**TFEE**	56.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	30.11 m	56.31 m²	2.31 m
1st Storey:	30.11 m	56.31 m²	2.63 m

7.0 Living Area	29.35	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	148.59	127.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	56.31	56.31

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	56.31

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	North							2.14	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	15.11	0.065	No
Independently assessed	E3 Sill	11.25	0.004	No
Independently assessed	E4 Jamb	37.65	0.005	No
Independently assessed	E5 Ground floor (normal)	30.11	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	30.11	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.24	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.87	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 186 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 186	**Prop Type Ref**	As
Property	L458-R - Det SG, Plot 186, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.04	**TER**	17.63
Environmental	94 A	**% DER<TER**	54.41		
CO_2 Emissions (t/year)	0.43	**DFEE**	43.39	**TFEE**	56.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	112.62	m^2	
DER	8.04	$kgCO_2/yr/m^2$	
TER	17.63	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.04	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.41	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	43.39	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	112.62	m^2	
DER	18.24	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.38	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.38	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.48	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.66	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.30	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.30	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 187 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 187	**Prop Type Ref**	Opp
Property	Type 3S - End SG, Plot 187, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.72 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.9 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.47 m², No overhang
Windows facing South: 7.88 m², No overhang
Windows facing West: 4.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1692.5948 (64)
Heat gains from water heating, kWh/month
               56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)
```

---

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
               75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
              418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
East                                     7.4700           19.6403           0.7200           0.7000           0.7700           51.2427 (76)
South                                    7.8800           46.7521           0.7200           0.7000           0.7700          128.6740 (78)
West                                     4.5500           19.6403           0.7200           0.7000           0.7700           31.2121 (80)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   211.1287  372.0338  534.0752  690.8089  790.9469  790.2901  760.0009  686.1702  589.3621  418.6921  255.3339  178.9929 (83)
Total gains   629.4998  788.2090  935.1302 1067.3506 1142.3927 1117.6873 1071.8560 1004.3613  920.2126  774.2817  639.3680  584.5586 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha         4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
               0.9918    0.9795    0.9499    0.8748    0.7430    0.5614    0.4151    0.4577    0.6978    0.9197    0.9831    0.9939 (86)

MIT           19.5392   19.8056   20.1653   20.5754   20.8390   20.9648   20.9924   20.9886   20.9102   20.5325   19.9659   19.5139 (87)
Th 2          19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
               0.9898    0.9745    0.9378    0.8462    0.6904    0.4867    0.3277    0.3673    0.6241    0.8947    0.9782    0.9923 (89)
MIT 2         18.0351   18.4239   18.9409   19.5238   19.8605   20.0187   20.0407   20.0436   19.9604   19.4838   18.6762   18.0116 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1928 (91)
MIT           18.3251   18.6903   19.1769   19.7266   20.0492   20.2011   20.2242   20.2258   20.1435   19.6860   18.9249   18.3013 (92)
Temperature adjustment                                                                                                     0.0000
adjusted MIT  18.3251   18.6903   19.1769   19.7266   20.0492   20.2011   20.2242   20.2258   20.1435   19.6860   18.9249   18.3013 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9849    0.9659    0.9255    0.8367    0.6921    0.4994    0.3444    0.3844    0.6331    0.8843    0.9707    0.9884 (94)
Useful gains 619.9681  761.3153  865.4988  893.0682  790.6997  558.2087  369.1408  386.0808  582.5410  684.6696  620.6106  577.7776 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1547.2590 1513.1099 1383.3612 1149.0638  881.1319  574.3634  371.6379  390.0243  626.9598  958.8897 1262.0909 1521.9195 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             689.9044  505.2059  385.2896  184.3169   67.2816    0.0000    0.0000    0.0000    0.0000  204.0197  461.8658  702.4415 (98)
Space heating                                                                                                             3200.3256 (98)
Space heating per m2                                                                                    (98) / (4) =     32.6831 (99)
```

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		93.3000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		3430.1453 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	689.9044	505.2059	385.2896	184.3169	67.2816	0.0000	0.0000	0.0000	0.0000	204.0197	461.8658	702.4415	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	739.4474	541.4855	412.9578	197.5529	72.1132	0.0000	0.0000	0.0000	0.0000	218.6707	495.0330	752.8848	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5546	89.4428	89.2263	88.7217	87.8747	86.7000	86.7000	86.7000	86.7000	88.7784	89.3671	89.5825	(217)
Fuel for water heating, kWh/month													
	193.1365	169.4969	176.2040	155.7239	151.7825	134.1289	125.6569	142.2510	143.3756	161.5362	173.5775	187.3883	(219)
Water heating fuel used												1914.2580	(219)
Annual totals kWh/year													
Space heating fuel - main system												3430.1453	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1068 * 1.00) =										-1384.2193		-1384.2193	(233)
Total delivered energy for all uses												4435.5591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3430.1453	0.2160	740.9114	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.2580	0.2160	413.4797	(264)
Space and water heating			1154.3911	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1384.2193	0.5190	-718.4098	(269)
Total CO2, kg/year			682.7010	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.9700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.9700	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		24.1577	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1577	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.4700	19.6403	0.6300	0.7000	0.7700	44.8373	(76)
South	7.8800	46.7521	0.6300	0.7000	0.7700	112.5897	(78)
West	4.5500	19.6403	0.6300	0.7000	0.7700	27.3106	(80)

Solar gains	184.7376	325.5296	467.3158	604.4578	692.0785	691.5038	665.0008	600.3989	515.6919	366.3556	223.4172	156.6188	(83)
Total gains	616.2616	754.8613	881.5348	993.6304	1055.4885	1030.2002	988.1621	930.5607	859.1831	735.1189	620.6131	575.3409	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9975	0.9929	0.9791	0.9354	0.8313	0.6568	0.4903	0.5392	0.7881	0.9620	0.9942	0.9982	(86)
MIT	19.7569	19.9549	20.2417	20.5799	20.8353	20.9626	20.9929	20.9888	20.9069	20.5531	20.0829	19.7209	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9967	0.9905	0.9720	0.9132	0.7779	0.5660	0.3791	0.4246	0.7073	0.9443	0.9919	0.9976	(89)
MIT 2	18.2911	18.5807	18.9959	19.4759	19.8030	19.9431	19.9644	19.9641	19.8932	19.4506	18.7756	18.2443	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.5737	18.8456	19.2361	19.6888	20.0021	20.1397	20.1627	20.1617	20.0887	19.6632	19.0277	18.5290	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5737	18.8456	19.2361	19.6888	20.0021	20.1397	20.1627	20.1617	20.0887	19.6632	19.0277	18.5290	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9870	0.9656	0.9063	0.7804	0.5820	0.4006	0.4467	0.7182	0.9378	0.9889	0.9964	(94)
Useful gains	613.2105	745.0569	851.1798	900.5062	823.6947	599.5397	395.8764	415.6860	617.0538	689.3976	613.6974	573.2654	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1637.5755	1596.3688	1454.7102	1219.5746	936.6452	619.3025	398.2921	419.8181	671.8649	1022.5157	1351.0077	1629.6854	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	762.1276	572.0816	449.0266	229.7292	84.0352	0.0000	0.0000	0.0000	0.0000	247.8399	530.8634	785.9764	(98)
Space heating												3661.6799	(98)
Space heating per m2											(98) / (4) =	37.3946	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3920.4282	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	762.1276	572.0816	449.0266	229.7292	84.0352	0.0000	0.0000	0.0000	0.0000	247.8399	530.8634	785.9764	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	815.9824	612.5070	480.7566	245.9628	89.9735	0.0000	0.0000	0.0000	0.0000	265.3532	568.3762	841.5165	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9905	87.6834	87.0676	85.7438	83.3946	80.3000	80.3000	80.3000	80.3000	85.8206	87.4665	88.0901	(217)
Fuel for water heating, kWh/month													
	241.0553	213.2300	225.5676	203.5576	202.6315	185.3441	177.5738	197.9532	200.1393	212.7859	220.6871	235.0105	(219)
Water heating fuel used												2515.5358	(219)
Annual totals kWh/year													
Space heating fuel - main system												3920.4282	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												6911.3391	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3920.4282	0.2160	846.8125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.5358	0.2160	543.3557	(264)
Space and water heating			1390.1682	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1636.8879	(272)
Emissions per m2 for space and water heating			14.1970	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1970 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			16.7200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 187 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 187	**Prop Type Ref**	Opp
Property	Type 3S - End SG, Plot 187, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 187 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 187	**Prop Type Ref**	Opp
Property	Type 3S - End SG, Plot 187, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	6.97	**TER**	16.72
Environmental	95 A	**% DER<TER**	58.30		
CO_2 Emissions (t/year)	0.32	**DFEE**	36.85	**TFEE**	49.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	6.97	$kgCO_2/yr/m^2$	
TER	16.72	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.97	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.30	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace		
Fabric energy efficiency (F.E.E.)	36.85	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.39	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.39	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	22	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 188 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 188	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 188, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Mid-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.22 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)44.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.85 m², No overhang
Windows facing West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.3400	1.2357	14.0133			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	43.5300	13.4800	30.0500	0.2100	6.3105			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			123.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5658			(33)
Party Wall			92.6300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0411	(36)
Total fabric heat loss (33) + (36) =	35.6069	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	79.1910	78.6625	78.1341	75.4917	74.9633	72.3209	72.3209	71.7925	73.3779	74.9633	76.0202	77.0771	(39)
Average = Sum(39)m / 12 =												75.3596	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9859	0.9794	0.9728	0.9399	0.9333	0.9004	0.9004	0.8938	0.9136	0.9333	0.9465	0.9596	(40)
HLP (average)												0.9382	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.0131   18.6637   15.1783   11.4910    8.5896    7.2517    7.8357   10.1852   13.6706   17.3579   20.2593   21.5972 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              375.7987  373.5837  359.8789  337.8718  315.5638  294.1439  280.3058  286.4093  297.7976  320.0167  345.4754  364.5320 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data       factor                W
                                                      W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
East                               7.8500           19.6403            0.7200           0.7000           0.7700           53.8494 (76)
West                               3.4900           19.6403            0.7200           0.7000           0.7700           23.9407 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    77.7901  152.1739  250.6087  365.4978  447.9313  458.5374  436.5463  374.9868  291.4683  180.5671   96.9951   63.9708 (83)
Total gains   453.5887  525.7576  610.4876  703.3697  763.4952  752.6813  716.8521  661.3961  589.2659  500.5838  442.4704  428.5028 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            55.7841   56.1589   56.5387   58.5177   58.9302   61.0833   61.0833   61.5329   60.2034   58.9302   58.1109   57.3140
alpha           4.7189    4.7439    4.7692    4.9012    4.9287    5.0722    5.0722    5.1022    5.0136    4.9287    4.8741    4.8209
util living area
                0.9958    0.9909    0.9751    0.9187    0.7914    0.5937    0.4399    0.4920    0.7648    0.9565    0.9916    0.9968 (86)

MIT            19.7362   19.9165   20.2174   20.6081   20.8636   20.9764   20.9957   20.9928   20.9179   20.5582   20.0951   19.7331 (87)
Th 2           20.0951   20.1006   20.1061   20.1337   20.1393   20.1672   20.1672   20.1727   20.1560   20.1393   20.1282   20.1171 (88)
util rest of house
                0.9947    0.9885    0.9685    0.8980    0.7449    0.5243    0.3586    0.4070    0.6990    0.9412    0.9890    0.9959 (89)
MIT 2          18.3953   18.6615   19.1001   19.6688   20.0019   20.1498   20.1651   20.1691   20.0857   19.6145   18.9426   18.4062 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2505 (91)
MIT            18.7312   18.9759   19.3800   19.9041   20.2177   20.3568   20.3732   20.3754   20.2942   19.8509   19.2313   18.7386 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT   18.7312   18.9759   19.3800   19.9041   20.2177   20.3568   20.3732   20.3754   20.2942   19.8509   19.2313   18.7386 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9923    0.9844    0.9616    0.8916    0.7495    0.5405    0.3789    0.4281    0.7106    0.9348    0.9853    0.9940 (94)
Useful gains  450.0774  517.5789  587.0361  627.1035  572.2430  406.8486  271.6177  283.1644  418.7305  467.9240  435.9642  425.9231 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1142.8214 1107.2463 1006.3677  830.7168  638.5159  416.3396  272.8812  285.4055  454.5168  693.4763  922.2229 1120.5948 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              515.4015  396.2565  311.9827  146.6016   49.3070    0.0000    0.0000    0.0000    0.0000  167.8110  350.1062  516.8357 (98)
Space heating                                                                                                          2454.3023 (98)
Space heating per m2                                                                                    (98) / (4) =     30.5566 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2630.5491	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	515.4015	396.2565	311.9827	146.6016	49.3070	0.0000	0.0000	0.0000	0.0000	167.8110	350.1062	516.8357	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	552.4132	424.7123	334.3866	157.1292	52.8478	0.0000	0.0000	0.0000	0.0000	179.8617	375.2478	553.9504	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4070	89.3161	89.1072	88.5681	87.6831	86.7000	86.7000	86.7000	86.7000	88.6558	89.2076	89.4287	(217)
Fuel for water heating, kWh/month													
	182.5770	160.2084	166.5716	147.3376	143.7257	126.8093	118.8742	134.4666	135.4969	152.7813	164.1597	177.1782	(219)
Water heating fuel used												1810.1864	(219)
Annual totals kWh/year													
Space heating fuel - main system												2630.5491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												371.0985	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												3710.2549	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2630.5491	0.2160	568.1986	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.1864	0.2160	391.0003	(264)
Space and water heating			959.1989	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.0985	0.5190	192.6001	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			580.0794	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.2200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.2200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		25.6783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.6783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	43.5300	13.4800	30.0500	0.1800	5.4090			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			123.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.4527			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7452	(36)
Total fabric heat loss (33) + (36) =	42.1979	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	81.6763	81.4350	81.1985	80.0876	79.8798	78.9122	78.9122	78.7330	79.2849	79.8798	80.3002	80.7398	(39)
Average = Sum(39)m / 12 =												80.0866	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0169	1.0139	1.0109	0.9971	0.9945	0.9825	0.9825	0.9802	0.9871	0.9945	0.9998	1.0052	(40)
HLP (average)												0.9971	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.0131	18.6637	15.1783	11.4910	8.5896	7.2517	7.8357	10.1852	13.6706	17.3579	20.2593	21.5972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.9584	386.4757	372.1455	349.5149	326.5796	304.5341	290.7022	297.4308	309.4493	332.2919	358.3722	377.6951	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(76)
West	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(80)

Solar gains	68.0663	133.1521	219.2826	319.8106	391.9399	401.2202	381.9780	328.1135	255.0347	157.9962	84.8707	55.9744	(83)
Total gains	457.0247	519.6278	591.4281	669.3255	718.5195	705.7544	672.6803	625.5443	564.4840	490.2882	443.2429	433.6696	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.2912	68.4936	68.6931	69.6459	69.8272	70.6833	70.6833	70.8442	70.3511	69.8272	69.4615	69.0833	
alpha	5.5527	5.5662	5.5795	5.6431	5.6551	5.7122	5.7122	5.7229	5.6901	5.6551	5.6308	5.6056	
util living area													
	0.9985	0.9965	0.9892	0.9581	0.8635	0.6819	0.5104	0.5680	0.8369	0.9786	0.9967	0.9989	(86)
MIT	19.9123	20.0488	20.2894	20.6057	20.8527	20.9714	20.9953	20.9917	20.9100	20.5777	20.1892	19.8912	(87)
Th 2	20.0693	20.0718	20.0742	20.0857	20.0879	20.0980	20.0980	20.0998	20.0941	20.0879	20.0835	20.0790	(88)
util rest of house													
	0.9980	0.9953	0.9854	0.9430	0.8185	0.5995	0.4089	0.4625	0.7688	0.9682	0.9953	0.9985	(89)
MIT 2	18.6092	18.8103	19.1616	19.6195	19.9435	20.0789	20.0962	20.0963	20.0212	19.5888	19.0246	18.5855	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.9356	19.1206	19.4441	19.8665	20.1713	20.3025	20.3214	20.3206	20.2439	19.8365	19.3163	18.9126	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9356	19.1206	19.4441	19.8665	20.1713	20.3025	20.3214	20.3206	20.2439	19.8365	19.3163	18.9126	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9936	0.9819	0.9385	0.8231	0.6190	0.4344	0.4890	0.7814	0.9644	0.9937	0.9978	(94)
Useful gains	455.6669	516.3006	580.7287	628.1874	591.4238	436.8822	292.2055	305.9139	441.0911	472.8310	440.4562	432.6983	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1195.3853	1158.0530	1051.0406	878.2829	676.6845	449.9940	293.6651	308.6835	487.1171	737.8076	980.9755	1187.8931	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	550.3505	431.2576	349.9121	180.0687	63.4339	0.0000	0.0000	0.0000	0.0000	197.1426	389.1738	561.8650	(98)
Space heating												2723.2043	(98)
Space heating per m2											(98) / (4) =	33.9044	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2915.6363	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	550.3505	431.2576	349.9121	180.0687	63.4339	0.0000	0.0000	0.0000	0.0000	197.1426	389.1738	561.8650	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	589.2404	461.7319	374.6382	192.7931	67.9164	0.0000	0.0000	0.0000	0.0000	211.0735	416.6743	601.5685	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4427	87.1989	86.6323	85.2865	82.9451	80.3000	80.3000	80.3000	80.3000	85.3956	86.8967	87.5351	(217)
Fuel for water heating, kWh/month													
	231.4659	203.8391	213.4684	192.3235	191.4592	174.1812	166.8789	186.0308	188.0853	201.3928	211.2691	225.7626	(219)
Water heating fuel used												2386.1569	(219)
Annual totals kWh/year													
Space heating fuel - main system												2915.6363	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												371.0985	(232)
Total delivered energy for all uses												5747.8917	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2915.6363	0.2160	629.7774	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2386.1569	0.2160	515.4099	(264)
Space and water heating			1145.1873	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.0985	0.5190	192.6001	(268)
Total CO2, kg/m2/year			1376.7124	(272)
Emissions per m2 for space and water heating			14.2578	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3979	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2578 * 1.00) + 2.3979 + 0.4846, rounded to 2 d.p.			17.1400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 188 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 188	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 188, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	8.69 m	40.16 m²	2.39 m
1st Storey:	8.69 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	43.53	30.05

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	92.63

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.53	0.065	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	22.20	0.005	No
Independently assessed	E5 Ground floor (normal)	8.69	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	8.69	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E18 Party wall between dwellings	20.04	0.030	No
Independently assessed	P1 Party wall - Ground floor	18.49	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	48.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	18.49	0.037	No

Y-value	0.033	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff — Standard

24.0 Main Heating 1 — Database

Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	

Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 188 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 188	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 188, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.22	$kgCO_2/yr/m^2$	
TER	17.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.22	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.88	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Mid-Terrace		
Fabric energy efficiency (F.E.E.)	33.04	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	17.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.58	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.04	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.04	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 189 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 189	**Prop Type Ref**	Opp
Property	Type 3 - End SG, Plot 189, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.30	**TER**	17.70
Environmental	95 A	**% DER<TER**	58.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	39.30	**TFEE**	51.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.30 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.55 m², No overhang
Windows facing East: 7.66 m², No overhang
Windows facing West: 4.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2300	1.2357	16.3489			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.2100	17.1108			(29a)
Main Roof	46.6300		46.6300	0.0700	3.2641			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.9957			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5688	(36)
Total fabric heat loss	(33) + (36) = 50.5644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	99.4416	98.8619	98.2822	95.3836	94.8039	91.9054	91.9054	91.3256	93.0648	94.8039	95.9633	97.1228	(39)

Average = Sum(39)m / 12 = 95.2387 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0663	1.0601	1.0539	1.0228	1.0166	0.9855	0.9855	0.9793	0.9979	1.0166	1.0290	1.0414	(40)
HLP (average)												1.0212	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8116    10.6590    11.7776    11.3586    11.7088    11.2984    11.6546    11.6898    11.3312    11.7491    11.4052    11.8011 (61)
Total heat required for water heating calculated for each month
              170.9572   149.8488   155.4089   136.5799   131.8616   114.9811   107.7319   121.9399   122.8980   141.7695   153.3327   165.9251 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                              Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              170.9572   149.8488   155.4089   136.5799   131.8616   114.9811   107.7319   121.9399   122.8980   141.7695   153.3327   165.9251 (64)
                                                                                                Total per year (kWh/year) = Sum(64)m =   1673.2347 (64)
Heat gains from water heating, kWh/month
               55.8688    48.9453    50.7018    44.4757    42.8780    37.2991    34.8594    39.5806    39.9288    46.1691    50.0422    54.1965 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883   133.3883 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               23.3605    20.7485    16.8739    12.7746     9.5492     8.0618     8.7111    11.3230    15.1977    19.2969    22.5224    24.0097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              244.9491   247.4909   241.0856   227.4496   210.2365   194.0587   183.2509   180.7090   187.1143   200.7504   217.9634   234.1413 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388    36.3388 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106  -106.7106 (71)
Water heating gains (Table 5)
               75.0925    72.8353    68.1476    61.7719    57.6317    51.8043    46.8540    53.1997    55.4566    62.0552    69.5030    72.8448 (72)
Total internal gains
              409.4185   407.0913   392.1236   368.0125   343.4339   319.9412   304.8324   311.2482   323.7851   348.1190   376.0053   397.0123 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2            Table 6a       Specific data    Specific data       factor                W
                                                        W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                1.5500            10.6334            0.7200           0.7000           0.7700            5.7566 (74)
East                                 7.6600            19.6403            0.7200           0.7000           0.7700           52.5460 (76)
West                                 4.0200            19.6403            0.7200           0.7000           0.7700           27.5764 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    85.8790   167.7376   276.8162   406.4832   501.8103   515.5873   490.0628   418.3041   322.6831   199.0764   107.0047    70.6878 (83)
Total gains   495.2975   574.8289   668.9398   774.4957   845.2442   835.5285   794.8951   729.5523   646.4682   547.1954   483.0100   467.7000 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           49.2364    49.5251    49.8173    51.3311    51.6450    53.2738    53.2738    53.6120    52.6101    51.6450    51.0210    50.4120
alpha          4.2824     4.3017     4.3212     4.4221     4.4430     4.5516     4.5516     4.5741     4.5073     4.4430     4.4014     4.3608
util living area
               0.9960     0.9920     0.9794     0.9363     0.8331     0.6548     0.4969     0.5553     0.8157     0.9661     0.9927     0.9969 (86)

MIT           19.5155    19.6991    20.0181    20.4489    20.7716    20.9468    20.9878    20.9806    20.8516    20.4117    19.9040    19.5094 (87)
Th 2          20.0285    20.0336    20.0387    20.0644    20.0696    20.0955    20.0955    20.1007    20.0851    20.0696    20.0592    20.0490 (88)
util rest of house
               0.9950     0.9899     0.9739     0.9189     0.7896     0.5787     0.4002     0.4558     0.7527     0.9536     0.9904     0.9961 (89)
MIT 2         18.0331    18.3042    18.7700    19.3998    19.8320    20.0546    20.0895    20.0903    19.9519    19.3612    18.6216    18.0381 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.2586 (91)
MIT           18.4165    18.6650    19.0928    19.6711    20.0750    20.2853    20.3219    20.3206    20.1846    19.6329    18.9532    18.4186 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.4165    18.6650    19.0928    19.6711    20.0750    20.2853    20.3219    20.3206    20.1846    19.6329    18.9532    18.4186 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9925     0.9857     0.9666     0.9100     0.7899     0.5955     0.4250     0.4810     0.7604     0.9459     0.9866     0.9941 (94)
Useful gains  491.5808   566.5929   646.5639   704.7859   667.6305   497.5617   337.8235   350.8827   491.5910   517.6045   476.5399   464.9382 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1403.7698  1360.8321  1237.6500  1027.3888   793.9849   522.5139   342.0594   358.0476   566.2618   856.3526  1137.4773  1380.9521 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              678.6686   533.7287   439.7681   232.2741    94.0077     0.0000     0.0000     0.0000     0.0000   252.0286   475.8749   681.5144 (98)
Space heating                                                                                                                 3387.8651 (98)
Space heating per m2                                                                                                 (98) / (4) =     36.3271 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3631.1523	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	678.6686	533.7287	439.7681	232.2741	94.0077	0.0000	0.0000	0.0000	0.0000	252.0286	475.8749	681.5144	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	727.4047	572.0565	471.3485	248.9540	100.7585	0.0000	0.0000	0.0000	0.0000	270.1271	510.0482	730.4548	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5518	89.4855	89.3315	88.9327	88.1629	86.7000	86.7000	86.7000	86.7000	88.9700	89.3954	89.5718	(217)
Fuel for water heating, kWh/month													
	190.9032	167.4559	173.9689	153.5768	149.5660	132.6195	124.2582	140.6458	141.7509	159.3452	171.5218	185.2426	(219)
Water heating fuel used												1890.8548	(219)
Annual totals kWh/year													
Space heating fuel - main system												3631.1523	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =										-1474.3553		-1474.3553	(233)
Total delivered energy for all uses												4535.2047	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3631.1523	0.2160	784.3289	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.8548	0.2160	408.4246	(264)
Space and water heating			1192.7535	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			680.6031	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.3000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.3000	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		24.8267	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.8267	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.2300	1.3258	17.5398			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.1800	14.6664			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8980			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.9321	(36)
Total fabric heat loss (33) + (36) =	56.8301	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	101.9410	101.6891	101.4421	100.2824	100.0654	99.0552	99.0552	98.8682	99.4443	100.0654	100.5043	100.9633	(39)
Average = Sum(39)m / 12 =												100.2813	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0931	1.0904	1.0877	1.0753	1.0730	1.0621	1.0621	1.0601	1.0663	1.0730	1.0777	1.0826	(40)
HLP (average)												1.0753	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3605	20.7485	16.8739	12.7746	9.5492	8.0618	8.7111	11.3230	15.1977	19.2969	22.5224	24.0097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5729	420.2491	405.2055	380.4398	355.2025	331.0530	315.9510	323.0233	336.2219	361.2105	389.1684	410.1701	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.6300	0.7000	0.7700	5.0370	(74)
East	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(76)
West	4.0200	19.6403	0.6300	0.7000	0.7700	24.1293	(80)

Solar gains	75.1441	146.7704	242.2142	355.6728	439.0840	451.1389	428.8049	366.0161	282.3477	174.1919	93.6291	61.8518	(83)
Total gains	497.7170	567.0195	647.4198	736.1126	794.2866	782.1919	744.7559	689.0394	618.5696	535.4024	482.7976	472.0219	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5308	63.6882	63.8432	64.5815	64.7216	65.3816	65.3816	65.5053	65.1258	64.7216	64.4389	64.1460	
alpha	5.2354	5.2459	5.2562	5.3054	5.3148	5.3588	5.3588	5.3670	5.3417	5.3148	5.2959	5.2764	
util living area													
	0.9989	0.9975	0.9925	0.9710	0.9002	0.7429	0.5710	0.6341	0.8825	0.9856	0.9976	0.9992	(86)
MIT	19.7735	19.9090	20.1562	20.4909	20.7798	20.9459	20.9892	20.9817	20.8566	20.4760	20.0659	19.7515	(87)
Th 2	20.0065	20.0087	20.0109	20.0211	20.0230	20.0319	20.0319	20.0335	20.0284	20.0230	20.0191	20.0151	(88)
util rest of house													
	0.9985	0.9966	0.9897	0.9595	0.8609	0.6560	0.4527	0.5137	0.8214	0.9780	0.9967	0.9989	(89)
MIT 2	18.3608	18.5604	18.9220	19.4096	19.8000	19.9945	20.0277	20.0256	19.9064	19.3958	18.7976	18.3347	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7262	18.9092	19.2412	19.6893	20.0534	20.2406	20.2764	20.2729	20.1522	19.6752	19.1256	18.7012	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7262	18.9092	19.2412	19.6893	20.0534	20.2406	20.2764	20.2729	20.1522	19.6752	19.1256	18.7012	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9952	0.9866	0.9546	0.8623	0.6762	0.4835	0.5449	0.8306	0.9743	0.9953	0.9983	(94)
Useful gains	496.5827	564.2922	638.7699	702.6733	684.9226	528.9079	360.0961	375.4587	513.7540	521.6581	480.5429	471.2065	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1470.6209	1424.5793	1292.4984	1081.9736	835.8859	558.7281	364.1633	382.9020	601.8538	908.1094	1208.6294	1464.0849	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	724.6844	578.1129	486.3740	273.0962	112.3167	0.0000	0.0000	0.0000	0.0000	287.5197	524.2223	738.7015	(98)
Space heating												3725.0278	(98)
Space heating per m2											(98) / (4) =	39.9424	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3988.2525	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	724.6844	578.1129	486.3740	273.0962	112.3167	0.0000	0.0000	0.0000	0.0000	287.5197	524.2223	738.7015	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	775.8933	618.9646	520.7430	292.3943	120.2535	0.0000	0.0000	0.0000	0.0000	307.8370	561.2658	790.9010	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9146	87.7228	87.2663	86.2045	84.0789	80.3000	80.3000	80.3000	80.3000	86.2146	87.4596	87.9950	(217)
Fuel for water heating, kWh/month													
	238.9869	211.1392	222.6985	199.9554	198.4863	183.0424	175.3686	195.4949	197.6539	209.6280	218.6639	233.0621	(219)
Water heating fuel used												2484.1802	(219)
Annual totals kWh/year													
Space heating fuel - main system												3988.2525	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Total delivered energy for all uses												6959.9855	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3988.2525	0.2160	861.4625	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.1802	0.2160	536.5829	(264)
Space and water heating			1398.0454	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Total CO2, kg/m2/year			1651.0854	(272)
Emissions per m2 for space and water heating			14.9908	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2959	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9908 * 1.00) + 2.2959 + 0.4174, rounded to 2 d.p.			17.7000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 189 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 189	**Prop Type Ref**	Opp
Property	Type 3 - End SG, Plot 189, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.30	**TER**	17.70
Environmental	95 A	**% DER<TER**	58.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	39.30	**TFEE**	51.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.85	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.63	46.63

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	46.63

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.065	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 189 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 189	**Prop Type Ref**	Opp
Property	Type 3 - End SG, Plot 189, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.30	**TER**	17.70
Environmental	95 A	**% DER<TER**	58.77		
CO_2 Emissions (t/year)	0.28	**DFEE**	39.30	**TFEE**	51.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.30	$kgCO_2/yr/m^2$	
TER	17.70	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.30	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.77	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace		
Fabric energy efficiency (F.E.E.)	39.30	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.27	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.27	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.53	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.06	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.06	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 190 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 190	**Prop Type Ref**	As
Property	Type 3 - End SG, Plot 190, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.05	**TER**	17.46
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.25	**TFEE**	50.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.66 m², No overhang
Windows facing South: 1.55 m², No overhang
Windows facing West: 4.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2300	1.2357	16.3489			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.2100	17.1108			(29a)
Main Roof	46.6300		46.6300	0.0700	3.2641			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.9957			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5688	(36)
Total fabric heat loss	(33) + (36) = 50.5644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	99.4416	98.8619	98.2822	95.3836	94.8039	91.9054	91.9054	91.3256	93.0648	94.8039	95.9633	97.1228	(39)

Average = Sum(39)m / 12 = 95.2387 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0663	1.0601	1.0539	1.0228	1.0166	0.9855	0.9855	0.9793	0.9979	1.0166	1.0290	1.0414	(40)
HLP (average)												1.0212	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8116	10.6590	11.7776	11.3586	11.7088	11.2984	11.6546	11.6898	11.3312	11.7491	11.4052	11.8011 (61)

Total heat required for water heating calculated for each month

	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251 (64)

Total per year (kWh/year) = Sum(64)m = 1673.2347 (64)

Heat gains from water heating, kWh/month

	55.8688	48.9453	50.7018	44.4757	42.8780	37.2991	34.8594	39.5806	39.9288	46.1691	50.0422	54.1965 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3605	20.7485	16.8739	12.7746	9.5492	8.0618	8.7111	11.3230	15.1977	19.2969	22.5224	24.0097	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	75.0925	72.8353	68.1476	61.7719	57.6317	51.8043	46.8540	53.1997	55.4566	62.0552	69.5030	72.8448	(72)

Total internal gains

	409.4185	407.0913	392.1236	368.0125	343.4339	319.9412	304.8324	311.2482	323.7851	348.1190	376.0053	397.0123	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6600	19.6403	0.7200	0.7000	0.7700	52.5460	(76)
South	1.5500	46.7521	0.7200	0.7000	0.7700	25.3102	(78)
West	4.0200	19.6403	0.7200	0.7000	0.7700	27.5764	(80)

Solar gains	105.4326	198.1881	310.9246	436.1341	523.5493	532.1329	508.1096	443.0167	355.3652	230.6904	129.9045	87.7591	(83)
Total gains	514.8512	605.2793	703.0482	804.1466	866.9832	852.0741	812.9419	754.2650	679.1502	578.8094	505.9098	484.7714	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.2364	49.5251	49.8173	51.3311	51.6450	53.2738	53.2738	53.6120	52.6101	51.6450	51.0210	50.4120	
alpha	4.2824	4.3017	4.3212	4.4221	4.4430	4.5516	4.5516	4.5741	4.5073	4.4430	4.4014	4.3608	
util living area	0.9954	0.9903	0.9755	0.9286	0.8231	0.6449	0.4868	0.5393	0.7948	0.9590	0.9912	0.9965	(86)
MIT	19.5398	19.7363	20.0572	20.4766	20.7838	20.9499	20.9888	20.9827	20.8677	20.4457	19.9322	19.5309	(87)
Th 2	20.0285	20.0336	20.0387	20.0644	20.0696	20.0955	20.0955	20.1007	20.0851	20.0696	20.0592	20.0490	(88)
util rest of house	0.9942	0.9878	0.9690	0.9096	0.7784	0.5691	0.3917	0.4417	0.7293	0.9444	0.9886	0.9955	(89)
MIT 2	18.0686	18.3580	18.8257	19.4370	19.8461	20.0572	20.0900	20.0915	19.9683	19.4079	18.6624	18.0694	(90)

Living area fraction fLA = Living area / (4) = 0.2586 (91)

MIT	18.4491	18.7145	19.1442	19.7058	20.0886	20.2881	20.3225	20.3220	20.2010	19.6763	18.9908	18.4474	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4491	18.7145	19.1442	19.7058	20.0886	20.2881	20.3225	20.3220	20.2010	19.6763	18.9908	18.4474	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9830	0.9611	0.9008	0.7794	0.5860	0.4161	0.4665	0.7385	0.9364	0.9843	0.9933	(94)
Useful gains	510.4232	594.9692	675.6801	724.4123	675.7272	499.3496	338.2287	351.8446	501.5531	542.0171	497.9615	481.5102	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1407.0117	1365.7273	1242.7012	1030.7008	795.2706	522.7685	342.1162	358.1817	567.7837	860.4716	1141.0857	1383.7473	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	667.0618	517.9494	421.8637	220.5277	88.9403	0.0000	0.0000	0.0000	0.0000	236.9302	463.0495	671.2644	(98)

Space heating 3287.5869 (98)

Space heating per m2 (98) / (4) = 35.2518 (99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3523.6730	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	667.0618	517.9494	421.8637	220.5277	88.9403	0.0000	0.0000	0.0000	0.0000	236.9302	463.0495	671.2644	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	714.9644	555.1440	452.1583	236.3641	95.3272	0.0000	0.0000	0.0000	0.0000	253.9445	496.3017	719.4688	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9572	149.8488	155.4089	136.5799	131.8616	114.9811	107.7319	121.9399	122.8980	141.7695	153.3327	165.9251	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5415	89.4664	89.3018	88.8884	88.1150	86.7000	86.7000	86.7000	86.7000	88.9178	89.3768	89.5629	(217)
Fuel for water heating, kWh/month													
	190.9251	167.4916	174.0267	153.6533	149.6472	132.6195	124.2582	140.6458	141.7509	159.4388	171.5576	185.2609	(219)
Water heating fuel used												1891.2756	(219)
Annual totals kWh/year													
Space heating fuel - main system												3523.6730	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =										-1474.3553		-1474.3553	(233)
Total delivered energy for all uses												4428.1463	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3523.6730	0.2160	761.1134	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1891.2756	0.2160	408.5155	(264)
Space and water heating			1169.6289	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			657.4785	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.0500	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		24.5767	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.5767	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.2300	1.3258	17.5398			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	96.8500	15.3700	81.4800	0.1800	14.6664			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			190.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8980			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.9321	(36)
Total fabric heat loss (33) + (36) =	56.8301	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	101.9410	101.6891	101.4421	100.2824	100.0654	99.0552	99.0552	98.8682	99.4443	100.0654	100.5043	100.9633	(39)
Average = Sum(39)m / 12 =												100.2813	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0931	1.0904	1.0877	1.0753	1.0730	1.0621	1.0621	1.0601	1.0663	1.0730	1.0777	1.0826	(40)
HLP (average)												1.0753	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3605	20.7485	16.8739	12.7746	9.5492	8.0618	8.7111	11.3230	15.1977	19.2969	22.5224	24.0097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5729	420.2491	405.2055	380.4398	355.2025	331.0530	315.9510	323.0233	336.2219	361.2105	389.1684	410.1701	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(76)
South	1.5500	46.7521	0.6300	0.7000	0.7700	22.1465	(78)
West	4.0200	19.6403	0.6300	0.7000	0.7700	24.1293	(80)

Solar gains	92.2536	173.4145	272.0590	381.6173	458.1056	465.6163	444.5959	387.6396	310.9445	201.8541	113.6664	76.7892	(83)
Total gains	514.8264	593.6637	677.2646	762.0572	813.3082	796.6693	760.5469	710.6629	647.1664	563.0646	502.8349	486.9594	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5308	63.6882	63.8432	64.5815	64.7216	65.3816	65.3816	65.5053	65.1258	64.7216	64.4389	64.1460	
alpha	5.2354	5.2459	5.2562	5.3054	5.3148	5.3588	5.3588	5.3670	5.3417	5.3148	5.2959	5.2764	
util living area													
	0.9987	0.9969	0.9908	0.9667	0.8925	0.7334	0.5603	0.6177	0.8659	0.9821	0.9971	0.9990	(86)
MIT	19.7908	19.9357	20.1852	20.5133	20.7909	20.9492	20.9901	20.9838	20.8714	20.5019	20.0860	19.7666	(87)
Th 2	20.0065	20.0087	20.0109	20.0211	20.0230	20.0319	20.0319	20.0335	20.0284	20.0230	20.0191	20.0151	(88)
util rest of house													
	0.9982	0.9958	0.9874	0.9538	0.8515	0.6462	0.4437	0.4990	0.8006	0.9730	0.9960	0.9987	(89)
MIT 2	18.3861	18.5992	18.9638	19.4403	19.8130	19.9970	20.0281	20.0266	19.9214	19.4320	18.8269	18.3569	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7494	18.9449	19.2797	19.7178	20.0659	20.2433	20.2769	20.2741	20.1671	19.7087	19.1526	18.7215	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7494	18.9449	19.2797	19.7178	20.0659	20.2433	20.2769	20.2741	20.1671	19.7087	19.1526	18.7215	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9840	0.9488	0.8535	0.6666	0.4740	0.5298	0.8114	0.9690	0.9944	0.9980	(94)
Useful gains	513.4607	590.1803	666.4205	723.0298	694.1895	531.0855	360.5099	376.5009	525.0808	545.5902	500.0293	485.9891	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1472.9854	1428.2125	1296.4016	1084.8365	837.1396	558.9973	364.2147	383.0299	603.3393	911.4626	1211.3376	1466.1380	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.8864	563.1576	468.7060	260.5008	106.3549	0.0000	0.0000	0.0000	0.0000	272.2090	512.1420	729.2308	(98)
Space heating												3626.1876	(98)
Space heating per m2											(98) / (4) =	38.8826	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3882.4278	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.8864	563.1576	468.7060	260.5008	106.3549	0.0000	0.0000	0.0000	0.0000	272.2090	512.1420	729.2308	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	764.3323	602.9525	501.8265	278.9088	113.8703	0.0000	0.0000	0.0000	0.0000	291.4444	548.3319	780.7610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8864	87.6709	87.1858	86.0882	83.9508	80.3000	80.3000	80.3000	80.3000	86.0799	87.4107	87.9712	(217)
Fuel for water heating, kWh/month													
	239.0637	211.2642	222.9042	200.2254	198.7891	183.0424	175.3686	195.4949	197.6539	209.9561	218.7860	233.1249	(219)
Water heating fuel used												2485.6735	(219)
Annual totals kWh/year													
Space heating fuel - main system												3882.4278	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.5529	(232)
Total delivered energy for all uses												6855.6543	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3882.4278	0.2160	838.6044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.6735	0.2160	536.9055	(264)
Space and water heating			1375.5099	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.5529	0.5190	214.1150	(268)
Total CO2, kg/m2/year			1628.5499	(272)
Emissions per m2 for space and water heating			14.7492	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2959	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7492 * 1.00) + 2.2959 + 0.4174, rounded to 2 d.p.			17.4600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 190 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 190	**Prop Type Ref**	As
Property	Type 3 - End SG, Plot 190, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.05	**TER**	17.46
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.25	**TFEE**	50.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.85	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.63	46.63

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	46.63

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.065	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 190 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 190	**Prop Type Ref**	As
Property	Type 3 - End SG, Plot 190, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.05	**TER**	17.46
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.25	**TFEE**	50.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.05	$kgCO_2/yr/m^2$	
TER	17.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.63	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace		
Fabric energy efficiency (F.E.E.)	38.25	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.48	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.28	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 191 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 191	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 191, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Mid-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.22 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)44.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.85 m², No overhang
Windows facing West: 3.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3738	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4051	0.3972	0.3892	0.3495	0.3416	0.3018	0.3018	0.2939	0.3177	0.3416	0.3575	0.3733	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6551	0.6472	0.6392	0.5995	0.5916	0.5518	0.5518	0.5439	0.5677	0.5916	0.6075	0.6233	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.3400	1.2357	14.0133			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	43.5300	13.4800	30.0500	0.2100	6.3105			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			123.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.5658			(33)
Party Wall			92.6300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	198.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0411	(36)
Total fabric heat loss (33) + (36) =	35.6069	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5841	43.0556	42.5271	39.8848	39.3563	36.7140	36.7140	36.1855	37.7709	39.3563	40.4133	41.4702	(38)
Heat transfer coeff	79.1910	78.6625	78.1341	75.4917	74.9633	72.3209	72.3209	71.7925	73.3779	74.9633	76.0202	77.0771	(39)
Average = Sum(39)m / 12 =												75.3596	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9859	0.9794	0.9728	0.9399	0.9333	0.9004	0.9004	0.8938	0.9136	0.9333	0.9465	0.9596	(40)
HLP (average)												0.9382	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7955   10.6404   11.7492   11.3349   11.6870   11.2803   11.6379   11.6697   11.3100   11.7235   11.3863   11.7854 (61)
Total heat required for water heating calculated for each month
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2367  143.0919  148.4273  130.4941  126.0231  109.9437  103.0640  116.5825  117.4758  135.4495  146.4429  158.4482 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1598.6795 (64)
Heat gains from water heating, kWh/month
               53.3031   46.7002   48.3828   42.4542   40.9385   35.6256   33.3086   37.8009   38.1276   44.0698   47.7529   51.7117 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.0131   18.6637   15.1783   11.4910    8.5896    7.2517    7.8357   10.1852   13.6706   17.3579   20.2593   21.5972 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6439   69.4944   65.0306   58.9641   55.0249   49.4801   44.7697   50.8077   52.9551   59.2336   66.3235   69.5050 (72)
Total internal gains
              375.7987  373.5837  359.8789  337.8718  315.5638  294.1439  280.3058  286.4093  297.7976  320.0167  345.4754  364.5320 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data       factor                W
                                                      W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
East                               7.8500           19.6403            0.7200           0.7000           0.7700           53.8494 (76)
West                               3.4900           19.6403            0.7200           0.7000           0.7700           23.9407 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    77.7901  152.1739  250.6087  365.4978  447.9313  458.5374  436.5463  374.9868  291.4683  180.5671   96.9951   63.9708 (83)
Total gains   453.5887  525.7576  610.4876  703.3697  763.4952  752.6813  716.8521  661.3961  589.2659  500.5838  442.4704  428.5028 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            55.7841   56.1589   56.5387   58.5177   58.9302   61.0833   61.0833   61.5329   60.2034   58.9302   58.1109   57.3140
alpha           4.7189    4.7439    4.7692    4.9012    4.9287    5.0722    5.0722    5.1022    5.0136    4.9287    4.8741    4.8209
util living area
                0.9958    0.9909    0.9751    0.9187    0.7914    0.5937    0.4399    0.4920    0.7648    0.9565    0.9916    0.9968 (86)

MIT            19.7362   19.9165   20.2174   20.6081   20.8636   20.9764   20.9957   20.9928   20.9179   20.5582   20.0951   19.7331 (87)
Th 2           20.0951   20.1006   20.1061   20.1337   20.1393   20.1672   20.1672   20.1727   20.1560   20.1393   20.1282   20.1171 (88)
util rest of house
                0.9947    0.9885    0.9685    0.8980    0.7449    0.5243    0.3586    0.4070    0.6990    0.9412    0.9890    0.9959 (89)
MIT 2          18.3953   18.6615   19.1001   19.6688   20.0019   20.1498   20.1651   20.1691   20.0857   19.6145   18.9426   18.4062 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2505 (91)
MIT            18.7312   18.9759   19.3800   19.9041   20.2177   20.3568   20.3732   20.3754   20.2942   19.8509   19.2313   18.7386 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT   18.7312   18.9759   19.3800   19.9041   20.2177   20.3568   20.3732   20.3754   20.2942   19.8509   19.2313   18.7386 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9923    0.9844    0.9616    0.8916    0.7495    0.5405    0.3789    0.4281    0.7106    0.9348    0.9853    0.9940 (94)
Useful gains  450.0774  517.5789  587.0361  627.1035  572.2430  406.8486  271.6177  283.1644  418.7305  467.9240  435.9642  425.9231 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1142.8214 1107.2463 1006.3677  830.7168  638.5159  416.3396  272.8812  285.4055  454.5168  693.4763  922.2229 1120.5948 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              515.4015  396.2565  311.9827  146.6016   49.3070    0.0000    0.0000    0.0000    0.0000  167.8110  350.1062  516.8357 (98)
Space heating                                                                                                          2454.3023 (98)
Space heating per m2                                                                                    (98) / (4) =     30.5566 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2630.5491	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	515.4015	396.2565	311.9827	146.6016	49.3070	0.0000	0.0000	0.0000	0.0000	167.8110	350.1062	516.8357	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	552.4132	424.7123	334.3866	157.1292	52.8478	0.0000	0.0000	0.0000	0.0000	179.8617	375.2478	553.9504	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4070	89.3161	89.1072	88.5681	87.6831	86.7000	86.7000	86.7000	86.7000	88.6558	89.2076	89.4287	(217)
Fuel for water heating, kWh/month													
	182.5770	160.2084	166.5716	147.3376	143.7257	126.8093	118.8742	134.4666	135.4969	152.7813	164.1597	177.1782	(219)
Water heating fuel used												1810.1864	(219)
Annual totals kWh/year													
Space heating fuel - main system												2630.5491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												371.0985	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												3710.2549	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2630.5491	0.2160	568.1986	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.1864	0.2160	391.0003	(264)
Space and water heating			959.1989	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.0985	0.5190	192.6001	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			580.0794	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.2200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.2200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		25.6783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.6783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3988	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	43.5300	13.4800	30.0500	0.1800	5.4090			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			123.8500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.4527			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7452	(36)
Total fabric heat loss (33) + (36) =	42.1979	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	81.6763	81.4350	81.1985	80.0876	79.8798	78.9122	78.9122	78.7330	79.2849	79.8798	80.3002	80.7398	(39)
Average = Sum(39)m / 12 =												80.0866	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0169	1.0139	1.0109	0.9971	0.9945	0.9825	0.9825	0.9802	0.9871	0.9945	0.9998	1.0052	(40)
HLP (average)												0.9971	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.0131	18.6637	15.1783	11.4910	8.5896	7.2517	7.8357	10.1852	13.6706	17.3579	20.2593	21.5972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.9584	386.4757	372.1455	349.5149	326.5796	304.5341	290.7022	297.4308	309.4493	332.2919	358.3722	377.6951	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.8500	19.6403	0.6300	0.7000	0.7700	47.1182	(76)
West	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481	(80)

Solar gains	68.0663	133.1521	219.2826	319.8106	391.9399	401.2202	381.9780	328.1135	255.0347	157.9962	84.8707	55.9744	(83)
Total gains	457.0247	519.6278	591.4281	669.3255	718.5195	705.7544	672.6803	625.5443	564.4840	490.2882	443.2429	433.6696	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.2912	68.4936	68.6931	69.6459	69.8272	70.6833	70.6833	70.8442	70.3511	69.8272	69.4615	69.0833	
alpha	5.5527	5.5662	5.5795	5.6431	5.6551	5.7122	5.7122	5.7229	5.6901	5.6551	5.6308	5.6056	
util living area													
	0.9985	0.9965	0.9892	0.9581	0.8635	0.6819	0.5104	0.5680	0.8369	0.9786	0.9967	0.9989	(86)
MIT	19.9123	20.0488	20.2894	20.6057	20.8527	20.9714	20.9953	20.9917	20.9100	20.5777	20.1892	19.8912	(87)
Th 2	20.0693	20.0718	20.0742	20.0857	20.0879	20.0980	20.0980	20.0998	20.0941	20.0879	20.0835	20.0790	(88)
util rest of house													
	0.9980	0.9953	0.9854	0.9430	0.8185	0.5995	0.4089	0.4625	0.7688	0.9682	0.9953	0.9985	(89)
MIT 2	18.6092	18.8103	19.1616	19.6195	19.9435	20.0789	20.0962	20.0963	20.0212	19.5888	19.0246	18.5855	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.9356	19.1206	19.4441	19.8665	20.1713	20.3025	20.3214	20.3206	20.2439	19.8365	19.3163	18.9126	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9356	19.1206	19.4441	19.8665	20.1713	20.3025	20.3214	20.3206	20.2439	19.8365	19.3163	18.9126	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9936	0.9819	0.9385	0.8231	0.6190	0.4344	0.4890	0.7814	0.9644	0.9937	0.9978	(94)
Useful gains	455.6669	516.3006	580.7287	628.1874	591.4238	436.8822	292.2055	305.9139	441.0911	472.8310	440.4562	432.6983	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1195.3853	1158.0530	1051.0406	878.2829	676.6845	449.9940	293.6651	308.6835	487.1171	737.8076	980.9755	1187.8931	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	550.3505	431.2576	349.9121	180.0687	63.4339	0.0000	0.0000	0.0000	0.0000	197.1426	389.1738	561.8650	(98)
Space heating												2723.2043	(98)
Space heating per m2											(98) / (4) =	33.9044	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2915.6363	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	550.3505	431.2576	349.9121	180.0687	63.4339	0.0000	0.0000	0.0000	0.0000	197.1426	389.1738	561.8650	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	589.2404	461.7319	374.6382	192.7931	67.9164	0.0000	0.0000	0.0000	0.0000	211.0735	416.6743	601.5685	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4427	87.1989	86.6323	85.2865	82.9451	80.3000	80.3000	80.3000	80.3000	85.3956	86.8967	87.5351	(217)
Fuel for water heating, kWh/month													
	231.4659	203.8391	213.4684	192.3235	191.4592	174.1812	166.8789	186.0308	188.0853	201.3928	211.2691	225.7626	(219)
Water heating fuel used												2386.1569	(219)
Annual totals kWh/year													
Space heating fuel - main system												2915.6363	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												371.0985	(232)
Total delivered energy for all uses												5747.8917	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2915.6363	0.2160	629.7774	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2386.1569	0.2160	515.4099	(264)
Space and water heating			1145.1873	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	371.0985	0.5190	192.6001	(268)
Total CO2, kg/m2/year			1376.7124	(272)
Emissions per m2 for space and water heating			14.2578	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3979	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2578 * 1.00) + 2.3979 + 0.4846, rounded to 2 d.p.			17.1400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 191 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 191	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 191, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	8.69 m	40.16 m²	2.39 m
1st Storey:	8.69 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	198.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	43.53	30.05

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	92.63

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.40	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.53	0.065	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	22.20	0.005	No
Independently assessed	E5 Ground floor (normal)	8.69	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	8.69	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E18 Party wall between dwellings	20.04	0.030	No
Independently assessed	P1 Party wall - Ground floor	18.49	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	48.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	18.49	0.037	No

Y-value	0.033	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff — Standard

24.0 Main Heating 1 — Database

Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	

Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 191 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 191	**Prop Type Ref**	
Property	Type 2 - Mid, Plot 191, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.22	**TER**	17.14
Environmental	95 A	**% DER<TER**	57.88		
CO_2 Emissions (t/year)	0.25	**DFEE**	33.04	**TFEE**	44.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	26.47		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.22	$kgCO_2/yr/m^2$	
TER	17.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.22	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.88	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Mid-Terrace		
Fabric energy efficiency (F.E.E.)	33.04	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	17.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.58	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.04	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.04	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 192 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 192	**Prop Type Ref**	As
Property	Type 3S - End SG, Plot 192, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.19	**TER**	17.81
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.44	**TFEE**	54.87
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.48		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

End-Terrace House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.81 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.88 m², No overhang
Windows facing East: 7.47 m², No overhang
Windows facing West: 4.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3761	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3466	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6261	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9000	1.2357	24.5913			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.2100	16.6698			(29a)
Main Roof	48.9600		48.9600	0.0700	3.4272			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.2631			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2742	(36)
Total fabric heat loss	(33) + (36) = 59.5372	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7834	50.1852	49.5870	46.5962	45.9980	43.0072	43.0072	42.4090	44.2035	45.9980	47.1944	48.3907	(38)
Heat transfer coeff	110.3206	109.7224	109.1242	106.1334	105.5352	102.5444	102.5444	101.9462	103.7407	105.5352	106.7316	107.9279	(39)
Average = Sum(39)m / 12 =												105.9839	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1266	1.1205	1.1144	1.0839	1.0778	1.0472	1.0472	1.0411	1.0594	1.0778	1.0900	1.1022	(40)
HLP (average)												1.0824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8158   10.6627   11.7829   11.3650   11.7147   11.3032   11.6591   11.6951   11.3369   11.7539   11.4090   11.8052 (61)
Total heat required for water heating calculated for each month
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9626  151.6027  157.2203  138.1609  133.3784  116.2897  108.9445  123.3316  124.3066  143.4093  155.1211  167.8672 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1692.5948 (64)
Heat gains from water heating, kWh/month
               56.5353   49.5282   51.3037   45.0009   43.3818   37.7338   35.2622   40.0429   40.3967   46.7139   50.6365   54.8419 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709  135.9709 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.6709   20.1361   16.3758   12.3975    9.2673    7.8238    8.4539   10.9887   14.7491   18.7273   21.8575   23.3010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.9206  255.5452  248.9314  234.8516  217.0784  200.3740  189.2145  186.5900  193.2037  207.2835  225.0568  241.7611 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971   36.5971 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 -108.7767 (71)
Water heating gains (Table 5)
               75.9883   73.7027   68.9565   62.5012   58.3089   52.4081   47.3954   53.8211   56.1065   62.7875   70.3285   73.7123 (72)
Total internal gains
              418.3711  416.1752  401.0550  376.5416  351.4459  327.3972  311.8551  318.1911  330.8505  355.5896  384.0341  405.5656 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                  7.8800            10.6334            0.7200           0.7000           0.7700           29.2659 (74)
East                                   7.4700            19.6403            0.7200           0.7000           0.7700           51.2427 (76)
West                                   4.5500            19.6403            0.7200           0.7000           0.7700           31.2121 (80)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   111.7206  217.2276  360.6728  540.0676  680.4287  706.1744  668.2533  560.5344  423.2106  257.9705  138.9146   92.2043 (83)
Total gains   530.0917  633.4028  761.7278  916.6093 1031.8746 1033.5716  980.1084  878.7254  754.0611  613.5601  522.9487  497.7699 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          46.3522   46.6049   46.8603   48.1809   48.4540   49.8672   49.8672   50.1598   49.2921   48.4540   47.9108   47.3798
alpha         4.0901    4.1070    4.1240    4.2121    4.2303    4.3245    4.3245    4.3440    4.2861    4.2303    4.1941    4.1587
util living area
               0.9956    0.9904    0.9739    0.9164    0.7880    0.5993    0.4515    0.5168    0.7891    0.9604    0.9918    0.9966 (86)

MIT           19.4234   19.6318   19.9892   20.4620   20.7958   20.9549   20.9894   20.9819   20.8529   20.3835   19.8330   19.4115 (87)
Th 2          19.9791   19.9841   19.9891   20.0140   20.0190   20.0442   20.0442   20.0492   20.0341   20.0190   20.0090   19.9990 (88)
util rest of house
               0.9945    0.9880    0.9670    0.8947    0.7385    0.5221    0.3575    0.4175    0.7209    0.9460    0.9893    0.9958 (89)
MIT 2         17.8667   18.1735   18.6936   19.3763   19.8131   20.0109   20.0392   20.0399   19.9056   19.2842   18.4848   17.8625 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1928 (91)
MIT           18.1668   18.4547   18.9434   19.5856   20.0026   20.1929   20.2225   20.2215   20.0883   19.4962   18.7447   18.1612 (92)
Temperature adjustment                                                                                                     0.0000
adjusted MIT  18.1668   18.4547   18.9434   19.5856   20.0026   20.1929   20.2225   20.2215   20.0883   19.4962   18.7447   18.1612 (93)
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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9914    0.9825    0.9573    0.8833    0.7376    0.5347    0.3754    0.4361    0.7252    0.9358    0.9845    0.9933 (94)
Useful gains 525.5319  622.3421  729.2214  809.6553  761.0803  552.6225  367.9686  383.1749  546.8194  574.1419  514.8321  494.4288 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1529.7969 1487.2535 1357.8810 1134.0999  876.2147  573.5227  371.4627  389.5924  621.2262  938.8620 1242.8601 1506.8005 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              747.1732  581.2205  467.7227  233.6001   85.6600    0.0000    0.0000    0.0000    0.0000  271.3517  524.1802  753.2046 (98)
Space heating                                                                                                             3664.1130 (98)
Space heating per m2                                                                                        (98) / (4) =     37.4195 (99)
```

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3927.2379	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	747.1732	581.2205	467.7227	233.6001	85.6600	0.0000	0.0000	0.0000	0.0000	271.3517	524.1802	753.2046	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	800.8287	622.9587	501.3105	250.3752	91.8113	0.0000	0.0000	0.0000	0.0000	290.8379	561.8222	807.2932	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9626	151.6027	157.2203	138.1609	133.3784	116.2897	108.9445	123.3316	124.3066	143.4093	155.1211	167.8672	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6006	89.5309	89.3665	88.9277	88.0731	86.7000	86.7000	86.7000	86.7000	89.0219	89.4518	89.6218	(217)
Fuel for water heating, kWh/month													
	193.0372	169.3299	175.9276	155.3631	151.4404	134.1289	125.6569	142.2510	143.3756	161.0943	173.4130	187.3063	(219)
Water heating fuel used												1912.3242	(219)
Annual totals kWh/year													
Space heating fuel - main system												3927.2379	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 597 * 1.00) =										-1548.3612		-1548.3612	(233)
Total delivered energy for all uses												4766.5760	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3927.2379	0.2160	848.2834	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.3242	0.2160	413.0620	(264)
Space and water heating			1261.3454	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Energy saving/generation technologies				
PV Unit	-1548.3612	0.5190	-803.5995	(269)
Total CO2, kg/year			704.4656	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1900	ZC1
Total Floor Area	TFA	97.9200	
Assumed number of occupants	N	2.7194	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3059	ZC2
CO2 emissions from cooking, equation (L16)		1.8818	ZC3
Total CO2 emissions		24.3777	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.3777	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9600 (1b)	x	2.3900 (2b)	=	117.0144	(1b) - (3b)
First floor	48.9600 (1c)	x	2.6300 (2c)	=	128.7648	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7792	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3004	0.3004	0.2925	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			19.9000	1.3258	26.3826			(27)
Ground floor			48.9600	0.1300	6.3648			(28a)
External Wall	101.4200	22.0400	79.3800	0.1800	14.2884			(29a)
Main Roof	48.9600		48.9600	0.1300	6.3648			(30)
Total net area of external elements Aum(A, m2)			199.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9686			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6112	(36)
Total fabric heat loss (33) + (36) =	67.5798	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1471	46.8910	46.6401	45.4613	45.2407	44.2141	44.2141	44.0240	44.6095	45.2407	45.6869	46.1533	(38)
Heat transfer coeff	114.7268	114.4708	114.2198	113.0411	112.8205	111.7939	111.7939	111.6037	112.1893	112.8205	113.2667	113.7331	(39)
Average = Sum(39)m / 12 =												113.0400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1716	1.1690	1.1665	1.1544	1.1522	1.1417	1.1417	1.1397	1.1457	1.1522	1.1567	1.1615	(40)
HLP (average)												1.1544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7194 (42)
Average daily hot water use (litres/day)	98.7862 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6648	104.7134	100.7619	96.8105	92.8590	88.9076	88.9076	92.8590	96.8105	100.7619	104.7134	108.6648	(44)
Energy conte	161.1468	140.9400	145.4374	126.7959	121.6637	104.9865	97.2854	111.6364	112.9697	131.6553	143.7121	156.0620	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2914	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1720	21.1410	21.8156	19.0194	18.2496	15.7480	14.5928	16.7455	16.9455	19.7483	21.5568	23.4093	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7421	47.3199	43.8448	45.3063	47.3199	47.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.7447	(64)
Heat gains from water heating, kWh/month													
	66.3210	58.3694	61.0977	54.0952	52.2832	45.8692	43.6740	48.9491	49.4980	56.5151	60.1130	64.6304	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	135.9709	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6709	20.1361	16.3758	12.3975	9.2673	7.8238	8.4539	10.9887	14.7491	18.7273	21.8575	23.3010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.9206	255.5452	248.9314	234.8516	217.0784	200.3740	189.2145	186.5900	193.2037	207.2835	225.0568	241.7611	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	36.5971	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	-108.7767	(71)
Water heating gains (Table 5)													
	89.1412	86.8592	82.1205	75.1322	70.2731	63.7072	58.7016	65.7918	68.7472	75.9612	83.4903	86.8688	(72)
Total internal gains													
	431.5240	429.3317	414.2190	389.1726	363.4100	338.6964	323.1613	330.1618	343.4912	368.7633	397.1959	418.7221	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8800	10.6334	0.6300	0.7000	0.7700	25.6077	(74)
East	7.4700	19.6403	0.6300	0.7000	0.7700	44.8373	(76)
West	4.5500	19.6403	0.6300	0.7000	0.7700	27.3106	(80)

Solar gains	97.7555	190.0741	315.5887	472.5592	595.3751	617.9026	584.7217	490.4676	370.3093	225.7242	121.5503	80.6787	(83)
Total gains	529.2795	619.4059	729.8077	861.7318	958.7851	956.5989	907.8829	820.6293	713.8005	594.4875	518.7462	499.4008	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.2712	59.4038	59.5343	60.1551	60.2727	60.8262	60.8262	60.9299	60.6118	60.2727	60.0353	59.7891	
alpha	4.9514	4.9603	4.9690	5.0103	5.0182	5.0551	5.0551	5.0620	5.0408	5.0182	5.0024	4.9859	
util living area													
	0.9988	0.9970	0.9904	0.9610	0.8690	0.6955	0.5303	0.6024	0.8664	0.9835	0.9974	0.9991	(86)
MIT	19.6746	19.8287	20.1075	20.4828	20.7929	20.9518	20.9900	20.9817	20.8506	20.4356	19.9875	19.6488	(87)
Th 2	19.9428	19.9449	19.9469	19.9566	19.9585	19.9669	19.9669	19.9685	19.9637	19.9585	19.9548	19.9509	(88)
util rest of house													
	0.9983	0.9960	0.9868	0.9460	0.8217	0.6037	0.4117	0.4788	0.7986	0.9747	0.9963	0.9988	(89)
MIT 2	18.1710	18.3976	18.8045	19.3466	19.7564	19.9353	19.9633	19.9610	19.8403	19.2895	18.6371	18.1389	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.4609	18.6735	19.0557	19.5657	19.9562	20.1313	20.1613	20.1578	20.0351	19.5105	18.8974	18.4300	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4609	18.6735	19.0557	19.5657	19.9562	20.1313	20.1613	20.1578	20.0351	19.5105	18.8974	18.4300	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9941	0.9826	0.9389	0.8216	0.6193	0.4347	0.5026	0.8042	0.9694	0.9946	0.9980	(94)
Useful gains	527.8948	615.7395	717.0904	809.0387	787.6982	592.4240	394.6386	412.4084	574.0030	576.3160	515.9446	498.4179	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1624.6342	1576.6653	1434.1110	1205.6575	931.4718	618.3631	398.1264	419.3846	665.8500	1005.2898	1336.2556	1618.4254	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	815.9741	645.7421	533.4633	285.5656	106.9676	0.0000	0.0000	0.0000	0.0000	319.1566	590.6240	833.2856	(98)
Space heating												4130.7787	(98)
Space heating per m2											(98) / (4) =	42.1852	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4422.6752	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	815.9741	645.7421	533.4633	285.5656	106.9676	0.0000	0.0000	0.0000	0.0000	319.1566	590.6240	833.2856	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	873.6339	691.3727	571.1598	305.7447	114.5263	0.0000	0.0000	0.0000	0.0000	341.7094	632.3597	892.1687	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.1057	186.9674	196.3963	174.5380	168.9836	148.8313	142.5917	158.9564	160.7119	182.6142	193.0272	207.0209	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1135	87.9171	87.4405	86.2831	83.9351	80.3000	80.3000	80.3000	80.3000	86.4430	87.6834	88.1926	(217)
Fuel for water heating, kWh/month													
	240.7187	212.6632	224.6056	202.2852	201.3265	185.3441	177.5738	197.9532	200.1393	211.2539	220.1410	234.7374	(219)
Water heating fuel used												2508.7420	(219)
Annual totals kWh/year													
Space heating fuel - main system												4422.6752	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.3752	(232)
Total delivered energy for all uses												7406.7924	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4422.6752	0.2160	955.2979	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2508.7420	0.2160	541.8883	(264)
Space and water heating			1497.1861	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.3752	0.5190	207.7947	(268)
Total CO2, kg/m2/year			1743.9058	(272)
Emissions per m2 for space and water heating			15.2899	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3975	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2899 * 1.00) + 2.1221 + 0.3975, rounded to 2 d.p.			17.8100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 192 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 192	**Prop Type Ref**	As
Property	Type 3S - End SG, Plot 192, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.19	**TER**	17.81
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.44	**TFEE**	54.87
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.48		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.96 m²	2.39 m
1st Storey:	20.24 m	48.96 m²	2.63 m

7.0 Living Area	18.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.38

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.96	48.96

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	48.96

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.49	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W13)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.02	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	35.70	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	15.03	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.046	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.026	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	North	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 192 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 192	**Prop Type Ref**	As
Property	Type 3S - End SG, Plot 192, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.19	**TER**	17.81
Environmental	95 A	**% DER<TER**	59.63		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.44	**TFEE**	54.87
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.48		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.92	m^2	
DER	7.19	$kgCO_2/yr/m^2$	
TER	17.81	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.19	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.63	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace	
Fabric energy efficiency (F.E.E.)	41.44	$kWh/m^2/yr$
CfSH ENE2 credits achieved	8.1	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.92	m^2	
DER	17.69	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.88	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.88	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.48	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.67	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.67	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	24	%	

ENE7 credits achieved	2

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 199 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 199 - EPC	**Prop Type Ref**	Opp
Property	4 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.89	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.70		
CO_2 Emissions (t/year)	1.19	**DFEE**	46.65	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.89	$kgCO_2/m^2$	Pass
	-3.57 (-21.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.65	$kWh/m^2/yr$	
	-5.5 (-10.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.61 m², No overhang
Windows facing East	1.42 m², No overhang
Windows facing South	5.73 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 199 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 199 - EPC	**Prop Type Ref**	Opp
Property	4 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.89	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.70		
CO_2 Emissions (t/year)	1.19	**DFEE**	46.65	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.89 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.20 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.61 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South: 5.73 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1235	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3335	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2835	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3615	0.3544	0.3473	0.3119	0.3048	0.2693	0.2693	0.2622	0.2835	0.3048	0.3190	0.3331	(22b)
Effective ac	0.5653	0.5628	0.5603	0.5486	0.5464	0.5363	0.5363	0.5344	0.5402	0.5464	0.5509	0.5555	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.4034	60.1324	59.8667	58.6187	58.3852	57.2983	57.2983	57.0970	57.7170	58.3852	58.8576	59.3514	(38)
Heat transfer coeff	137.0009	136.7299	136.4642	135.2162	134.9827	133.8958	133.8958	133.6945	134.3145	134.9827	135.4551	135.9489	(39)
Average = Sum(39)m / 12 =												135.2151	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1108	1.1086	1.1064	1.0963	1.0944	1.0856	1.0856	1.0840	1.0890	1.0944	1.0982	1.1022	(40)
HLP (average)												1.0963	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

Distribution loss (46)m = 0.15 x (45)m

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869 (46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8822	10.7222	11.8479	11.4354	11.7864	11.3701	11.7266	11.7654	11.4052	11.8179	11.4722	11.8711 (61)

Total heat required for water heating calculated for each month

	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836 (64)

Total per year (kWh/year) = Sum(64)m = 1751.6614 (64)

Heat gains from water heating, kWh/month

	58.5605	51.2999	53.1328	46.5990	44.9163	39.0592	36.4917	41.4520	41.8219	48.3709	52.4437	56.8037 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139 (71)

Water heating gains (Table 5)

	78.7104	76.3391	71.4150	64.7208	60.3714	54.2488	49.0480	55.7150	58.0860	65.0147	72.8384	76.3490 (72)

Total internal gains

	465.6785	463.1429	445.9483	418.1652	389.5593	362.5123	345.3255	352.1569	366.7984	394.8160	426.8961	451.3313 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.7200	0.7000	0.7700	28.2631	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	5.7300	46.7521	0.7200	0.7000	0.7700	93.5662	(78)
North	0.6500	15.2954	0.7200	0.7000	1.0000	4.5097	(82)

Solar gains	136.0800	234.7016	333.1708	440.0556	522.8710	533.6376	508.3290	443.4186	369.2180	262.2248	163.4171	116.2380	(83)
Total gains	601.7585	697.8446	779.1191	858.2208	912.4303	896.1498	853.6545	795.5755	736.0164	657.0408	590.3133	567.5693	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5198	62.6438	62.7658	63.3450	63.4546	63.9697	63.9697	64.0660	63.7703	63.4546	63.2333	63.0037	
alpha	5.1680	5.1763	5.1844	5.2230	5.2303	5.2646	5.2646	5.2711	5.2514	5.2303	5.2156	5.2002	
util living area													
	0.9993	0.9982	0.9952	0.9833	0.9403	0.8210	0.6565	0.7166	0.9196	0.9899	0.9984	0.9995	(86)
MIT	19.7065	19.8455	20.0764	20.3908	20.6943	20.9066	20.9779	20.9654	20.8076	20.4204	20.0057	19.6814	(87)
Th 2	19.9921	19.9938	19.9956	20.0039	20.0054	20.0126	20.0126	20.0140	20.0098	20.0054	20.0023	19.9990	(88)
util rest of house													
	0.9990	0.9976	0.9933	0.9762	0.9123	0.7399	0.5258	0.5893	0.8700	0.9844	0.9977	0.9993	(89)
MIT 2	18.2525	18.4570	18.7953	19.2564	19.6802	19.9431	20.0035	19.9978	19.8368	19.3037	18.6977	18.2207	(90)
Living area fraction											fLA = Living area / (4) =	0.1432	(91)
MIT	18.4607	18.6558	18.9787	19.4189	19.8254	20.0810	20.1430	20.1363	19.9758	19.4636	18.8850	18.4298	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4607	18.6558	18.9787	19.4189	19.8254	20.0810	20.1430	20.1363	19.9758	19.4636	18.8850	18.4298	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9963	0.9905	0.9704	0.9059	0.7464	0.5442	0.6066	0.8678	0.9799	0.9965	0.9988	(94)
Useful gains	600.7787	695.2475	771.7245	832.8005	826.5766	668.8562	464.5867	482.6257	638.7411	643.8375	588.2330	566.8869	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1940.0256	1880.8322	1702.8933	1422.3212	1096.7876	733.8873	474.3965	499.5285	789.2035	1196.4352	1596.3384	1934.5288	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	996.3997	796.7129	692.7896	424.4549	201.0370	0.0000	0.0000	0.0000	0.0000	411.1326	725.8359	1017.5255	(98)
Space heating												5265.8882	(98)
Space heating per m2											(98) / (4) =	42.6941	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5644.0388	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	996.3997	796.7129	692.7896	424.4549	201.0370	0.0000	0.0000	0.0000	0.0000	411.1326	725.8359	1017.5255	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1067.9525	853.9260	742.5397	454.9356	215.4737	0.0000	0.0000	0.0000	0.0000	440.6566	777.9591	1090.5954	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7324	89.6871	89.5924	89.3650	88.7991	86.7000	86.7000	86.7000	86.7000	89.3163	89.6259	89.7563	(217)
Fuel for water heating, kWh/month													
	199.5600	174.9925	181.6422	160.0007	155.4194	138.7455	129.9412	147.1590	148.3391	166.1608	179.1579	193.6171	(219)
Water heating fuel used												1974.7355	(219)
Annual totals kWh/year													
Space heating fuel - main system												5644.0388	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1068 * 1.00) =										-683.5651		-683.5651	(233)
Total delivered energy for all uses												7510.6675	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5644.0388	0.2160	1219.1124	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.7355	0.2160	426.5429	(264)
Space and water heating			1645.6552	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-683.5651	0.5190	-354.7703	(269)
Total CO2, kg/year			1589.5478	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.8900	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.3231	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3231	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 199 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 199 - EPC	**Prop Type Ref**	Opp
Property	4 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.89	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.70		
CO_2 Emissions (t/year)	1.19	**DFEE**	46.65	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.89	$kgCO_2/m^2$	Pass
	-3.57 (-21.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.65	$kWh/m^2/yr$	
	-5.5 (-10.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 199 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 199 - EPC	**Prop Type Ref**	Opp
Property	4 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.89	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.70		
CO_2 Emissions (t/year)	1.19	**DFEE**	46.65	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.20	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£282	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 199 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 199 - EPC	**Prop Type Ref**	Opp
Property	4 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.89	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.70		
CO_2 Emissions (t/year)	1.19	**DFEE**	46.65	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	12.89	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.89	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.70	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	46.65	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.69	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.12	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.12	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.24	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.24	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 200 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 200 - EPC	**Prop Type Ref**	As
Property	3 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.92	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.52		
CO_2 Emissions (t/year)	1.20	**DFEE**	46.79	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.92	$kgCO_2/m^2$	Pass
	-3.54 (-21.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.79	$kWh/m^2/yr$	
	-5.4 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.61 m², No overhang
Windows facing South	5.73 m², No overhang
Windows facing West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 200 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 200 - EPC	**Prop Type Ref**	As
Property	3 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.92	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.52		
CO_2 Emissions (t/year)	1.20	**DFEE**	46.79	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.92 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.26 (max. 0.30)        0.27 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           0.18 (max. 0.25)        0.18 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.32 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.36 (measured in this dwelling)
Maximum                                 10.0                                        OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control           OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                         OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                         OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                             OK
Based on:
Overshading:                            Average
Windows facing North:                   7.61 m², No overhang
Windows facing South:                   5.73 m², No overhang
Windows facing West:                    1.42 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Thermal bridging y-value                0.027 W/m²K
Photovoltaic array                      0.80 kW



---------------------------------------------------------------------------------------------------
```

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			4.3600	
Infiltration rate			0.3415	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2903	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3701	0.3629	0.3556	0.3193	0.3121	0.2758	0.2758	0.2685	0.2903	0.3121	0.3266	0.3411	(22b)
Effective ac	0.5685	0.5658	0.5632	0.5510	0.5487	0.5380	0.5380	0.5361	0.5421	0.5487	0.5533	0.5582	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7423	60.4581	60.1795	58.8709	58.6261	57.4864	57.4864	57.2754	57.9254	58.6261	59.1214	59.6392	(38)
Heat transfer coeff	137.3398	137.0556	136.7770	135.4685	135.2236	134.0839	134.0839	133.8729	134.5229	135.2236	135.7189	136.2367	(39)
Average = Sum(39)m / 12 =												135.4673	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1135	1.1112	1.1089	1.0983	1.0963	1.0871	1.0871	1.0854	1.0907	1.0963	1.1004	1.1046	(40)
HLP (average)												1.0983	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8822    10.7222    11.8479    11.4354    11.7864    11.3701    11.7266    11.7654    11.4052    11.8179    11.4722    11.8711 (61)
Total heat required for water heating calculated for each month
             179.0700   156.9458   162.7376   142.9846   138.0111   120.2923   112.6591   127.5869   128.6100   148.4088   160.5718   173.7836 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0700   156.9458   162.7376   142.9846   138.0111   120.2923   112.6591   127.5869   128.6100   148.4088   160.5718   173.7836 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.6614 (64)
Heat gains from water heating, kWh/month
              58.5605    51.2999    53.1328    46.5990    44.9163    39.0592    36.4917    41.4520    41.8219    48.3709    52.4437    56.8037 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.7104    76.3391    71.4150    64.7208    60.3714    54.2488    49.0480    55.7150    58.0860    65.0147    72.8384    76.3490 (72)
Total internal gains
             465.6785   463.1429   445.9483   418.1652   389.5593   362.5123   345.3255   352.1569   366.7984   394.8160   426.8961   451.3313 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    7.6100           10.6334           0.7200           0.7000           0.7700           28.2631 (74)
South                                    5.7300           46.7521           0.7200           0.7000           0.7700           93.5662 (78)
West                                     1.4200           19.6403           0.7200           0.7000           0.7700            9.7409 (80)
North                                    0.6500           15.2954           0.7200           0.7000           1.0000            4.5097 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    136.0800   234.7016   333.1708   440.0556   522.8710   533.6376   508.3290   443.4186   369.2180   262.2248   163.4171   116.2380 (83)
Total gains    601.7585   697.8446   779.1191   858.2208   912.4303   896.1498   853.6545   795.5755   736.0164   657.0408   590.3133   567.5693 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          62.3656    62.4949    62.6222    63.2271    63.3416    63.8800    63.8800    63.9807    63.6715    63.3416    63.1104    62.8706
alpha         5.1577     5.1663     5.1748     5.2151     5.2228     5.2587     5.2587     5.2654     5.2448     5.2228     5.2074     5.1914
util living area
              0.9993     0.9982     0.9952     0.9834     0.9406     0.8215     0.6572     0.7172     0.9199     0.9899     0.9984     0.9995 (86)

MIT          19.7028    19.8420    20.0733    20.3888    20.6929    20.9060    20.9777    20.9652    20.8067    20.4187    20.0033    19.6782 (87)
Th 2         19.9898    19.9917    19.9935    20.0022    20.0038    20.0114    20.0114    20.0128    20.0085    20.0038    20.0005    19.9971 (88)
util rest of house
              0.9990     0.9976     0.9933     0.9762     0.9126     0.7404     0.5263     0.5898     0.8703     0.9844     0.9977     0.9993 (89)
MIT 2        18.2455    18.4504    18.7893    19.2522    19.6770    19.9414    20.0022    19.9965    19.8345    19.3001    18.6929    18.2147 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1432 (91)
MIT          18.4542    18.6497    18.9732    19.4149    19.8224    20.0795    20.1419    20.1352    19.9737    19.4603    18.8805    18.4243 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT 18.4542    18.6497    18.9732    19.4149    19.8224    20.0795    20.1419    20.1352    19.9737    19.4603    18.8805    18.4243 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.9984     0.9963     0.9905     0.9704     0.9061     0.7468     0.5447     0.6071     0.8681     0.9799     0.9965     0.9988 (94)
Useful gains 600.7761   695.2449   771.7286   832.8456   826.7887   669.2605   465.0064   483.0037   638.9468   643.8535   588.2311   566.8851 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1943.9294  1884.4698  1706.0425  1424.4427  1098.3436   734.7121   474.9064   500.0396   790.1522  1198.1165  1598.8424  1937.8664 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             999.3060   799.1591   695.1295   425.9500   202.0369     0.0000     0.0000     0.0000     0.0000   412.3717   727.6401  1020.0101 (98)
Space heating                                                                                                                  5281.6033 (98)
Space heating per m2                                                                                          (98) / (4) =     42.8215 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5660.8825	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	999.3060	799.1591	695.1295	425.9500	202.0369	0.0000	0.0000	0.0000	0.0000	412.3717	727.6401	1020.0101	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1071.0675	856.5478	745.0477	456.5380	216.5454	0.0000	0.0000	0.0000	0.0000	441.9846	779.8929	1093.2584	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7338	89.6887	89.5943	89.3674	88.8035	86.7000	86.7000	86.7000	86.7000	89.3185	89.6272	89.7575	(217)
Fuel for water heating, kWh/month													
	199.5570	174.9895	181.6383	159.9963	155.4118	138.7455	129.9412	147.1590	148.3391	166.1568	179.1552	193.6147	(219)
Water heating fuel used												1974.7044	(219)
Annual totals kWh/year													
Space heating fuel - main system												5660.8825	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1068 * 1.00) =										-683.5651		-683.5651	(233)
Total delivered energy for all uses												7527.4801	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5660.8825	0.2160	1222.7506	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.7044	0.2160	426.5361	(264)
Space and water heating			1649.2868	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-683.5651	0.5190	-354.7703	(269)
Total CO2, kg/year			1593.1794	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.9200	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.3531	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3531	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 200 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 200 - EPC	**Prop Type Ref**	As
Property	3 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.92	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.52		
CO_2 Emissions (t/year)	1.20	**DFEE**	46.79	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.92	$kgCO_2/m^2$	Pass
	-3.54 (-21.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.79	$kWh/m^2/yr$	
	-5.4 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 200 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 200 - EPC	**Prop Type Ref**	As
Property	3 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.92	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.52		
CO_2 Emissions (t/year)	1.20	**DFEE**	46.79	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.36	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£282	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 200 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 200 - EPC	**Prop Type Ref**	As
Property	3 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	12.92	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.52		
CO_2 Emissions (t/year)	1.20	**DFEE**	46.79	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	12.92	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.92	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.52	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	46.79	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.84	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.27	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.27	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 201 BG2	**Issued on Date**	04/04/2025
Assessment Reference	EPC 201	**Prop Type Ref**	As
Property	2 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.31	**TER**	16.46
Environmental	89 B	**% DER<TER**	19.15		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.63	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.31	$kgCO_2/m^2$	Pass
	-3.15 (-19.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.63	$kWh/m^2/yr$	
	-3.6 (-6.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.25 (average for dwelling type)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average	
Windows facing North Windows facing South Windows facing West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang	
Air change rate	8.00 ach	
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	6.25 (average for dwelling type)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 201 BG2	**Issued on Date**	04/04/2025
Assessment Reference	EPC 201	**Prop Type Ref**	As
Property	2 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.31	**TER**	16.46
Environmental	89 B	**% DER<TER**	19.15		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.63	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.31 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 6.25 (average for dwelling type)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.61 m², No overhang
Windows facing South: 5.73 m², No overhang
Windows facing West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			6.2500	
Infiltration rate			0.4360	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3706	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4726	0.4633	0.4540	0.4077	0.3984	0.3521	0.3521	0.3428	0.3706	0.3984	0.4170	0.4355	(22b)
Effective ac	0.6117	0.6073	0.6031	0.5831	0.5794	0.5620	0.5620	0.5588	0.5687	0.5794	0.5869	0.5948	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.3530	64.8897	64.4356	62.3028	61.9038	60.0461	60.0461	59.7021	60.7617	61.9038	62.7110	63.5550	(38)
Heat transfer coeff	141.9505	141.4872	141.0331	138.9003	138.5013	136.6436	136.6436	136.2996	137.3592	138.5013	139.3085	140.1525	(39)
Average = Sum(39)m / 12 =												138.8984	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1509	1.1471	1.1435	1.1262	1.1229	1.1079	1.1079	1.1051	1.1137	1.1229	1.1295	1.1363	(40)
HLP (average)												1.1261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data        factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    7.6100           10.6334           0.7200           0.7000           0.7700           28.2631 (74)
South                                    5.7300           46.7521           0.7200           0.7000           0.7700           93.5662 (78)
West                                     1.4200           19.6403           0.7200           0.7000           0.7700            9.7409 (80)
North                                    0.6500           15.2954           0.7200           0.7000           1.0000            4.5097 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    136.0800   234.7016   333.1708   440.0556   522.8710   533.6376   508.3290   443.4186   369.2180   262.2248   163.4171   116.2380 (83)
Total gains    601.7405   697.8265   779.1010   858.2027   912.4123   896.1318   853.6364   795.5575   735.9984   657.0227   590.2953   567.5512 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          60.3399    60.5375    60.7324    61.6649    61.8426    62.6833    62.6833    62.8415    62.3568    61.8426    61.4842    61.1140
alpha         5.0227     5.0358     5.0488     5.1110     5.1228     5.1789     5.1789     5.1894     5.1571     5.1228     5.0989     5.0743
util living area
               0.9992     0.9982     0.9952     0.9840     0.9433     0.8278     0.6660     0.7252     0.9232     0.9902     0.9984     0.9994 (86)

MIT           19.6530    19.7953    20.0321    20.3605    20.6729    20.8981    20.9749    20.9616    20.7943    20.3956    19.9704    19.6357 (87)
Th 2          19.9595    19.9625    19.9655    19.9795    19.9822    19.9944    19.9944    19.9967    19.9897    19.9822    19.9768    19.9713 (88)
util rest of house
               0.9990     0.9976     0.9934     0.9770     0.9160     0.7468     0.5326     0.5960     0.8745     0.9847     0.9977     0.9992 (89)
MIT 2         18.1511    18.3613    18.7092    19.1949    19.6332    19.9182    19.9841    19.9786    19.8040    19.2509    18.6280    18.1341 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1432 (91)
MIT           18.3662    18.5666    18.8986    19.3618    19.7821    20.0585    20.1259    20.1194    19.9458    19.4148    18.8202    18.3491 (92)
Temperature adjustment                                                                                                             0.0000
adjusted MIT  18.3662    18.5666    18.8986    19.3618    19.7821    20.0585    20.1259    20.1194    19.9458    19.4148    18.8202    18.3491 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9983     0.9962     0.9906     0.9711     0.9091     0.7528     0.5513     0.6135     0.8718     0.9802     0.9964     0.9988 (94)
Useful gains 600.7227   695.1888   771.7545   833.3993   829.5067   674.5932   470.6205   488.0460   641.6115   644.0369   588.1860   566.8419 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1996.7012  1933.6503  1748.6201  1453.1462  1119.3792   745.8658   481.7976   506.9498   802.9743  1220.8632  1632.7271  1983.0284 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1038.6080   832.2462   726.7880   446.2177   215.6652     0.0000     0.0000     0.0000     0.0000   429.1588   752.0696  1053.6428 (98)
Space heating                                                                                                                     5494.3963 (98)
Space heating per m2                                                                                                 (98) / (4) =     44.5468 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5888.9564	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1038.6080	832.2462	726.7880	446.2177	215.6652	0.0000	0.0000	0.0000	0.0000	429.1588	752.0696	1053.6428	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1113.1919	892.0109	778.9796	478.2612	231.1524	0.0000	0.0000	0.0000	0.0000	459.9773	806.0768	1129.3063	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7521	89.7092	89.6194	89.3994	88.8605	86.7000	86.7000	86.7000	86.7000	89.3470	89.6453	89.7724	(217)
Fuel for water heating, kWh/month													
	199.4565	174.8956	181.5276	159.8810	155.2516	138.6856	129.8794	147.0972	148.2792	166.0438	179.0612	193.5227	(219)
Water heating fuel used												1973.5814	(219)
Annual totals kWh/year													
Space heating fuel - main system												5888.9564	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1068 * 1.00) =										-683.5651		-683.5651	(233)
Total delivered energy for all uses												7754.4311	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5888.9564	0.2160	1272.0146	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.5814	0.2160	426.2936	(264)
Space and water heating			1698.3082	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-683.5651	0.5190	-354.7703	(269)
Total CO2, kg/year			1642.2008	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3100	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.7431	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.7431	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 201 BG2	**Issued on Date**	04/04/2025
Assessment Reference	EPC 201	**Prop Type Ref**	As
Property	2 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.31	**TER**	16.46
Environmental	89 B	**% DER<TER**	19.15		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.63	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.31	$kgCO_2/m^2$	Pass
	-3.15 (-19.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.63	$kWh/m^2/yr$	
	-3.6 (-6.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.25 (average for dwelling type)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.61 m², No overhang
Windows facing South	5.73 m², No overhang
Windows facing West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	6.25 (average for dwelling type)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 201 BG2	**Issued on Date**	04/04/2025
Assessment Reference	EPC 201	**Prop Type Ref**	As
Property	2 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.31	**TER**	16.46
Environmental	89 B	**% DER<TER**	19.15		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.63	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	No	
As Built AP_{50}	4.25	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£140	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 201 BG2	**Issued on Date**	04/04/2025
Assessment Reference	EPC 201	**Prop Type Ref**	As
Property	2 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.31	**TER**	16.46
Environmental	89 B	**% DER<TER**	19.15		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.63	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	13.31	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.31	$kgCO_2/yr/m^2$	
Reduction DER/TER	19.15	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	48.63	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	18.17	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.60	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.60	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.29	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.72	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.72	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 202 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 202 - EPC	**Prop Type Ref**	Opp
Property	1 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.37	**TER**	16.46
Environmental	89 B	**% DER<TER**	18.78		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.87	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.37	$kgCO_2/m^2$	Pass
	-3.09 (-18.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.87	$kWh/m^2/yr$	
	-3.3 (-6.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.47 (average for dwelling type)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	6.47 (average for dwelling type)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 202 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 202 - EPC	**Prop Type Ref**	Opp
Property	1 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.37	**TER**	16.46
Environmental	89 B	**% DER<TER**	18.78		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.87	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 6.47 (average for dwelling type)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.61 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South: 5.73 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			6.4700	
Infiltration rate			0.4470	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3800	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4845	0.4750	0.4655	0.4180	0.4085	0.3610	0.3610	0.3515	0.3800	0.4085	0.4275	0.4465	(22b)
Effective ac	0.6174	0.6128	0.6083	0.5874	0.5834	0.5652	0.5652	0.5618	0.5722	0.5834	0.5914	0.5997	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.9625	65.4756	64.9983	62.7565	62.3371	60.3845	60.3845	60.0229	61.1366	62.3371	63.1856	64.0726	(38)
Heat transfer coeff	142.5600	142.0731	141.5958	139.3540	138.9346	136.9820	136.9820	136.6205	137.7341	138.9346	139.7831	140.6701	(39)
Average = Sum(39)m / 12 =												139.3520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1558	1.1519	1.1480	1.1298	1.1264	1.1106	1.1106	1.1077	1.1167	1.1264	1.1333	1.1405	(40)
HLP (average)												1.1298	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

Distribution loss (46)m = 0.15 x (45)m

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8822	10.7222	11.8479	11.4354	11.7864	11.3701	11.7266	11.7654	11.4052	11.8179	11.4722	11.8711 (61)

Total heat required for water heating calculated for each month

	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836 (64)

Total per year (kWh/year) = Sum(64)m = 1751.6614 (64)

Heat gains from water heating, kWh/month

	58.5605	51.2999	53.1328	46.5990	44.9163	39.0592	36.4917	41.4520	41.8219	48.3709	52.4437	56.8037 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139 (71)

Water heating gains (Table 5)

	78.7104	76.3391	71.4150	64.7208	60.3714	54.2488	49.0480	55.7150	58.0860	65.0147	72.8384	76.3490 (72)

Total internal gains

	465.6785	463.1429	445.9483	418.1652	389.5593	362.5123	345.3255	352.1569	366.7984	394.8160	426.8961	451.3313 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.7200	0.7000	0.7700	28.2631	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	5.7300	46.7521	0.7200	0.7000	0.7700	93.5662	(78)
North	0.6500	15.2954	0.7200	0.7000	1.0000	4.5097	(82)

Solar gains	136.0800	234.7016	333.1708	440.0556	522.8710	533.6376	508.3290	443.4186	369.2180	262.2248	163.4171	116.2380	(83)
Total gains	601.7585	697.8446	779.1191	858.2208	912.4303	896.1498	853.6545	795.5755	736.0164	657.0408	590.3133	567.5693	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0819	60.2878	60.4910	61.4642	61.6497	62.5285	62.5285	62.6940	62.1870	61.6497	61.2755	60.8891	
alpha	5.0055	5.0192	5.0327	5.0976	5.1100	5.1686	5.1686	5.1796	5.1458	5.1100	5.0850	5.0593	
util living area	0.9992	0.9982	0.9953	0.9840	0.9436	0.8285	0.6672	0.7262	0.9236	0.9902	0.9984	0.9994	(86)
MIT	19.6465	19.7891	20.0267	20.3568	20.6703	20.8971	20.9745	20.9611	20.7927	20.3926	19.9661	19.6301	(87)
Th 2	19.9555	19.9587	19.9618	19.9765	19.9793	19.9922	19.9922	19.9946	19.9872	19.9793	19.9737	19.9679	(88)
util rest of house	0.9990	0.9976	0.9934	0.9771	0.9164	0.7476	0.5334	0.5968	0.8750	0.9848	0.9977	0.9992	(89)
MIT 2	18.1388	18.3496	18.6987	19.1874	19.6275	19.9151	19.9817	19.9763	19.8000	19.2445	18.6195	18.1235	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.3547	18.5557	18.8889	19.3548	19.7768	20.0557	20.1238	20.1173	19.9421	19.4089	18.8123	18.3392	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3547	18.5557	18.8889	19.3548	19.7768	20.0557	20.1238	20.1173	19.9421	19.4089	18.8123	18.3392	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9906	0.9712	0.9095	0.7535	0.5522	0.6143	0.8722	0.9803	0.9964	0.9987	(94)
Useful gains	600.7357	695.2009	771.7757	833.4844	829.8583	675.2813	471.3508	488.7010	641.9579	644.0772	588.1998	566.8564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2003.6334	1940.1120	1754.2146	1456.9213	1122.1434	747.3317	482.7024	507.8573	804.6592	1223.8554	1637.1843	1988.9674	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1043.7559	836.5803	730.9345	448.8745	217.4601	0.0000	0.0000	0.0000	0.0000	431.3550	755.2689	1058.0506	(98)
Space heating												5522.2799	(98)
Space heating per m2											(98) / (4) =	44.7728	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5918.8423	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1043.7559	836.5803	730.9345	448.8745	217.4601	0.0000	0.0000	0.0000	0.0000	431.3550	755.2689	1058.0506	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1118.7094	896.6563	783.4239	481.1088	233.0763	0.0000	0.0000	0.0000	0.0000	462.3312	809.5057	1134.0306	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0700	156.9458	162.7376	142.9846	138.0111	120.2923	112.6591	127.5869	128.6100	148.4088	160.5718	173.7836	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7542	89.7116	89.6223	89.4032	88.8674	86.7000	86.7000	86.7000	86.7000	89.3503	89.6474	89.7741	(217)
Fuel for water heating, kWh/month													
	199.5115	174.9449	181.5815	159.9323	155.3000	138.7455	129.9412	147.1590	148.3391	166.0977	179.1149	193.5787	(219)
Water heating fuel used												1974.2463	(219)
Annual totals kWh/year													
Space heating fuel - main system												5918.8423	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1068 * 1.00) =										-683.5651		-683.5651	(233)
Total delivered energy for all uses												7784.9819	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5918.8423	0.2160	1278.4699	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.2463	0.2160	426.4372	(264)
Space and water heating			1704.9071	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-683.5651	0.5190	-354.7703	(269)
Total CO2, kg/year			1648.7997	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3700	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.8031	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.8031	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 202 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 202 - EPC	**Prop Type Ref**	Opp
Property	1 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.37	**TER**	16.46
Environmental	89 B	**% DER<TER**	18.78		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.87	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.37	$kgCO_2/m^2$	Pass
	-3.09 (-18.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.87	$kWh/m^2/yr$	
	-3.3 (-6.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.47 (average for dwelling type)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	6.47 (average for dwelling type)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	0.80	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 202 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 202 - EPC	**Prop Type Ref**	Opp
Property	1 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.37	**TER**	16.46
Environmental	89 B	**% DER<TER**	18.78		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.87	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	15.00	m³/(h.m²) @ 50 Pa
Property Tested ?	No	
As Built AP_{50}	4.47	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£289	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 202 BG2	**Issued on Date**	04/04/2025
Assessment Reference	plot 202 - EPC	**Prop Type Ref**	Opp
Property	1 Corncake Close, Boorley Green, Southampton, SO32 2TJ		

SAP Rating	88 B	**DER**	13.37	**TER**	16.46
Environmental	89 B	**% DER<TER**	18.78		
CO_2 Emissions (t/year)	1.23	**DFEE**	48.87	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	13.37	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	18.78	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	3		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	48.87	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	18.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.66	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.66	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.35	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.78	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.78	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 203 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 203 - EPC	**Prop Type Ref**	As
Property	1 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.47	**TER**	18.41
Environmental	89 B	**% DER<TER**	26.82		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.48	**TFEE**	57.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.47	$kgCO_2/m^2$	Pass
	-4.94 (-26.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.85	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.48	$kWh/m^2/yr$	
	-5.3 (-9.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	5.94 m², No overhang
Windows facing East	1.31 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	5.25 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	6.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.20	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 203 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 203 - EPC	**Prop Type Ref**	As
Property	1 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.47	**TER**	18.41
Environmental	89 B	**% DER<TER**	26.82		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.48	**TFEE**	57.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.47 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.5 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.40 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   5.94 m², No overhang
Windows facing East:                    1.31 m², No overhang
Windows facing South East:              1.02 m², No overhang
Windows facing South:                   5.25 m², No overhang
Windows facing South West:              1.02 m², No overhang
Windows facing West:                    6.71 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.021 W/m²K
Photovoltaic array                      1.20 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.4251	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4200	0.4118	0.4036	0.3624	0.3541	0.3130	0.3130	0.3047	0.3294	0.3541	0.3706	0.3871	(22b)
Effective ac	0.5882	0.5848	0.5814	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5749	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2500	1.2357	26.2595			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1900	9.3632			(28a)
External Wall	142.9500	25.4900	117.4600	0.2700	31.7142			(29a)
Main Roof	47.9200		47.9200	0.1600	7.6672			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5625			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1602	(36)
Total fabric heat loss (33) + (36) =	86.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3258	47.0502	46.7801	45.5112	45.2738	44.1687	44.1687	43.9640	44.5944	45.2738	45.7541	46.2561	(38)
Heat transfer coeff	134.0485	133.7729	133.5028	132.2339	131.9965	130.8914	130.8914	130.6868	131.3171	131.9965	132.4768	132.9789	(39)
Average = Sum(39)m / 12 =												132.2328	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3791	1.3763	1.3735	1.3604	1.3580	1.3466	1.3466	1.3445	1.3510	1.3580	1.3629	1.3681	(40)
HLP (average)												1.3604	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8689	10.7106	11.8359	11.4160	11.7675	11.3544	11.7121	11.7480	11.3880	11.8071	11.4604	11.8582	(61)
Total heat required for water heating calculated for each month													
	172.7302	151.4009	157.0157	137.9872	133.2156	116.1549	108.8251	123.1867	124.1576	143.2292	154.9179	167.6438	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	172.7302	151.4009	157.0157	137.9872	133.2156	116.1549	108.8251	123.1867	124.1576	143.2292	154.9179	167.6438	(64)
									Total per year (kWh/year) = Sum(64)m =			1690.4647	(64)
Heat gains from water heating, kWh/month													
	56.4536	49.4572	51.2313	44.9389	43.3234	37.6848	35.2181	39.9904	40.3429	46.6496	50.5647	54.7633	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4536	19.9431	16.2188	12.2787	9.1785	7.7489	8.3729	10.8834	14.6077	18.5478	21.6481	23.0777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	75.8785	73.5970	68.8592	62.4152	58.2303	52.3400	47.3362	53.7505	56.0318	62.7011	70.2288	73.6065	(72)
Total internal gains													
	416.7329	414.5530	399.5086	375.1115	350.1375	326.1925	310.7062	317.0189	329.6068	354.2293	382.5460	403.9785	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.9400	10.6334	0.7200	0.7000	0.7700	22.0608	(74)
East	1.3100	19.6403	0.7200	0.7000	0.7700	8.9863	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2500	46.7521	0.7200	0.7000	0.7700	85.7282	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	6.7100	19.6403	0.7200	0.7000	0.7700	46.0292	(80)

Solar gains	189.0208	334.8380	488.8230	651.4025	767.2353	777.1284	742.8899	654.8418	545.2527	378.6775	228.8309	160.1458	(83)
Total gains	605.7537	749.3910	888.3317	1026.5140	1117.3728	1103.3208	1053.5961	971.8607	874.8595	732.9068	611.3770	564.1242	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.3549	50.4586	50.5607	51.0459	51.1377	51.5695	51.5695	51.6502	51.4023	51.1377	50.9523	50.7599	
alpha	4.3570	4.3639	4.3707	4.4031	4.4092	4.4380	4.4380	4.4433	4.4268	4.4092	4.3968	4.3840	
util living area													
	0.9975	0.9935	0.9817	0.9441	0.8513	0.6899	0.5290	0.5884	0.8297	0.9697	0.9947	0.9982	(86)
MIT	19.4841	19.6923	20.0125	20.4130	20.7427	20.9286	20.9827	20.9727	20.8321	20.3836	19.8529	19.4472	(87)
Th 2	19.7794	19.7816	19.7837	19.7938	19.7957	19.8045	19.8045	19.8061	19.8011	19.7957	19.7919	19.7879	(88)
util rest of house													
	0.9967	0.9912	0.9751	0.9230	0.7965	0.5875	0.3941	0.4502	0.7472	0.9542	0.9925	0.9976	(89)
MIT 2	17.7807	18.0854	18.5501	19.1218	19.5521	19.7593	19.7987	19.7957	19.6715	19.0942	18.3279	17.7325	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.1277	18.4127	18.8480	19.3848	19.7947	19.9975	20.0399	20.0355	19.9079	19.3569	18.6386	18.0818	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1277	18.4127	18.8480	19.3848	19.7947	19.9975	20.0399	20.0355	19.9079	19.3569	18.6386	18.0818	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9873	0.9679	0.9139	0.7964	0.6054	0.4217	0.4783	0.7558	0.9463	0.9892	0.9962	(94)
Useful gains	602.6257	739.9005	859.8351	938.1547	889.9192	667.9307	444.2626	464.7989	661.2297	693.5840	604.8045	561.9535	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1853.5865	1807.6362	1648.4871	1386.4501	1068.4677	706.4878	450.2471	475.1076	762.6733	1155.8744	1528.5948	1845.9837	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	930.7148	717.5184	586.7571	322.7727	132.8401	0.0000	0.0000	0.0000	0.0000	343.9440	665.1290	955.3185	(98)
Space heating												4654.9946	(98)
Space heating per m2											(98) / (4) =	47.8909	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4989.2761	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	930.7148	717.5184	586.7571	322.7727	132.8401	0.0000	0.0000	0.0000	0.0000	343.9440	665.1290	955.3185	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	997.5507	769.0444	628.8929	345.9515	142.3795	0.0000	0.0000	0.0000	0.0000	368.6431	712.8928	1023.9212	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7302	151.4009	157.0157	137.9872	133.2156	116.1549	108.8251	123.1867	124.1576	143.2292	154.9179	167.6438	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7169	89.6514	89.5153	89.1909	88.4609	86.7000	86.7000	86.7000	86.7000	89.2109	89.5972	89.7437	(217)
Fuel for water heating, kWh/month													
	192.5281	168.8774	175.4065	154.7100	150.5927	133.9734	125.5192	142.0838	143.2036	160.5511	172.9048	186.8028	(219)
Water heating fuel used												1907.1535	(219)
Annual totals kWh/year													
Space heating fuel - main system												4989.2761	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.5383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 853 * 1.00) =										-818.9087		-818.9087	(233)
Total delivered energy for all uses												6549.0592	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4989.2761	0.2160	1077.6836	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.1535	0.2160	411.9452	(264)
Space and water heating			1489.6288	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.5383	0.5190	205.8034	(268)
Energy saving/generation technologies				
PV Unit	-818.9087	0.5190	-425.0136	(269)
Total CO2, kg/year			1309.3435	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.4700	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		30.7100	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7100	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1230	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3730	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.3200	118.6300	0.1800	21.3534			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8598			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.1035	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7982	123.5859	123.3778	122.4006	122.2178	121.3666	121.3666	121.2090	121.6945	122.2178	122.5876	122.9743	(39)
Average = Sum(39)m / 12 =												122.3997	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2736	1.2715	1.2693	1.2593	1.2574	1.2486	1.2486	1.2470	1.2520	1.2574	1.2612	1.2652	(40)
HLP (average)												1.2593	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5307	20.0116	16.2745	12.3209	9.2100	7.7755	8.4017	10.9208	14.6579	18.6115	21.7224	23.1569	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9451	427.7602	412.7105	387.7375	362.0872	337.4735	321.9963	328.9811	342.2506	367.4488	395.7644	417.1964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.6100	10.6334	0.6300	0.7000	0.7700	18.2308	(74)
East	1.2400	19.6403	0.6300	0.7000	0.7700	7.4429	(76)
Southeast	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(77)
South	4.9600	46.7521	0.6300	0.7000	0.7700	70.8687	(78)
Southwest	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(79)
West	6.3500	19.6403	0.6300	0.7000	0.7700	38.1147	(80)

Solar gains	156.2469	276.8004	404.1337	538.5902	634.3884	642.5762	614.2629	541.4448	450.8033	313.0525	189.1582	132.3759	(83)
Total gains	586.1920	704.5606	816.8442	926.3277	996.4756	980.0497	936.2592	870.4259	793.0539	680.5014	584.9226	549.5723	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5242	54.6179	54.7100	55.1468	55.2293	55.6166	55.6166	55.6889	55.4668	55.2293	55.0626	54.8895	
alpha	4.6349	4.6412	4.6473	4.6765	4.6820	4.7078	4.7078	4.7126	4.6978	4.6820	4.6708	4.6593	
util living area													
	0.9979	0.9948	0.9856	0.9551	0.8735	0.7177	0.5522	0.6099	0.8472	0.9743	0.9955	0.9985	(86)
MIT	19.5992	19.7816	20.0696	20.4351	20.7478	20.9303	20.9839	20.9747	20.8408	20.4238	19.9378	19.5641	(87)
Th 2	19.8615	19.8633	19.8649	19.8729	19.8744	19.8813	19.8813	19.8826	19.8786	19.8744	19.8714	19.8682	(88)
util rest of house													
	0.9972	0.9929	0.9803	0.9378	0.8251	0.6204	0.4209	0.4766	0.7716	0.9612	0.9937	0.9979	(89)
MIT 2	18.0043	18.2715	18.6902	19.2147	19.6288	19.8355	19.8756	19.8724	19.7517	19.2090	18.5059	17.9577	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.3292	18.5791	18.9712	19.4633	19.8568	20.0585	20.1013	20.0970	19.9736	19.4564	18.7976	18.2849	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3292	18.5791	18.9712	19.4633	19.8568	20.0585	20.1013	20.0970	19.9736	19.4564	18.7976	18.2849	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9899	0.9746	0.9298	0.8242	0.6372	0.4478	0.5036	0.7791	0.9545	0.9910	0.9967	(94)
Useful gains	583.6579	697.4365	796.0611	861.3034	821.2755	624.4413	419.2510	438.3713	617.8806	649.5197	579.6363	547.7856	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1736.7866	1690.5482	1538.6681	1292.9563	996.9016	662.4794	424.9444	448.1056	714.7840	1082.4127	1433.9821	1732.0860	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	857.9278	667.3711	552.4996	310.7901	130.6658	0.0000	0.0000	0.0000	0.0000	322.0724	615.1290	881.1195	(98)
Space heating												4337.5753	(98)
Space heating per m2											(98) / (4) =	44.6253	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4644.0849	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	857.9278	667.3711	552.4996	310.7901	130.6658	0.0000	0.0000	0.0000	0.0000	322.0724	615.1290	881.1195	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	918.5523	714.5301	591.5413	332.7517	139.8992	0.0000	0.0000	0.0000	0.0000	344.8312	658.5964	943.3827	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2033	87.9808	87.5161	86.4921	84.4168	80.3000	80.3000	80.3000	80.3000	86.4679	87.7660	88.2896	(217)
Fuel for water heating, kWh/month													
	240.1500	212.2256	224.1173	201.4390	199.8230	185.0158	177.2592	197.6025	199.7848	210.9233	219.6438	234.1664	(219)
Water heating fuel used												2502.1506	(219)
Annual totals kWh/year													
Space heating fuel - main system												4644.0849	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9000	(232)
Total delivered energy for all uses												7619.1355	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4644.0849	0.2160	1003.1223	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2502.1506	0.2160	540.4645	(264)
Space and water heating			1543.5869	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9000	0.5190	206.5101	(268)
Total CO2, kg/m2/year			1789.0220	(272)
Emissions per m2 for space and water heating			15.8805	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1246	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8805 * 1.00) + 2.1246 + 0.4005, rounded to 2 d.p.			18.4100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 203 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 203 - EPC	**Prop Type Ref**	As
Property	1 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.47	**TER**	18.41
Environmental	89 B	**% DER<TER**	26.82		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.48	**TFEE**	57.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.47	$kgCO_2/m^2$	Pass
	-4.94 (-26.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.85	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.48	$kWh/m^2/yr$	
	-5.3 (-9.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	5.94 m², No overhang
Windows facing East	1.31 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	5.25 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	6.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.20	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 203 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 203 - EPC	**Prop Type Ref**	As
Property	1 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.47	**TER**	18.41
Environmental	89 B	**% DER<TER**	26.82		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.48	**TFEE**	57.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	49.28 m²	2.39 m
1st Storey:	1.00 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	142.95	117.46

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.92	47.92
Bay Roof	External Slope Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	49.28

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3a	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.02	10
W3b	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.25	10
W3c	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	10
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00	1.31	10
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	1.31	10
D1	Half Glazed Door	[1] External Wall	West			2.12	10
D2*	Half Glazed Door	[1] External Wall	East			2.12	10
D3 (W14)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.060	No
Independently assessed	E3 Sill	14.79	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.84	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.40	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.20	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£91	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 203 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 203 - EPC	**Prop Type Ref**	As
Property	1 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.47	**TER**	18.41
Environmental	89 B	**% DER<TER**	26.82		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.48	**TFEE**	57.85
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	13.47	$kgCO_2/yr/m^2$	
TER	18.41	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.47	$kgCO_2/yr/m^2$	
Reduction DER/TER	26.82	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.48	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	20.28	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.52	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.52	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.91	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 204 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 204 - EPC	**Prop Type Ref**	As
Property	3 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.18	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.90	**DFEE**	44.48	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.20	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.18	$kgCO_2/m^2$	Pass
	-4.02 (-23.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.48	$kWh/m^2/yr$	
	-5.4 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.12 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average	
Windows facing East Windows facing South Windows facing West	7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang	
Air change rate	8.00 ach	
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.12 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 204 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 204 - EPC	**Prop Type Ref**	As
Property	3 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.18	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.90	**DFEE**	44.48	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.20 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.18 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.12 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum: 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.61 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value: 0.00 W/m²K
Thermal bridging y-value: 0.021 W/m²K
Photovoltaic array: 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669 (8)
Pressure test		Yes
Measured/design AP50		4.1200
Infiltration rate		0.3729 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4041	0.3962	0.3882	0.3486	0.3407	0.3011	0.3011	0.2932	0.3169	0.3407	0.3566	0.3724	(22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3700	1.2357	16.5219			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.1800	8.6058			(28a)
External Wall	98.3600	15.4900	82.8700	0.2700	22.3749			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3146			(33)
Party Wall 1			45.1900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0412	(36)
Total fabric heat loss	(33) + (36) = 62.3557	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0119	45.7611	45.5153	44.3606	44.1446	43.1389	43.1389	42.9527	43.5263	44.1446	44.5816	45.0385	(38)
Heat transfer coeff	108.3676	108.1168	107.8710	106.7163	106.5003	105.4946	105.4946	105.3084	105.8820	106.5003	106.9373	107.3942	(39)
Average = Sum(39)m / 12 =												106.7153	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1346	1.1320	1.1294	1.1173	1.1151	1.1045	1.1045	1.1026	1.1086	1.1151	1.1196	1.1244	(40)
HLP (average)												1.1173	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8674	10.7093	11.8346	11.4137	11.7654	11.3527	11.7105	11.7461	11.3860	11.8058	11.4590	11.8568	(61)
Total heat required for water heating calculated for each month													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.6601	(64)
Heat gains from water heating, kWh/month													
	56.2193	49.2523	51.0198	44.7543	43.1463	37.5320	35.0765	39.8278	40.1784	46.4582	50.3558	54.5364	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5636	73.2921	68.5750	62.1588	57.9923	52.1277	47.1458	53.5320	55.8033	62.4438	69.9386	73.3016	(72)
Total internal gains													
	414.6320	412.2815	397.1091	372.6625	347.7218	323.9057	308.6051	315.0702	327.7969	352.4678	380.7367	402.0512	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	98.4387	188.8748	303.9668	435.3788	528.5576	539.3261	514.1464	444.6482	350.6617	222.0653	122.0280	81.4351	(83)
Total gains	513.0707	601.1563	701.0759	808.0413	876.2794	863.2319	822.7515	759.7184	678.4586	574.5331	502.7647	483.4863	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2050	61.3470	61.4868	62.1520	62.2781	62.8718	62.8718	62.9830	62.6418	62.2781	62.0236	61.7597	
alpha	5.0803	5.0898	5.0991	5.1435	5.1519	5.1915	5.1915	5.1989	5.1761	5.1519	5.1349	5.1173	
util living area													
	0.9988	0.9971	0.9907	0.9644	0.8841	0.7213	0.5512	0.6139	0.8674	0.9833	0.9975	0.9991	(86)
MIT	19.7208	19.8741	20.1417	20.4936	20.7865	20.9479	20.9894	20.9821	20.8592	20.4630	20.0261	19.6948	(87)
Th 2	19.9727	19.9748	19.9769	19.9867	19.9885	19.9971	19.9971	19.9987	19.9938	19.9885	19.9848	19.9809	(88)
util rest of house													
	0.9984	0.9961	0.9873	0.9507	0.8405	0.6316	0.4323	0.4920	0.8011	0.9747	0.9964	0.9988	(89)
MIT 2	18.2596	18.4850	18.8759	19.3855	19.7766	19.9620	19.9932	19.9912	19.8770	19.3509	18.7149	18.2274	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4823	18.6967	19.0689	19.5544	19.9306	20.1123	20.1450	20.1423	20.0267	19.5205	18.9148	18.4511	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4823	18.6967	19.0689	19.5544	19.9306	20.1123	20.1450	20.1423	20.0267	19.5205	18.9148	18.4511	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9941	0.9830	0.9431	0.8376	0.6427	0.4504	0.5104	0.8037	0.9690	0.9947	0.9981	(94)
Useful gains	511.7714	597.6259	689.1385	762.0433	733.9551	554.7921	370.5537	387.7304	545.2834	556.7078	500.0880	482.5765	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1536.9036	1491.6593	1355.8159	1137.0004	876.5585	581.5185	373.9835	394.0911	627.5337	950.0324	1263.4395	1530.4900	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	762.6983	600.7904	496.0080	269.9691	106.0969	0.0000	0.0000	0.0000	0.0000	292.6335	549.6131	779.6476	(98)
Space heating												3857.4569	(98)
Space heating per m2											(98) / (4) =	40.3880	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4134.4661	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	762.6983	600.7904	496.0080	269.9691	106.0969	0.0000	0.0000	0.0000	0.0000	292.6335	549.6131	779.6476	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	817.4687	643.9340	531.6270	289.3560	113.7158	0.0000	0.0000	0.0000	0.0000	313.6479	589.0815	835.6352	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6152	89.5540	89.4101	89.0526	88.2635	86.7000	86.7000	86.7000	86.7000	89.0877	89.4856	89.6435	(217)
Fuel for water heating, kWh/month													
	191.9599	168.3726	174.9014	154.3261	150.3254	133.4428	125.0275	141.5195	142.6325	160.1267	172.4180	186.2501	(219)
Water heating fuel used												1901.3026	(219)
Annual totals kWh/year													
Space heating fuel - main system												4134.4661	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 908 * 1.00) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												5950.0911	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4134.4661	0.2160	893.0447	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.3026	0.2160	410.6814	(264)
Space and water heating			1303.7260	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Energy saving/generation technologies				
PV Unit	-581.0267	0.5190	-301.5529	(269)
Total CO2, kg/year			1259.2594	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.1800	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.5429	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.5429	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	98.3600	15.4900	82.8700	0.1800	14.9166			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6023			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.8436	(36)
Total fabric heat loss (33) + (36) =	57.4459	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	103.5372	103.2833	103.0344	101.8656	101.6469	100.6289	100.6289	100.4404	101.0210	101.6469	102.0893	102.5518	(39)
Average = Sum(39)m / 12 =												101.8645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0840	1.0814	1.0788	1.0665	1.0643	1.0536	1.0536	1.0516	1.0577	1.0643	1.0689	1.0737	(40)
HLP (average)												1.0665	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.7675	425.4207	410.2557	385.1748	359.5713	335.0943	319.8006	326.9262	340.3189	365.6241	393.8812	415.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	86.1339	165.2654	265.9710	380.9565	462.4879	471.9104	449.8781	389.0671	306.8290	194.3072	106.7745	71.2557	(83)
Total gains	513.9014	590.6861	676.2267	766.1312	822.0592	807.0047	769.6787	715.9934	647.1479	559.9312	500.6557	486.4461	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.0605	64.2179	64.3730	65.1117	65.2518	65.9119	65.9119	66.0356	65.6560	65.2518	64.9690	64.6760	
alpha	5.2707	5.2812	5.2915	5.3408	5.3501	5.3941	5.3941	5.4024	5.3771	5.3501	5.3313	5.3117	
util living area													
	0.9988	0.9973	0.9917	0.9686	0.8950	0.7355	0.5625	0.6224	0.8727	0.9840	0.9975	0.9991	(86)
MIT	19.7900	19.9308	20.1797	20.5102	20.7907	20.9495	20.9902	20.9836	20.8677	20.4944	20.0821	19.7667	(87)
Th 2	20.0139	20.0161	20.0182	20.0282	20.0301	20.0389	20.0389	20.0405	20.0355	20.0301	20.0263	20.0223	(88)
util rest of house													
	0.9984	0.9963	0.9886	0.9564	0.8547	0.6489	0.4463	0.5040	0.8093	0.9758	0.9965	0.9988	(89)
MIT 2	18.3902	18.5974	18.9614	19.4420	19.8193	20.0042	20.0351	20.0335	19.9244	19.4271	18.8265	18.3622	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.6036	18.8007	19.1471	19.6048	19.9674	20.1483	20.1807	20.1783	20.0682	19.5898	19.0179	18.5763	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6036	18.8007	19.1471	19.6048	19.9674	20.1483	20.1807	20.1783	20.0682	19.5898	19.0179	18.5763	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9946	0.9848	0.9495	0.8516	0.6596	0.4640	0.5218	0.8119	0.9705	0.9948	0.9981	(94)
Useful gains	512.6319	587.4814	665.9490	727.4158	700.1021	532.2657	357.1049	373.6169	525.4013	543.4152	498.0561	485.5432	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1480.9502	1435.7080	1303.0855	1090.4543	840.3528	558.3223	360.3252	379.4967	602.9148	913.7853	1216.6952	1474.3125	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	720.4288	570.0083	474.0296	261.3877	104.3465	0.0000	0.0000	0.0000	0.0000	275.5553	517.4202	735.6444	(98)
Space heating												3658.8208	(98)
Space heating per m2											(98) / (4) =	38.3082	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3917.3671	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	720.4288	570.0083	474.0296	261.3877	104.3465	0.0000	0.0000	0.0000	0.0000	275.5553	517.4202	735.6444	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	771.3371	610.2873	507.5263	279.8584	111.7200	0.0000	0.0000	0.0000	0.0000	295.0271	553.9831	787.6278	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8945	87.6854	87.1975	86.0810	83.8918	80.3000	80.3000	80.3000	80.3000	86.0954	87.4224	87.9786	(217)
Fuel for water heating, kWh/month													
	240.1932	212.2387	224.2081	201.5159	200.1942	184.2067	176.4840	196.7383	198.9111	211.1685	219.7894	234.2197	(219)
Water heating fuel used												2499.8678	(219)
Annual totals kWh/year													
Space heating fuel - main system												3917.3671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Total delivered energy for all uses												6912.5840	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3917.3671	0.2160	846.1513	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2499.8678	0.2160	539.9715	(264)
Space and water heating			1386.1227	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Total CO2, kg/m2/year			1643.2089	(272)
Emissions per m2 for space and water heating			14.5129	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2842	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5129 * 1.00) + 2.2842 + 0.4075, rounded to 2 d.p.			17.2000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 204 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 204 - EPC	**Prop Type Ref**	As
Property	3 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.18	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.90	**DFEE**	44.48	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.20	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.18	$kgCO_2/m^2$	Pass
	-4.02 (-23.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.48	$kWh/m^2/yr$	
	-5.4 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.12 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.12 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 204 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 204 - EPC	**Prop Type Ref**	As
Property	3 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.18	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.90	**DFEE**	44.48	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	98.36	82.87

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	45.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	47.81

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W8)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.33	0.060	No
Independently assessed	E3 Sill	8.73	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	19.63	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.63	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.63	0.030	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.02	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.02	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.02	0.045	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.12	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	

In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£101	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 204 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 204 - EPC	**Prop Type Ref**	As
Property	3 Crane Way, Boorley Green, Southhampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.18	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.90	**DFEE**	44.48	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.18	$kgCO_2/yr/m^2$	
TER	17.20	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.18	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.39	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	44.48	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	18.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.40	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	32.76	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	32.76	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 205 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 205 - EPC	**Prop Type Ref**	Opp
Property	5 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.38	**TER**	17.31
Environmental	90 B	**% DER<TER**	22.71		
CO_2 Emissions (t/year)	0.91	**DFEE**	45.29	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.38	$kgCO_2/m^2$	Pass
	-3.93 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.42	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.29	$kWh/m^2/yr$	
	-5.1 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

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Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.71 m², No overhang 7.61 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.80	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 205 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 205 - EPC	**Prop Type Ref**	Opp
Property	5 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.38	**TER**	17.31
Environmental	90 B	**% DER<TER**	22.71		
CO_2 Emissions (t/year)	0.91	**DFEE**	45.29	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 7.61 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669 (8)
Pressure test		Yes
Measured/design AP50		4.4800
Infiltration rate		0.3909 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3322 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4236	0.4153	0.4070	0.3655	0.3572	0.3156	0.3156	0.3073	0.3322	0.3572	0.3738	0.3904	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3700	1.2357	16.5219			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.1800	8.6058			(28a)
External Wall	98.3600	15.4900	82.8700	0.2700	22.3749			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3146			(33)
Party Wall 1			45.1900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0412 (36)
Total fabric heat loss (33) + (36) =	62.3557 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6506	46.3750	46.1048	44.8360	44.5986	43.4935	43.4935	43.2888	43.9192	44.5986	45.0788	45.5809	(38)
Heat transfer coeff	109.0063	108.7307	108.4605	107.1917	106.9543	105.8492	105.8492	105.6445	106.2749	106.9543	107.4346	107.9366	(39)
Average = Sum(39)m / 12 =												107.1906	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1413	1.1384	1.1356	1.1223	1.1198	1.1083	1.1083	1.1061	1.1127	1.1198	1.1249	1.1301	(40)
HLP (average)												1.1223	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8674	10.7093	11.8346	11.4137	11.7654	11.3527	11.7105	11.7461	11.3860	11.8058	11.4590	11.8568	(61)
Total heat required for water heating calculated for each month													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(64)
									Total per year (kWh/year) = Sum(64)m =			1683.6601	(64)
Heat gains from water heating, kWh/month													
	56.2193	49.2523	51.0198	44.7543	43.1463	37.5320	35.0765	39.8278	40.1784	46.4582	50.3558	54.5364	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5636	73.2921	68.5750	62.1588	57.9923	52.1277	47.1458	53.5320	55.8033	62.4438	69.9386	73.3016	(72)
Total internal gains													
	414.6320	412.2815	397.1091	372.6625	347.7218	323.9057	308.6051	315.0702	327.7969	352.4678	380.7367	402.0512	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	89.4819	174.9265	288.3430	421.7968	518.5997	531.7472	505.8798	433.3282	335.6912	207.5841	111.5385	73.6154	(83)
Total gains	504.1139	587.2080	685.4521	794.4593	866.3215	855.6529	814.4849	748.3984	663.4881	560.0519	492.2752	475.6665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8464	61.0006	61.1526	61.8764	62.0138	62.6612	62.6612	62.7826	62.4102	62.0138	61.7366	61.4494	
alpha	5.0564	5.0667	5.0768	5.1251	5.1343	5.1774	5.1774	5.1855	5.1607	5.1343	5.1158	5.0966	
util living area													
	0.9989	0.9974	0.9916	0.9669	0.8889	0.7273	0.5578	0.6233	0.8765	0.9851	0.9977	0.9992	(86)
MIT	19.7031	19.8521	20.1196	20.4774	20.7779	20.9454	20.9887	20.9807	20.8498	20.4457	20.0100	19.6795	(87)
Th 2	19.9672	19.9696	19.9719	19.9827	19.9847	19.9941	19.9941	19.9958	19.9905	19.9847	19.9806	19.9763	(88)
util rest of house													
	0.9985	0.9965	0.9885	0.9539	0.8463	0.6375	0.4375	0.5001	0.8124	0.9773	0.9967	0.9989	(89)
MIT 2	18.2298	18.4493	18.8404	19.3601	19.7632	19.9571	19.9899	19.9877	19.8643	19.3237	18.6884	18.2018	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4544	18.6631	19.0354	19.5304	19.9179	20.1078	20.1421	20.1390	20.0145	19.4948	18.8898	18.4270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4544	18.6631	19.0354	19.5304	19.9179	20.1078	20.1421	20.1390	20.0145	19.4948	18.8898	18.4270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9947	0.9844	0.9464	0.8430	0.6485	0.4558	0.5186	0.8142	0.9718	0.9951	0.9982	(94)
Useful gains	502.9261	584.0789	674.7831	751.9058	730.2839	554.8825	371.2568	388.0896	540.2225	544.2705	489.8757	474.8298	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1542.9202	1496.4733	1359.5944	1139.4922	878.9386	582.9928	374.9319	395.0085	628.5668	951.3325	1266.6350	1535.6185	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	773.7556	613.1290	509.4996	279.0622	110.5991	0.0000	0.0000	0.0000	0.0000	302.8541	559.2667	789.2268	(98)
Space heating												3937.3932	(98)
Space heating per m2											(98) / (4) =	41.2249	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4220.1427	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.7556	613.1290	509.4996	279.0622	110.5991	0.0000	0.0000	0.0000	0.0000	302.8541	559.2667	789.2268	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	829.3201	657.1586	546.0875	299.1021	118.5414	0.0000	0.0000	0.0000	0.0000	324.6025	599.4284	845.9022	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0252	150.7844	156.3795	137.4315	132.6824	115.6949	108.3989	122.6974	123.6624	142.6532	154.2892	166.9611	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6231	89.5659	89.4280	89.0795	88.3004	86.7000	86.7000	86.7000	86.7000	89.1152	89.4965	89.6500	(217)
Fuel for water heating, kWh/month													
	191.9429	168.3501	174.8665	154.2796	150.2626	133.4428	125.0275	141.5195	142.6325	160.0774	172.3969	186.2365	(219)
Water heating fuel used												1901.0350	(219)
Annual totals kWh/year													
Space heating fuel - main system												4220.1427	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 908 * 1.00) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												6035.5001	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4220.1427	0.2160	911.5508	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.0350	0.2160	410.6236	(264)
Space and water heating			1322.1744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Energy saving/generation technologies				
PV Unit	-581.0267	0.5190	-301.5529	(269)
Total CO2, kg/year			1277.7077	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3800	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.7429	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7429	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	98.3600	15.4900	82.8700	0.1800	14.9166			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6023			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.8436	(36)
Total fabric heat loss (33) + (36) =	57.4459	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	103.5372	103.2833	103.0344	101.8656	101.6469	100.6289	100.6289	100.4404	101.0210	101.6469	102.0893	102.5518	(39)
Average = Sum(39)m / 12 =												101.8645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0840	1.0814	1.0788	1.0665	1.0643	1.0536	1.0536	1.0516	1.0577	1.0643	1.0689	1.0737	(40)
HLP (average)												1.0665	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.7675	425.4207	410.2557	385.1748	359.5713	335.0943	319.8006	326.9262	340.3189	365.6241	393.8812	415.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	78.2967	153.0607	252.3001	369.0722	453.7747	465.2788	442.6448	379.1622	293.7298	181.6361	97.5961	64.4134	(83)
Total gains	506.0642	578.4814	662.5558	754.2470	813.3461	800.3731	762.4454	706.0884	634.0487	547.2601	491.4773	479.6038	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.0605	64.2179	64.3730	65.1117	65.2518	65.9119	65.9119	66.0356	65.6560	65.2518	64.9690	64.6760	
alpha	5.2707	5.2812	5.2915	5.3408	5.3501	5.3941	5.3941	5.4024	5.3771	5.3501	5.3313	5.3117	
util living area													
	0.9989	0.9975	0.9924	0.9705	0.8985	0.7398	0.5673	0.6298	0.8802	0.9855	0.9977	0.9992	(86)
MIT	19.7822	19.9188	20.1667	20.5002	20.7857	20.9481	20.9898	20.9827	20.8610	20.4828	20.0731	19.7599	(87)
Th 2	20.0139	20.0161	20.0182	20.0282	20.0301	20.0389	20.0389	20.0405	20.0355	20.0301	20.0263	20.0223	(88)
util rest of house													
	0.9985	0.9967	0.9896	0.9589	0.8590	0.6533	0.4504	0.5106	0.8187	0.9780	0.9968	0.9989	(89)
MIT 2	18.3788	18.5800	18.9426	19.4282	19.8135	20.0031	20.0350	20.0330	19.9176	19.4108	18.8134	18.3522	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.5928	18.7841	19.1292	19.5916	19.9617	20.1472	20.1805	20.1778	20.0614	19.5742	19.0054	18.5668	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5928	18.7841	19.1292	19.5916	19.9617	20.1472	20.1805	20.1778	20.0614	19.5742	19.0054	18.5668	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9860	0.9521	0.8557	0.6639	0.4682	0.5285	0.8207	0.9729	0.9952	0.9983	(94)
Useful gains	504.8980	575.6154	653.2816	718.1372	695.9594	531.3433	356.9439	373.1995	520.3598	532.4545	489.1248	478.7698	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1479.8343	1433.9925	1301.2418	1089.1061	839.7731	558.2044	360.3048	379.4441	602.2293	912.1993	1215.4163	1473.3435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	725.3526	576.8294	482.0824	267.0976	106.9974	0.0000	0.0000	0.0000	0.0000	282.5301	522.9299	739.9629	(98)
Space heating												3703.7822	(98)
Space heating per m2											(98) / (4) =	38.7790	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3965.5056	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	725.3526	576.8294	482.0824	267.0976	106.9974	0.0000	0.0000	0.0000	0.0000	282.5301	522.9299	739.9629	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	776.6088	617.5903	516.1481	285.9717	114.5583	0.0000	0.0000	0.0000	0.0000	302.4948	559.8821	792.2515	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9074	87.7090	87.2342	86.1343	83.9501	80.3000	80.3000	80.3000	80.3000	86.1570	87.4446	87.9894	(217)
Fuel for water heating, kWh/month													
	240.1582	212.1817	224.1137	201.3912	200.0553	184.2067	176.4840	196.7383	198.9111	211.0174	219.7337	234.1910	(219)
Water heating fuel used												2499.1823	(219)
Annual totals kWh/year													
Space heating fuel - main system												3965.5056	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Total delivered energy for all uses												6960.0369	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3965.5056	0.2160	856.5492	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2499.1823	0.2160	539.8234	(264)
Space and water heating			1396.3726	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Total CO2, kg/m2/year			1653.4588	(272)
Emissions per m2 for space and water heating			14.6202	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2842	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6202 * 1.00) + 2.2842 + 0.4075, rounded to 2 d.p.			17.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 205 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 205 - EPC	**Prop Type Ref**	Opp
Property	5 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.38	**TER**	17.31
Environmental	90 B	**% DER<TER**	22.71		
CO_2 Emissions (t/year)	0.91	**DFEE**	45.29	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.38	$kgCO_2/m^2$	Pass
	-3.93 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.42	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.29	$kWh/m^2/yr$	
	-5.1 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.71 m², No overhang 7.61 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 205 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 205 - EPC	**Prop Type Ref**	Opp
Property	5 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.38	**TER**	17.31
Environmental	90 B	**% DER<TER**	22.71		
CO_2 Emissions (t/year)	0.91	**DFEE**	45.29	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	98.36	82.87

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	45.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	47.81

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W8)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.33	0.060	No
Independently assessed	E3 Sill	8.73	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	19.63	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.63	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.63	0.030	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.02	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.02	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.02	0.045	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	

In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£103	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 205 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 205 - EPC	**Prop Type Ref**	Opp
Property	5 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.38	**TER**	17.31
Environmental	90 B	**% DER<TER**	22.71		
CO_2 Emissions (t/year)	0.91	**DFEE**	45.29	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.38	$kgCO_2/yr/m^2$	
TER	17.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.38	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.71	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	45.29	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	18.76	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.12	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.12	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	32.97	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	32.97	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 206 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 206 - EPC	**Prop Type Ref**	As
Property	7 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.91	**TER**	18.59
Environmental	89 B	**% DER<TER**	25.16		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	59.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.91	$kgCO_2/m^2$	Pass
	-4.68 (-25.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.58	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.54	$kWh/m^2/yr$	
	-5.1 (-8.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.38 m², No overhang 8.37 m², No overhang 7.69 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.20	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 206 BG2	**Issued on Date**	04/04/2025
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Property	7 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.91	**TER**	18.59
Environmental	89 B	**% DER<TER**	25.16		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	59.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 101 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.45 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.38 m², No overhang
Windows facing East: 8.37 m², No overhang
Windows facing West: 7.69 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.20 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3300 (1b)	x	2.3900 (2b)	=	120.2887	(1b) - (3b)
First floor	50.3300 (1c)	x	2.6300 (2c)	=	132.3679	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.6566	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1979	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.4204	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3573	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4556	0.4467	0.4377	0.3931	0.3841	0.3395	0.3395	0.3305	0.3573	0.3841	0.4020	0.4199	(22b)
Effective ac	0.6038	0.5998	0.5958	0.5773	0.5738	0.5576	0.5576	0.5546	0.5638	0.5738	0.5808	0.5881	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.4400	1.2357	22.7871			(27)
Opening Type 8			4.2400	1.5000	6.3600			(26a)
Ground floor			50.3300	0.1900	9.5627			(28a)
External Wall	144.4200	22.6800	121.7400	0.2700	32.8698			(29a)
Main Roof	50.3300		50.3300	0.1600	8.0528			(30)
Total net area of external elements Aum(A, m2)			245.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.6324			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7736	(36)
Total fabric heat loss					(33) + (36) =		84.4060	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.3418	50.0058	49.6764	48.1294	47.8399	46.4925	46.4925	46.2430	47.0115	47.8399	48.4255	49.0377	(38)
Heat transfer coeff	134.7479	134.4118	134.0825	132.5354	132.2460	130.8985	130.8985	130.6490	131.4175	132.2460	132.8315	133.4437	(39)
Average = Sum(39)m / 12 =												132.5340	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3386	1.3353	1.3320	1.3167	1.3138	1.3004	1.3004	1.2979	1.3056	1.3138	1.3196	1.3257	(40)
HLP (average)												1.3167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7456	(42)
Average daily hot water use (litres/day)												99.4069	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3476	105.3713	101.3950	97.4187	93.4425	89.4662	89.4662	93.4425	97.4187	101.3950	105.3713	109.3476	(44)
Energy conte	162.1593	141.8255	146.3512	127.5926	122.4281	105.6461	97.8967	112.3379	113.6795	132.4825	144.6151	157.0426	(45)
Energy content (annual)										Total = Sum(45)m =		1564.0571	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3239	21.2738	21.9527	19.1389	18.3642	15.8469	14.6845	16.8507	17.0519	19.8724	21.6923	23.5564	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8716	10.7130	11.8384	11.4201	11.7713	11.3576	11.7150	11.7515	11.3917	11.8093	11.4628	11.8609	(61)
Total heat required for water heating calculated for each month													
	174.0309	152.5385	158.1896	139.0127	134.1994	117.0037	109.6117	124.0894	125.0712	144.2918	156.0778	168.9034	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0309	152.5385	158.1896	139.0127	134.1994	117.0037	109.6117	124.0894	125.0712	144.2918	156.0778	168.9034	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.0202	(64)
Heat gains from water heating, kWh/month													
	56.8859	49.8352	51.6214	45.2796	43.6502	37.9667	35.4794	40.2902	40.6464	47.0028	50.9502	55.1819	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3725	20.7592	16.8825	12.7812	9.5541	8.0659	8.7155	11.3288	15.2055	19.3069	22.5339	24.0221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.3904	260.0613	253.3307	239.0020	220.9147	203.9151	192.5584	189.8875	196.6181	210.9467	229.0341	246.0336	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	(71)
Water heating gains (Table 5)													
	76.4595	74.1596	69.3836	62.8883	58.6696	52.7316	47.6874	54.1535	56.4533	63.1758	70.7642	74.1692	(72)
Total internal gains													
	424.4056	422.1633	406.7801	381.8547	356.3216	331.8959	316.1446	322.5531	335.4601	360.6126	389.5155	411.4081	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.3800	10.6334	0.7200	0.7000	0.7700	8.8392	(74)
East	8.3700	19.6403	0.7200	0.7000	0.7700	57.4165	(76)
West	7.6900	19.6403	0.7200	0.7000	0.7700	52.7518	(80)

Solar gains	119.0075	232.4047	383.6224	563.7333	696.4806	715.8817	680.3243	580.3156	447.2963	275.8317	148.2712	97.9658	(83)
Total gains	543.4131	654.5680	790.4024	945.5880	1052.8022	1047.7777	996.4689	902.8686	782.7564	636.4443	537.7867	509.3740	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8767	52.0064	52.1342	52.7427	52.8582	53.4023	53.4023	53.5043	53.1914	52.8582	52.6251	52.3837	
alpha	4.4584	4.4671	4.4756	4.5162	4.5239	4.5602	4.5602	4.5670	4.5461	4.5239	4.5083	4.4922	
util living area													
	0.9987	0.9967	0.9894	0.9601	0.8763	0.7184	0.5570	0.6269	0.8743	0.9833	0.9973	0.9990	(86)
MIT	19.4597	19.6357	19.9505	20.3699	20.7216	20.9227	20.9810	20.9683	20.7982	20.3209	19.8144	19.4333	(87)
Th 2	19.8107	19.8133	19.8158	19.8278	19.8300	19.8405	19.8405	19.8425	19.8365	19.8300	19.8255	19.8208	(88)
util rest of house													
	0.9982	0.9955	0.9853	0.9441	0.8275	0.6185	0.4207	0.4876	0.8040	0.9741	0.9961	0.9987	(89)
MIT 2	17.7661	18.0248	18.4844	19.0909	19.5593	19.7901	19.8339	19.8297	19.6709	19.0330	18.2949	17.7342	(90)
Living area fraction									fLA = Living area / (4) =			0.1737	(91)
MIT	18.0602	18.3046	18.7390	19.3130	19.7612	19.9868	20.0331	20.0274	19.8667	19.2567	18.5588	18.0292	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0602	18.3046	18.7390	19.3130	19.7612	19.9868	20.0331	20.0274	19.8667	19.2567	18.5588	18.0292	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9931	0.9799	0.9348	0.8241	0.6323	0.4443	0.5114	0.8062	0.9675	0.9940	0.9978	(94)
Useful gains	541.7965	650.0258	774.5343	883.9553	867.5654	662.5243	442.7716	461.7241	631.0497	615.7890	534.5825	508.2371	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1854.1580	1801.7322	1641.0321	1380.0917	1066.0584	705.1201	449.3833	473.9223	757.8446	1144.8108	1522.0866	1845.4224	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	976.3970	773.9467	644.6744	357.2182	147.6788	0.0000	0.0000	0.0000	0.0000	393.5923	711.0029	994.8659	(98)
Space heating												4999.3761	(98)
Space heating per m2											(98) / (4) =	49.6660	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5358.3881	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	976.3970	773.9467	644.6744	357.2182	147.6788	0.0000	0.0000	0.0000	0.0000	393.5923	711.0029	994.8659	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1046.5134	829.5249	690.9693	382.8705	158.2838	0.0000	0.0000	0.0000	0.0000	421.8567	762.0610	1066.3085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0309	152.5385	158.1896	139.0127	134.1994	117.0037	109.6117	124.0894	125.0712	144.2918	156.0778	168.9034	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7363	89.6869	89.5672	89.2617	88.5495	86.7000	86.7000	86.7000	86.7000	89.3053	89.6301	89.7591	(217)
Fuel for water heating, kWh/month													
	193.9358	170.0790	176.6155	155.7361	151.5530	134.9524	126.4264	143.1250	144.2574	161.5715	174.1355	188.1742	(219)
Water heating fuel used												1920.5618	(219)
Annual totals kWh/year													
Space heating fuel - main system												5358.3881	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.7652	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.20 * 853 * 1.00) =										-818.9087		-818.9087	(233)
Total delivered energy for all uses												6947.8063	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5358.3881	0.2160	1157.4118	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1920.5618	0.2160	414.8413	(264)
Space and water heating			1572.2532	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.7652	0.5190	214.2251	(268)
Energy saving/generation technologies				
PV Unit	-818.9087	0.5190	-425.0136	(269)
Total CO2, kg/year			1400.3897	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9100	ZC1
Total Floor Area	TFA	100.6600	
Assumed number of occupants	N	2.7456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1524	ZC2
CO2 emissions from cooking, equation (L16)		1.8368	ZC3
Total CO2 emissions		30.8992	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.8992	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3300 (1b)	x	2.3900 (2b)	=	120.2887	(1b) - (3b)
First floor	50.3300 (1c)	x	2.6300 (2c)	=	132.3679	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	252.6566	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1583 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4083 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3471 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4425	0.4338	0.4252	0.3818	0.3731	0.3297	0.3297	0.3210	0.3471	0.3731	0.3905	0.4078	(22b)
Effective ac	0.5979	0.5941	0.5904	0.5729	0.5696	0.5544	0.5544	0.5515	0.5602	0.5696	0.5762	0.5832	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.4400	1.3258	24.4470			(27)
Ground floor			50.3300	0.1300	6.5429			(28a)
External Wall	144.4200	22.6800	121.7400	0.1800	21.9132			(29a)
Main Roof	50.3300		50.3300	0.1300	6.5429			(30)
Total net area of external elements Aum(A, m2)			245.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.5340			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6392	(36)
Total fabric heat loss (33) + (36) =	76.1732	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.8517	49.5347	49.2240	47.7646	47.4915	46.2204	46.2204	45.9850	46.7100	47.4915	48.0439	48.6214	(38)
Heat transfer coeff	126.0249	125.7079	125.3972	123.9377	123.6647	122.3936	122.3936	122.1582	122.8832	123.6647	124.2171	124.7946	(39)
Average = Sum(39)m / 12 =												123.9364	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2520	1.2488	1.2457	1.2313	1.2285	1.2159	1.2159	1.2136	1.2208	1.2285	1.2340	1.2398	(40)
HLP (average)												1.2312	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7456 (42)
Average daily hot water use (litres/day)	99.4069 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3476	105.3713	101.3950	97.4187	93.4425	89.4662	89.4662	93.4425	97.4187	101.3950	105.3713	109.3476	(44)
Energy conte	162.1593	141.8255	146.3512	127.5926	122.4281	105.6461	97.8967	112.3379	113.6795	132.4825	144.6151	157.0426	(45)
Energy content (annual)										Total = Sum(45)m =		1564.0571	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3239	21.2738	21.9527	19.1389	18.3642	15.8469	14.6845	16.8507	17.0519	19.8724	21.6923	23.5564	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.0421	47.6172	44.1203	45.5910	47.6172	48.0421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	213.1182	187.8529	197.3101	175.6347	170.0453	149.7664	143.4877	159.9551	161.7216	183.4414	193.9301	208.0015	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.1182	187.8529	197.3101	175.6347	170.0453	149.7664	143.4877	159.9551	161.7216	183.4414	193.9301	208.0015	(64)
								Total per year (kWh/year) = Sum(64)m =				2144.2651	(64)
Heat gains from water heating, kWh/month													
	66.6577	58.6638	61.4015	54.4351	52.6117	46.1574	43.9484	49.2567	49.8090	56.7902	60.4133	64.9564	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	137.2776	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3725	20.7592	16.8825	12.7812	9.5541	8.0659	8.7155	11.3288	15.2055	19.3069	22.5339	24.0221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.3904	260.0613	253.3307	239.0020	220.9147	203.9151	192.5584	189.8875	196.6181	210.9467	229.0341	246.0336	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	36.7278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	-109.8221	(71)
Water heating gains (Table 5)													
	89.5937	87.2974	82.5289	75.6042	70.7146	64.1075	59.0704	66.2052	69.1791	76.3309	83.9073	87.3070	(72)
Total internal gains													
	437.5398	435.3011	419.9254	394.5707	368.3666	343.2719	327.5276	334.6047	348.1860	373.7677	402.6586	424.5459	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.3800	10.6334	0.6300	0.7000	0.7700	7.7343	(74)
East	8.3700	19.6403	0.6300	0.7000	0.7700	50.2394	(76)
West	7.6900	19.6403	0.6300	0.7000	0.7700	46.1578	(80)

Solar gains	104.1316	203.3541	335.6696	493.2666	609.4205	626.3965	595.2838	507.7761	391.3842	241.3527	129.7373	85.7201	(83)
Total gains	541.6713	638.6553	755.5950	887.8373	977.7871	969.6684	922.8114	842.3808	739.5702	615.1205	532.3959	510.2660	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4674	55.6073	55.7451	56.4015	56.5261	57.1131	57.1131	57.2232	56.8856	56.5261	56.2747	56.0143	
alpha	4.6978	4.7072	4.7163	4.7601	4.7684	4.8075	4.8075	4.8149	4.7924	4.7684	4.7516	4.7343	
util living area													
	0.9987	0.9970	0.9906	0.9646	0.8863	0.7295	0.5645	0.6321	0.8787	0.9843	0.9974	0.9991	(86)
MIT	19.5677	19.7287	20.0190	20.4086	20.7393	20.9300	20.9838	20.9729	20.8176	20.3739	19.9013	19.5434	(87)
Th 2	19.8786	19.8811	19.8836	19.8951	19.8972	19.9073	19.9073	19.9092	19.9034	19.8972	19.8929	19.8883	(88)
util rest of house													
	0.9983	0.9959	0.9871	0.9505	0.8412	0.6342	0.4339	0.4990	0.8120	0.9758	0.9963	0.9987	(89)
MIT 2	17.9701	18.2070	18.6313	19.1964	19.6397	19.8605	19.9014	19.8979	19.7515	19.1569	18.4680	17.9412	(90)
Living area fraction										fLA = Living area / (4) =		0.1737	(91)
MIT	18.2476	18.4712	18.8723	19.4069	19.8306	20.0462	20.0894	20.0846	19.9366	19.3682	18.7169	18.2194	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2476	18.4712	18.8723	19.4069	19.8306	20.0462	20.0894	20.0846	19.9366	19.3682	18.7169	18.2194	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9938	0.9825	0.9423	0.8380	0.6474	0.4566	0.5218	0.8144	0.9699	0.9945	0.9979	(94)
Useful gains	540.1832	634.7236	742.3533	836.5650	819.3615	627.8091	421.3608	439.5772	602.3228	596.5844	529.4442	509.2069	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1757.7413	1706.0073	1551.4461	1302.2027	1005.4701	666.5858	427.0753	450.1043	717.2190	1084.3218	1443.0176	1749.5439	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	905.8632	719.9027	601.9650	335.2592	138.4648	0.0000	0.0000	0.0000	0.0000	362.8766	657.7728	922.8107	(98)
Space heating												4644.9150	(98)
Space heating per m2											(98) / (4) =	46.1446	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4973.1425	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	905.8632	719.9027	601.9650	335.2592	138.4648	0.0000	0.0000	0.0000	0.0000	362.8766	657.7728	922.8107	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	969.8750	770.7737	644.5022	358.9499	148.2493	0.0000	0.0000	0.0000	0.0000	388.5188	704.2536	988.0201	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.1182	187.8529	197.3101	175.6347	170.0453	149.7664	143.4877	159.9551	161.7216	183.4414	193.9301	208.0015	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2851	88.1067	87.6776	86.6531	84.5392	80.3000	80.3000	80.3000	80.3000	86.7368	87.8831	88.3558	(217)
Fuel for water heating, kWh/month													
	241.3977	213.2107	225.0405	202.6871	201.1439	186.5086	178.6895	199.1969	201.3968	211.4921	220.6683	235.4134	(219)
Water heating fuel used												2516.8455	(219)
Annual totals kWh/year													
Space heating fuel - main system												4973.1425	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.7652	(232)
Total delivered energy for all uses												7977.7531	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4973.1425	0.2160	1074.1988	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2516.8455	0.2160	543.6386	(264)
Space and water heating			1617.8374	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.7652	0.5190	214.2251	(268)
Total CO2, kg/m2/year			1870.9875	(272)
Emissions per m2 for space and water heating			16.0723	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3867	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0723 * 1.00) + 2.1282 + 0.3867, rounded to 2 d.p.			18.5900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 206 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 206 - EPC	**Prop Type Ref**	As
Property	7 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.91	**TER**	18.59
Environmental	89 B	**% DER<TER**	25.16		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	59.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.91	$kgCO_2/m^2$	Pass
	-4.68 (-25.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.58	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.54	$kWh/m^2/yr$	
	-5.1 (-8.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.38 m², No overhang 8.37 m², No overhang 7.69 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.20	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 206 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 206 - EPC	**Prop Type Ref**	As
Property	7 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.91	**TER**	18.59
Environmental	89 B	**% DER<TER**	25.16		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	59.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	50.33 m²	2.39 m
1st Storey:	1.00 m	50.33 m²	2.63 m

7.0 Living Area	17.48	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	144.42	121.74

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	50.33	50.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	50.33

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
D2 (W13)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
D3	Half Glazed Door	[1] External Wall	East							2.12	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.34	0.060	No
Independently assessed	E3 Sill	12.72	0.009	No
Independently assessed	E4 Jamb	40.80	0.011	No
Independently assessed	E5 Ground floor (normal)	28.83	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.83	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.91	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.92	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.45	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	

Fuel Type	Mains gas
Main Heating	BGW
SAP Code	104
In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.20	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£116	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 206 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 206 - EPC	**Prop Type Ref**	As
Property	7 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.91	**TER**	18.59
Environmental	89 B	**% DER<TER**	25.16		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	59.58
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	100.66	m^2	
DER	13.91	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.16	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.54	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	100.66	m^2	
DER	20.55	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.15	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.84	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.54	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.54	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	16.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.15	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.84	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.32	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.32	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 207 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 207 - EPC	**Prop Type Ref**	Opp
Property	1 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	13.05	**TER**	18.24
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.73	**DFEE**	45.27	**TFEE**	50.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.24	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.05	$kgCO_2/m^2$	Pass
	-5.19 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.27	$kWh/m^2/yr$	
	-5.0 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	4.49 m², No overhang 6.45 m², No overhang 0.96 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 207 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 207 - EPC	**Prop Type Ref**	Opp
Property	1 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	13.05	**TER**	18.24
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.73	**DFEE**	45.27	**TFEE**	50.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.24 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum: 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.49 m², No overhang
Windows facing South: 6.45 m², No overhang
Windows facing West: 0.96 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5151	0.5050	0.4949	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747	(22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.9000	1.2357	14.7053			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.2000	7.9100			(28a)
External Wall	89.1400	14.0200	75.1200	0.2700	20.2824			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4057			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.0779 (36)
Total fabric heat loss	(33) + (36) =	56.4836 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4528	41.1152	40.7843	39.2301	38.9393	37.5857	37.5857	37.3350	38.1071	38.9393	39.5276	40.1426	(38)
Heat transfer coeff	97.9364	97.5988	97.2679	95.7137	95.4229	94.0693	94.0693	93.8186	94.5907	95.4229	96.0112	96.6262	(39)
Average = Sum(39)m / 12 =												95.7123	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2381	1.2339	1.2297	1.2100	1.2064	1.1892	1.1892	1.1861	1.1958	1.2064	1.2138	1.2216	(40)
HLP (average)												1.2100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4894	18.1985	14.8000	11.2046	8.3755	7.0710	7.6405	9.9313	13.3298	16.9253	19.7543	21.0589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	371.9792	369.8085	356.2842	334.5478	312.5155	291.3311	277.6195	283.6548	294.8766	316.8237	341.9878	360.8237	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.7200	0.7000	0.7700	16.6756	(74)
South	6.4500	46.7521	0.7200	0.7000	0.7700	105.3233	(78)
West	0.9600	19.6403	0.7200	0.7000	0.7700	6.5854	(80)

Solar gains	128.5843	217.2428	295.0917	366.2593	413.8737	413.2961	397.3962	360.9637	319.3105	239.2699	153.6267	110.3261	(83)
Total gains	500.5635	587.0513	651.3759	700.8071	726.3892	704.6272	675.0157	644.6186	614.1871	556.0936	495.6146	471.1498	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0880	56.2820	56.4735	57.3905	57.5654	58.3937	58.3937	58.5498	58.0719	57.5654	57.2127	56.8485	
alpha	4.7392	4.7521	4.7649	4.8260	4.8377	4.8929	4.8929	4.9033	4.8715	4.8377	4.8142	4.7899	
util living area													
	0.9975	0.9942	0.9863	0.9631	0.9001	0.7591	0.5902	0.6354	0.8539	0.9724	0.9946	0.9981	(86)
MIT	19.6722	19.8449	20.1013	20.4325	20.7254	20.9208	20.9817	20.9740	20.8490	20.4692	20.0122	19.6486	(87)
Th 2	19.8896	19.8930	19.8963	19.9120	19.9149	19.9286	19.9286	19.9312	19.9233	19.9149	19.9090	19.9028	(88)
util rest of house													
	0.9966	0.9922	0.9813	0.9485	0.8587	0.6666	0.4580	0.5042	0.7816	0.9586	0.9924	0.9975	(89)
MIT 2	18.1303	18.3843	18.7584	19.2423	19.6392	19.8741	19.9218	19.9203	19.8013	19.3025	18.6405	18.1049	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.4319	18.6699	19.0210	19.4751	19.8517	20.0788	20.1291	20.1264	20.0062	19.5307	18.9088	18.4068	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4319	18.6699	19.0210	19.4751	19.8517	20.0788	20.1291	20.1264	20.0062	19.5307	18.9088	18.4068	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9889	0.9758	0.9409	0.8558	0.6809	0.4839	0.5296	0.7881	0.9520	0.9894	0.9961	(94)
Useful gains	497.9780	580.5395	635.5860	659.3731	621.6239	479.7855	326.6595	341.4188	484.0641	529.3819	490.3789	469.3010	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1384.0234	1343.9285	1217.8957	1012.1798	777.8545	515.3867	331.9781	349.6047	558.6683	852.1909	1133.7721	1372.7487	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	659.2177	512.9975	433.2385	254.0208	116.2356	0.0000	0.0000	0.0000	0.0000	240.1699	463.2431	672.1650	(98)
Space heating												3351.2880	(98)
Space heating per m2											(98) / (4) =	42.3677	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3591.9486	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	659.2177	512.9975	433.2385	254.0208	116.2356	0.0000	0.0000	0.0000	0.0000	240.1699	463.2431	672.1650	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	706.5570	549.8365	464.3499	272.2624	124.5826	0.0000	0.0000	0.0000	0.0000	257.4168	496.5092	720.4341	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5650	89.4929	89.3569	89.0494	88.3953	86.7000	86.7000	86.7000	86.7000	88.9721	89.4118	89.5933	(217)
Fuel for water heating, kWh/month													
	181.3031	159.0586	165.2492	145.7975	141.8531	126.1873	118.3042	133.8032	134.8228	151.4646	162.9371	175.9329	(219)
Water heating fuel used												1796.7136	(219)
Annual totals kWh/year													
Space heating fuel - main system												3591.9486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.8493	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1080 * 1.00) =										-690.8958		-690.8958	(233)
Total delivered energy for all uses												5134.6157	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3591.9486	0.2160	775.8609	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1796.7136	0.2160	388.0901	(264)
Space and water heating			1163.9510	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.8493	0.5190	187.7998	(268)
Energy saving/generation technologies				
PV Unit	-690.8958	0.5190	-358.5749	(269)
Total CO2, kg/year			1032.1009	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		31.5942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.9000	1.3258	15.7765			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	14.0200	75.1200	0.1800	13.5216			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1251			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.6804	(36)
Total fabric heat loss (33) + (36) =	51.8055	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	90.7549	90.5145	90.2789	89.1723	88.9652	88.0013	88.0013	87.8229	88.3726	88.9652	89.3841	89.8220	(39)
Average = Sum(39)m / 12 =												89.1713	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1473	1.1443	1.1413	1.1273	1.1247	1.1125	1.1125	1.1103	1.1172	1.1247	1.1300	1.1355	(40)
HLP (average)												1.1273	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4894	18.1985	14.8000	11.2046	8.3755	7.0710	7.6405	9.9313	13.3298	16.9253	19.7543	21.0589	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1216	382.5831	368.4370	346.0807	323.4249	301.6186	287.9131	294.5699	306.4180	328.9851	354.7672	373.9694	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4900	10.6334	0.6300	0.7000	0.7700	14.5912	(74)
South	6.4500	46.7521	0.6300	0.7000	0.7700	92.1579	(78)
West	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(80)

Solar gains	112.5112	190.0874	258.2052	320.4769	362.1395	361.6341	347.7216	315.8433	279.3967	209.3612	134.4234	96.5354	(83)
Total gains	497.6329	572.6705	626.6422	666.5576	685.5644	663.2527	635.6348	610.4132	585.8147	538.3463	489.1906	470.5048	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5263	60.6870	60.8454	61.6005	61.7439	62.4201	62.4201	62.5470	62.1579	61.7439	61.4545	61.1549	
alpha	5.0351	5.0458	5.0564	5.1067	5.1163	5.1613	5.1613	5.1698	5.1439	5.1163	5.0970	5.0770	
util living area													
	0.9975	0.9945	0.9873	0.9655	0.9041	0.7624	0.5898	0.6331	0.8535	0.9728	0.9947	0.9981	(86)
MIT	19.7893	19.9449	20.1790	20.4809	20.7525	20.9312	20.9853	20.9790	20.8689	20.5211	20.0993	19.7627	(87)
Th 2	19.9624	19.9648	19.9672	19.9786	19.9807	19.9906	19.9906	19.9924	19.9868	19.9807	19.9764	19.9719	(88)
util rest of house													
	0.9967	0.9927	0.9827	0.9520	0.8650	0.6739	0.4643	0.5085	0.7838	0.9596	0.9926	0.9975	(89)
MIT 2	18.3522	18.5807	18.9222	19.3616	19.7297	19.9426	19.9850	19.9835	19.8800	19.4252	18.8151	18.3202	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.6333	18.8475	19.1680	19.5805	19.9298	20.1359	20.1806	20.1782	20.0734	19.6395	19.0663	18.6023	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6333	18.8475	19.1680	19.5805	19.9298	20.1359	20.1806	20.1782	20.0734	19.6395	19.0663	18.6023	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9898	0.9778	0.9453	0.8627	0.6879	0.4889	0.5327	0.7907	0.9536	0.9898	0.9962	(94)
Useful gains	495.1914	566.8254	612.7542	630.0966	591.4491	456.2389	310.7935	325.1763	463.2277	513.3681	484.2242	468.7384	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1300.8170	1262.4514	1143.6525	952.4067	732.1618	487.1692	315.0981	331.8116	527.8824	804.2013	1069.5941	1293.6423	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	599.3854	467.4607	394.9883	232.0633	104.6903	0.0000	0.0000	0.0000	0.0000	216.3799	421.4663	613.7285	(98)
Space heating												3050.1628	(98)
Space heating per m2											(98) / (4) =	38.5608	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3265.6989	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	599.3854	467.4607	394.9883	232.0633	104.6903	0.0000	0.0000	0.0000	0.0000	216.3799	421.4663	613.7285	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	641.7403	500.4933	422.8997	248.4617	112.0881	0.0000	0.0000	0.0000	0.0000	231.6702	451.2488	657.0969	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6271	87.3852	86.9276	85.9394	84.0442	80.3000	80.3000	80.3000	80.3000	85.6455	87.0902	87.7216	(217)
Fuel for water heating, kWh/month													
	229.9470	202.1899	211.4730	189.7226	187.8271	173.1411	165.8823	184.9199	186.9622	199.6061	209.5411	224.2844	(219)
Water heating fuel used												2365.4966	(219)
Annual totals kWh/year													
Space heating fuel - main system												3265.6989	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.8493	(232)
Total delivered energy for all uses												6068.0448	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3265.6989	0.2160	705.3910	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.4966	0.2160	510.9473	(264)
Space and water heating			1216.3382	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.8493	0.5190	187.7998	(268)
Total CO2, kg/m2/year			1443.0630	(272)
Emissions per m2 for space and water heating			15.3772	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3742	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3772 * 1.00) + 2.3742 + 0.4921, rounded to 2 d.p.			18.2400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 207 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 207 - EPC	**Prop Type Ref**	Opp
Property	1 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	13.05	**TER**	18.24
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.73	**DFEE**	45.27	**TFEE**	50.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.24	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.05	$kgCO_2/m^2$	Pass
	-5.19 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.27	$kWh/m^2/yr$	
	-5.0 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	4.49 m², No overhang 6.45 m², No overhang 0.96 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.024	W/m²K	
Photovoltaic array	0.80	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
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General Requirements Compliance	Pass	**% DFEE<TFEE**	10.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	39.55 m²	2.39 m
1st Storey:	1.00 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	89.14	75.12

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.49	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.060	No
Independently assessed	E3 Sill	6.93	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	26.49	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	26.49	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	17.38	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.024	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.47	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19080	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£90	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 207 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 207 - EPC	**Prop Type Ref**	Opp
Property	1 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	13.05	**TER**	18.24
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.73	**DFEE**	45.27	**TFEE**	50.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	13.05	$kgCO_2/yr/m^2$	
TER	18.24	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	28.47	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.27	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	20.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.67	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.67	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.14	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.14	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 208 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 208 - EPC	**Prop Type Ref**	Opp
Property	2 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	89 B	**DER**	12.27	**TER**	18.01
Environmental	91 B	**% DER<TER**	31.86		
CO_2 Emissions (t/year)	0.70	**DFEE**	44.29	**TFEE**	50.04
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.27	$kgCO_2/m^2$	Pass
	-5.74 (-31.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.04	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.29	$kWh/m^2/yr$	
	-5.7 (-11.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	3.64 m², No overhang
Windows facing South	7.99 m², No overhang
Windows facing West	2.47 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.80	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 208 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 208 - EPC	**Prop Type Ref**	Opp
Property	2 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	89 B	**DER**	12.27	**TER**	18.01
Environmental	91 B	**% DER<TER**	31.86		
CO_2 Emissions (t/year)	0.70	**DFEE**	44.29	**TFEE**	50.04
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

End-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.27 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.64 m², No overhang
Windows facing South: 7.99 m², No overhang
Windows facing West: 2.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.3900	(2b) =	95.9824	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.4800	
Infiltration rate			0.3728	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4040	0.3961	0.3882	0.3486	0.3407	0.3010	0.3010	0.2931	0.3169	0.3407	0.3565	0.3723	(22b)
Effective ac	0.5816	0.5785	0.5753	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5635	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.1000	1.2357	17.4240			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	89.8400	16.2200	73.6200	0.2700	19.8774			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.5374			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2099	(36)
Total fabric heat loss (33) + (36) =	58.7473	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6946	38.4838	38.2771	37.3063	37.1247	36.2792	36.2792	36.1226	36.6048	37.1247	37.4921	37.8763	(38)
Heat transfer coeff	97.4419	97.2311	97.0244	96.0536	95.8720	95.0265	95.0265	94.8699	95.3521	95.8720	96.2394	96.6235	(39)
Average = Sum(39)m / 12 =												96.0527	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2132	1.2105	1.2080	1.1959	1.1936	1.1831	1.1831	1.1811	1.1872	1.1936	1.1982	1.2030	(40)
HLP (average)												1.1959	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7955	10.6404	11.7492	11.3349	11.6870	11.2803	11.6379	11.6697	11.3100	11.7235	11.3863	11.7854	(61)
Total heat required for water heating calculated for each month													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
								Total per year (kWh/year) = Sum(64)m =				1598.6795	(64)
Heat gains from water heating, kWh/month													
	53.3031	46.7002	48.3828	42.4542	40.9385	35.6256	33.3086	37.8009	38.1276	44.0698	47.7529	51.7117	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1247	17.8746	14.5366	11.0051	8.2265	6.9451	7.5045	9.7546	13.0926	16.6240	19.4027	20.6840	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6439	69.4944	65.0306	58.9641	55.0249	49.4801	44.7697	50.8077	52.9551	59.2336	66.3235	69.5050	(72)
Total internal gains													
	374.9102	372.7946	359.2371	337.3860	315.2007	293.8373	279.9745	285.9786	297.2197	319.2828	344.6188	363.6189	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6400	10.6334	0.7200	0.7000	0.7700	13.5188	(74)
South	7.9900	46.7521	0.7200	0.7000	0.7700	130.4702	(78)
West	2.4700	19.6403	0.7200	0.7000	0.7700	16.9437	(80)

Solar gains	160.9327	272.6571	370.6720	457.7543	513.1239	510.0687	491.4526	449.7273	400.5982	300.5534	192.4556	137.9418	(83)
Total gains	535.8429	645.4517	729.9091	795.1403	828.3246	803.9060	771.4271	735.7059	697.8178	619.8362	537.0744	501.5607	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.2421	57.3662	57.4884	58.0694	58.1794	58.6971	58.6971	58.7940	58.4966	58.1794	57.9573	57.7269	
alpha	4.8161	4.8244	4.8326	4.8713	4.8786	4.9131	4.9131	4.9196	4.8998	4.8786	4.8638	4.8485	
util living area													
	0.9968	0.9918	0.9794	0.9443	0.8589	0.6986	0.5294	0.5738	0.8052	0.9604	0.9929	0.9977	(86)
MIT	19.7364	19.9299	20.1993	20.5229	20.7910	20.9459	20.9887	20.9834	20.8884	20.5339	20.0675	19.6996	(87)
Th 2	19.9095	19.9116	19.9136	19.9233	19.9251	19.9335	19.9335	19.9351	19.9303	19.9251	19.9214	19.9176	(88)
util rest of house													
	0.9957	0.9890	0.9722	0.9242	0.8088	0.6046	0.4076	0.4506	0.7247	0.9419	0.9900	0.9969	(89)
MIT 2	18.2376	18.5205	18.9107	19.3731	19.7236	19.8982	19.9295	19.9285	19.8448	19.3981	18.7293	18.1897	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6130	18.8736	19.2335	19.6611	19.9910	20.1606	20.1948	20.1928	20.1062	19.6826	19.0646	18.5679	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6130	18.8736	19.2335	19.6611	19.9910	20.1606	20.1948	20.1928	20.1062	19.6826	19.0646	18.5679	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9853	0.9663	0.9182	0.8123	0.6260	0.4383	0.4816	0.7395	0.9365	0.9868	0.9954	(94)
Useful gains	532.5367	635.9846	705.2866	730.0733	672.8861	503.2618	338.0984	354.2917	516.0485	580.4815	529.9746	499.2540	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.6908	1358.6635	1235.4568	1033.6429	794.8770	528.4075	341.6053	359.8209	572.7065	870.7646	1151.4617	1388.2801	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	641.4426	485.6402	394.4467	218.5701	90.7612	0.0000	0.0000	0.0000	0.0000	215.9706	447.4707	661.4354	(98)
Space heating												3155.7375	(98)
Space heating per m2											(98) / (4) =	39.2896	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3382.3554	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	641.4426	485.6402	394.4467	218.5701	90.7612	0.0000	0.0000	0.0000	0.0000	215.9706	447.4707	661.4354	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	687.5055	520.5147	422.7724	234.2659	97.2789	0.0000	0.0000	0.0000	0.0000	231.4798	479.6042	708.9340	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2367	143.0919	148.4273	130.4941	126.0231	109.9437	103.0640	116.5825	117.4758	135.4495	146.4429	158.4482	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5457	89.4547	89.2864	88.9197	88.1717	86.7000	86.7000	86.7000	86.7000	88.8776	89.3848	89.5812	(217)
Fuel for water heating, kWh/month													
	182.2942	159.9603	166.2373	146.7549	142.9292	126.8093	118.8742	134.4666	135.4969	152.4000	163.8341	176.8767	(219)
Water heating fuel used												1806.9338	(219)
Annual totals kWh/year													
Space heating fuel - main system												3382.3554	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.4085	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1080 * 1.00) =										-690.8958		-690.8958	(233)
Total delivered energy for all uses												4928.8019	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3382.3554	0.2160	730.5888	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1806.9338	0.2160	390.2977	(264)
Space and water heating			1120.8865	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.4085	0.5190	184.4570	(268)
Energy saving/generation technologies				
PV Unit	-690.8958	0.5190	-358.5749	(269)
Total CO2, kg/year			985.6936	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.2700	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		30.7283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7283	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3988 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.1000	1.3258	18.6932			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	16.2200	73.6200	0.1800	13.2516			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9304			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.8236 (36)
Total fabric heat loss	(33) + (36) =	54.7540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	94.2324	93.9911	93.7546	92.6437	92.4359	91.4683	91.4683	91.2891	91.8410	92.4359	92.8563	93.2959	(39)
Average = Sum(39)m / 12 =												92.6427	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1732	1.1702	1.1673	1.1534	1.1508	1.1388	1.1388	1.1366	1.1434	1.1508	1.1561	1.1616	(40)
HLP (average)												1.1534	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1247	17.8746	14.5366	11.0051	8.2265	6.9451	7.5045	9.7546	13.0926	16.6240	19.4027	20.6840	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0700	385.6866	371.5037	349.0290	326.2164	304.2275	290.3709	297.0002	308.8713	331.5580	357.5157	376.7820	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6400	10.6334	0.6300	0.7000	0.7700	11.8289	(74)
South	7.9900	46.7521	0.6300	0.7000	0.7700	114.1614	(78)
West	2.4700	19.6403	0.6300	0.7000	0.7700	14.8257	(80)

Solar gains	140.8161	238.5749	324.3380	400.5350	448.9834	446.3101	430.0210	393.5114	350.5234	262.9842	168.3987	120.6991	(83)
Total gains	528.8861	624.2615	695.8417	749.5640	775.1999	750.5377	720.3920	690.5116	659.3947	594.5422	525.9144	497.4811	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1917	59.3437	59.4934	60.2068	60.3421	60.9804	60.9804	61.1001	60.7330	60.3421	60.0689	59.7859	
alpha	4.9461	4.9562	4.9662	5.0138	5.0228	5.0654	5.0654	5.0733	5.0489	5.0228	5.0046	4.9857	
util living area													
	0.9970	0.9927	0.9821	0.9517	0.8739	0.7174	0.5454	0.5881	0.8177	0.9639	0.9933	0.9978	(86)
MIT	19.7816	19.9590	20.2120	20.5236	20.7870	20.9449	20.9888	20.9837	20.8893	20.5461	20.1027	19.7503	(87)
Th 2	19.9415	19.9439	19.9463	19.9574	19.9595	19.9693	19.9693	19.9711	19.9655	19.9595	19.9553	19.9509	(88)
util rest of house													
	0.9960	0.9902	0.9759	0.9339	0.8275	0.6258	0.4245	0.4665	0.7406	0.9469	0.9907	0.9970	(89)
MIT 2	18.3262	18.5860	18.9534	19.4022	19.7507	19.9325	19.9651	19.9645	19.8792	19.4421	18.8046	18.2872	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6908	18.9299	19.2687	19.6831	20.0103	20.1861	20.2216	20.2198	20.1322	19.7187	19.1297	18.6537	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6908	18.9299	19.2687	19.6831	20.0103	20.1861	20.2216	20.2198	20.1322	19.7187	19.1297	18.6537	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9869	0.9705	0.9281	0.8301	0.6465	0.4549	0.4971	0.7546	0.9419	0.9877	0.9956	(94)
Useful gains	525.8120	616.0907	675.3454	695.6506	643.5259	485.1910	327.7300	343.2262	497.5680	559.9747	519.4280	495.2993	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1356.0780	1318.6874	1197.1215	998.9881	768.1683	510.9504	331.2582	348.7045	554.0049	842.8908	1117.0362	1348.4719	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	617.7179	472.1450	388.2015	218.4030	92.7340	0.0000	0.0000	0.0000	0.0000	210.4896	430.2779	634.7604	(98)
Space heating												3064.7293	(98)
Space heating per m2											(98) / (4) =	38.1565	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3281.2947	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	617.7179	472.1450	388.2015	218.4030	92.7340	0.0000	0.0000	0.0000	0.0000	210.4896	430.2779	634.7604	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	661.3682	505.5086	415.6333	233.8362	99.2869	0.0000	0.0000	0.0000	0.0000	225.3636	460.6830	679.6150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6783	87.3936	86.8742	85.7728	83.7496	80.3000	80.3000	80.3000	80.3000	85.5609	87.1228	87.7788	(217)
Fuel for water heating, kWh/month													
	230.8439	203.3850	212.8740	191.2330	189.6201	174.1812	166.8789	186.0308	188.0853	201.0037	210.7209	225.1361	(219)
Water heating fuel used												2379.9929	(219)
Annual totals kWh/year													
Space heating fuel - main system												3281.2947	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.4085	(232)
Total delivered energy for all uses												6091.6961	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3281.2947	0.2160	708.7597	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2379.9929	0.2160	514.0785	(264)
Space and water heating			1222.8381	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.4085	0.5190	184.4570	(268)
Total CO2, kg/m2/year			1446.2201	(272)
Emissions per m2 for space and water heating			15.2246	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2965	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2246 * 1.00) + 2.2965 + 0.4846, rounded to 2 d.p.			18.0100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 208 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 208 - EPC	**Prop Type Ref**	Opp
Property	2 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	89 B	**DER**	12.27	**TER**	18.01
Environmental	91 B	**% DER<TER**	31.86		
CO_2 Emissions (t/year)	0.70	**DFEE**	44.29	**TFEE**	50.04
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.27	$kgCO_2/m^2$	Pass
	-5.74 (-31.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.04	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.29	$kWh/m^2/yr$	
	-5.7 (-11.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	3.64 m², No overhang
Windows facing South	7.99 m², No overhang
Windows facing West	2.47 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 208 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 208 - EPC	**Prop Type Ref**	Opp
Property	2 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	89 B	**DER**	12.27	**TER**	18.01
Environmental	91 B	**% DER<TER**	31.86		
CO_2 Emissions (t/year)	0.70	**DFEE**	44.29	**TFEE**	50.04
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	40.16 m²	2.39 m
1st Storey:	1.00 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	89.84	73.62

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.82	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.67	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.82	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.060	No
Independently assessed	E3 Sill	8.98	0.009	No
Independently assessed	E4 Jamb	30.00	0.011	No
Independently assessed	E5 Ground floor (normal)	17.93	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.052	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.053	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.045	No

Y-value	0.025	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

SAP Code	104
In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£88	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 208 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 208 - EPC	**Prop Type Ref**	Opp
Property	2 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	89 B	**DER**	12.27	**TER**	18.01
Environmental	91 B	**% DER<TER**	31.86		
CO_2 Emissions (t/year)	0.70	**DFEE**	44.29	**TFEE**	50.04
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	12.27	$kgCO_2/yr/m^2$	
TER	18.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.27	$kgCO_2/yr/m^2$	
Reduction DER/TER	31.86	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace		
Fabric energy efficiency (F.E.E.)	44.29	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	19.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.66	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.66	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.20	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.20	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 209 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 209 - EPC	**Prop Type Ref**	
Property	3 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	90 B	**DER**	10.58	**TER**	15.92
Environmental	92 A	**% DER<TER**	33.55		
CO_2 Emissions (t/year)	0.68	**DFEE**	35.34	**TFEE**	41.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	15.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.58	$kgCO_2/m^2$	Pass
	-5.34 (-33.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.67	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	35.34	$kWh/m^2/yr$	
	-6.4 (-15.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	4.11 m², No overhang 7.84 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 209 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 209 - EPC	**Prop Type Ref**	
Property	3 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	90 B	**DER**	10.58	**TER**	15.92
Environmental	92 A	**% DER<TER**	33.55		
CO_2 Emissions (t/year)	0.68	**DFEE**	35.34	**TFEE**	41.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Mid-Terrace House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.58 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)41.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.36 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.11 m², No overhang
Windows facing South: 7.84 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3463	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2944	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3753	0.3679	0.3606	0.3238	0.3164	0.2796	0.2796	0.2723	0.2944	0.3164	0.3311	0.3459	(22b)
Effective ac	0.5704	0.5677	0.5650	0.5524	0.5501	0.5391	0.5391	0.5371	0.5433	0.5501	0.5548	0.5598	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.9500	1.2357	14.7671			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.5800	0.1800	8.3844			(28a)
External Wall	50.5400	14.0700	36.4700	0.2700	9.8469			(29a)
Main Roof	46.5800		46.5800	0.1600	7.4528			(30)
Total net area of external elements Aum(A, m2)			143.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.6312			(33)
Party Wall			92.6300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9879	(36)
Total fabric heat loss (33) + (36) =	47.6191	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.0165	43.8055	43.5987	42.6271	42.4454	41.5992	41.5992	41.4425	41.9251	42.4454	42.8131	43.1975	(38)
Heat transfer coeff	91.6356	91.4246	91.2178	90.2462	90.0645	89.2183	89.2183	89.0616	89.5442	90.0645	90.4322	90.8166	(39)
Average = Sum(39)m / 12 =												90.2454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9836	0.9814	0.9792	0.9687	0.9668	0.9577	0.9577	0.9560	0.9612	0.9668	0.9707	0.9748	(40)
HLP (average)												0.9687	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6666 (42)
Average daily hot water use (litres/day)	97.5306 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8115	10.6589	11.7774	11.3585	11.7087	11.2983	11.6545	11.6896	11.3311	11.7490	11.4052	11.8010 (61)
Total heat required for water heating calculated for each month												
	170.9101	149.8075	155.3663	136.5427	131.8260	114.9503	107.7034	121.9071	122.8649	141.7309	153.2906	165.8794 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.9101	149.8075	155.3663	136.5427	131.8260	114.9503	107.7034	121.9071	122.8649	141.7309	153.2906	165.8794 (64)
								Total per year (kWh/year) = Sum(64)m =				1672.7793 (64)
Heat gains from water heating, kWh/month												
	55.8531	48.9316	50.6877	44.4634	42.8662	37.2889	34.8499	39.5697	39.9178	46.1562	50.0282	54.1813 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8658	21.1974	17.2389	13.0509	9.7557	8.2362	8.8995	11.5679	15.5264	19.7143	23.0095	24.5291	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	75.0714	72.8149	68.1286	61.7547	57.6158	51.7901	46.8412	53.1851	55.4413	62.0380	69.4836	72.8244	(72)
Total internal gains													
	409.7081	407.3232	392.2777	368.0897	343.4549	319.9435	304.8579	311.3302	323.9456	348.3563	376.2979	397.3244	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1100	10.6334	0.7200	0.7000	0.7700	15.2643	(74)
South	7.8400	46.7521	0.7200	0.7000	0.7700	128.0208	(78)

Solar gains	143.2851	238.8360	316.6447	381.4738	421.8056	417.5318	402.9670	372.2805	338.5900	260.8677	170.5788	123.3469	(83)
Total gains	552.9933	646.1592	708.9224	749.5634	765.2605	737.4753	707.8249	683.6107	662.5355	609.2240	546.8767	520.6712	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.5997	70.7626	70.9231	71.6866	71.8313	72.5125	72.5125	72.6401	72.2486	71.8313	71.5392	71.2363	
alpha	5.7066	5.7175	5.7282	5.7791	5.7888	5.8342	5.8342	5.8427	5.8166	5.7888	5.7693	5.7491	
util living area	0.9981	0.9949	0.9868	0.9613	0.8883	0.7267	0.5465	0.5869	0.8219	0.9694	0.9953	0.9986	(86)
MIT	19.9829	20.1377	20.3517	20.6128	20.8354	20.9634	20.9940	20.9911	20.9235	20.6390	20.2573	19.9527	(87)
Th 2	20.0970	20.0989	20.1007	20.1095	20.1111	20.1187	20.1187	20.1202	20.1158	20.1111	20.1078	20.1043	(88)
util rest of house	0.9974	0.9932	0.9822	0.9473	0.8483	0.6452	0.4414	0.4810	0.7527	0.9554	0.9935	0.9982	(89)
MIT 2	18.7327	18.9598	19.2712	19.6490	19.9456	20.0934	20.1164	20.1163	20.0547	19.6917	19.1416	18.6941	(90)
Living area fraction									fLA = Living area / (4) =			0.2589	(91)
MIT	19.0564	19.2648	19.5510	19.8985	20.1760	20.3187	20.3436	20.3428	20.2796	19.9370	19.4305	19.0199	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0564	19.2648	19.5510	19.8985	20.1760	20.3187	20.3436	20.3428	20.2796	19.9370	19.4305	19.0199	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9911	0.9786	0.9432	0.8516	0.6648	0.4687	0.5085	0.7669	0.9520	0.9916	0.9974	(94)
Useful gains	551.0008	640.4209	693.7359	707.0076	651.7341	490.2755	331.7818	347.6332	508.0983	579.9643	542.2689	519.3109	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1352.2100	1313.2949	1190.4798	992.5777	763.3863	510.2091	334.0003	351.1541	553.3495	840.9328	1115.0720	1345.8967	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	596.0997	452.1713	369.5775	205.6105	83.0692	0.0000	0.0000	0.0000	0.0000	194.1606	412.4183	614.9798	(98)
Space heating												2928.0869	(98)
Space heating per m2											(98) / (4) =	31.4307	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3138.3568	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	596.0997	452.1713	369.5775	205.6105	83.0692	0.0000	0.0000	0.0000	0.0000	194.1606	412.4183	614.9798	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.9064	484.6424	396.1173	220.3757	89.0345	0.0000	0.0000	0.0000	0.0000	208.1035	442.0346	659.1424	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9101	149.8075	155.3663	136.5427	131.8260	114.9503	107.7034	121.9071	122.8649	141.7309	153.2906	165.8794	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4722	89.3765	89.2037	88.8281	88.0570	86.7000	86.7000	86.7000	86.7000	88.7451	89.2953	89.5105	(217)
Fuel for water heating, kWh/month													
	191.0204	167.6141	174.1701	153.7157	149.7052	132.5840	124.2253	140.6080	141.7127	159.7056	171.6671	185.3185	(219)
Water heating fuel used												1892.0467	(219)
Annual totals kWh/year													
Space heating fuel - main system												3138.3568	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												421.4768	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 1080 * 1.00) =										-690.8958		-690.8958	(233)
Total delivered energy for all uses												4835.9845	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3138.3568	0.2160	677.8851	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1892.0467	0.2160	408.6821	(264)
Space and water heating			1086.5671	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	421.4768	0.5190	218.7465	(268)
Energy saving/generation technologies				
PV Unit	-690.8958	0.5190	-358.5749	(269)
Total CO2, kg/year			985.6637	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.5800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		10.5800	ZC1
Total Floor Area	TFA	93.1600	
Assumed number of occupants	N	2.6666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5697	ZC2
CO2 emissions from cooking, equation (L16)		1.9643	ZC3
Total CO2 emissions		28.1140	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.1140	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3617	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.9500	1.3258	15.8428			(27)
Ground floor			46.5800	0.1300	6.0554			(28a)
External Wall	50.5400	14.0700	36.4700	0.1800	6.5646			(29a)
Main Roof	46.5800		46.5800	0.1300	6.0554			(30)
Total net area of external elements Aum(A, m2)			143.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0622			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1092	(36)
Total fabric heat loss	(33) + (36) =	46.1714	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.0672	44.8154	44.5686	43.4092	43.1923	42.1825	42.1825	41.9955	42.5715	43.1923	43.6311	44.0899	(38)
Heat transfer coeff	91.2387	90.9868	90.7400	89.5806	89.3637	88.3539	88.3539	88.1669	88.7429	89.3637	89.8025	90.2613	(39)
Average = Sum(39)m / 12 =												89.5796	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9794	0.9767	0.9740	0.9616	0.9592	0.9484	0.9484	0.9464	0.9526	0.9592	0.9640	0.9689	(40)
HLP (average)												0.9616	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6666	(42)
Average daily hot water use (litres/day)		97.5306	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6945	47.1353	46.7185	43.2875	44.7305	46.7185	47.1353	50.6945	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.9106	(64)
Heat gains from water heating, kWh/month													
	65.6400	57.7738	60.4169	53.4076	51.6186	45.2862	43.1189	48.3269	48.8688	55.8926	59.5057	63.9708	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8658	21.1974	17.2389	13.0509	9.7557	8.2362	8.8995	11.5679	15.5264	19.7143	23.0095	24.5291	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	88.2258	85.9728	81.2056	74.1772	69.3799	62.8975	57.9555	64.9556	67.8734	75.1245	82.6468	85.9823	(72)
Total internal gains													
	422.8625	420.4811	405.3547	380.5122	355.2189	331.0508	315.9721	323.1006	336.3776	361.4429	389.4610	410.4823	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1100	10.6334	0.6300	0.7000	0.7700	13.3563	(74)
South	7.8400	46.7521	0.6300	0.7000	0.7700	112.0182	(78)

Solar gains	125.3745	208.9815	277.0641	333.7895	369.0799	365.3403	352.5962	325.7454	296.2662	228.2592	149.2565	107.9285	(83)
Total gains	548.2370	629.4627	682.4188	714.3017	724.2989	696.3912	668.5683	648.8461	632.6438	589.7021	538.7175	518.4108	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.9068	71.1031	71.2965	72.2192	72.3945	73.2219	73.2219	73.3772	72.9010	72.3945	72.0408	71.6746	
alpha	5.7271	5.7402	5.7531	5.8146	5.8263	5.8815	5.8815	5.8918	5.8601	5.8263	5.8027	5.7783	
util living area													
	0.9982	0.9955	0.9888	0.9680	0.9053	0.7531	0.5712	0.6098	0.8399	0.9730	0.9957	0.9987	(86)
MIT	19.9840	20.1274	20.3325	20.5902	20.8168	20.9571	20.9928	20.9896	20.9153	20.6286	20.2572	19.9589	(87)
Th 2	20.1006	20.1028	20.1050	20.1155	20.1174	20.1265	20.1265	20.1282	20.1230	20.1174	20.1135	20.1093	(88)
util rest of house													
	0.9976	0.9940	0.9850	0.9559	0.8691	0.6727	0.4632	0.5020	0.7737	0.9604	0.9939	0.9982	(89)
MIT 2	18.7371	18.9478	19.2472	19.6233	19.9298	20.0962	20.1237	20.1237	20.0540	19.6828	19.1458	18.7069	(90)
Living area fraction									fLA = Living area / (4) =			0.2589	(91)
MIT	19.0599	19.2532	19.5282	19.8737	20.1594	20.3191	20.3487	20.3479	20.2770	19.9277	19.4335	19.0310	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0599	19.2532	19.5282	19.8737	20.1594	20.3191	20.3487	20.3479	20.2770	19.9277	19.4335	19.0310	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9921	0.9816	0.9518	0.8711	0.6917	0.4914	0.5300	0.7867	0.9570	0.9921	0.9974	(94)
Useful gains	546.3416	624.4843	669.8870	679.9030	630.9555	481.6847	328.5055	343.9010	497.6762	564.3458	534.4626	517.0864	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1346.6771	1305.9536	1182.1768	983.0283	755.9656	505.3029	331.2122	348.0714	548.1680	833.5552	1107.5807	1338.6677	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.4496	457.9474	381.1436	218.2502	93.0076	0.0000	0.0000	0.0000	0.0000	200.2918	412.6451	611.2565	(98)
Space heating												2969.9917	(98)
Space heating per m2											(98) / (4) =	31.8805	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3179.8627	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.4496	457.9474	381.1436	218.2502	93.0076	0.0000	0.0000	0.0000	0.0000	200.2918	412.6451	611.2565	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	637.5264	490.3077	408.0767	233.6726	99.5799	0.0000	0.0000	0.0000	0.0000	214.4452	441.8041	654.4502	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5290	87.2405	86.7174	85.6471	83.6450	80.3000	80.3000	80.3000	80.3000	85.3111	86.9376	87.6315	(217)
Fuel for water heating, kWh/month													
	239.9860	212.2591	224.0421	201.1971	199.4569	182.9883	175.3167	195.4371	197.5955	211.7854	219.9285	233.9769	(219)
Water heating fuel used												2493.9695	(219)
Annual totals kWh/year													
Space heating fuel - main system												3179.8627	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												421.4768	(232)
Total delivered energy for all uses												6170.3090	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3179.8627	0.2160	686.8503	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.9695	0.2160	538.6974	(264)
Space and water heating			1225.5478	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	421.4768	0.5190	218.7465	(268)
Total CO2, kg/m2/year			1483.2192	(272)
Emissions per m2 for space and water heating			13.1553	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3481	(272b)
Emissions per m2 for pumps and fans			0.4178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.1553 * 1.00) + 2.3481 + 0.4178, rounded to 2 d.p.			15.9200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 209 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 209 - EPC	**Prop Type Ref**	
Property	3 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	90 B	**DER**	10.58	**TER**	15.92
Environmental	92 A	**% DER<TER**	33.55		
CO_2 Emissions (t/year)	0.68	**DFEE**	35.34	**TFEE**	41.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	15.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.58	$kgCO_2/m^2$	Pass
	-5.34 (-33.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.67	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	35.34	$kWh/m^2/yr$	
	-6.4 (-15.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.11 m², No overhang
Windows facing South	7.84 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 209 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 209 - EPC	**Prop Type Ref**	
Property	3 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	90 B	**DER**	10.58	**TER**	15.92
Environmental	92 A	**% DER<TER**	33.55		
CO_2 Emissions (t/year)	0.68	**DFEE**	35.34	**TFEE**	41.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	46.58 m²	2.39 m
1st Storey:	1.00 m	46.58 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	50.54	36.47

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	92.63

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	46.58	46.58

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	46.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.30	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
D2 (W10)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.09	0.060	No
Independently assessed	E3 Sill	7.49	0.009	No
Independently assessed	E4 Jamb	22.20	0.011	No
Independently assessed	E5 Ground floor (normal)	10.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	10.09	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.030	No
Independently assessed	E18 Party wall between dwellings	20.04	0.023	No
Independently assessed	P1 Party wall - Ground floor	18.49	0.053	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	18.49	0.045	No

Y-value	0.028	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.36	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£89	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 209 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 209 - EPC	**Prop Type Ref**	
Property	3 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	90 B	**DER**	10.58	**TER**	15.92
Environmental	92 A	**% DER<TER**	33.55		
CO_2 Emissions (t/year)	0.68	**DFEE**	35.34	**TFEE**	41.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	15.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.16	m^2	
DER	10.58	$kgCO_2/yr/m^2$	
TER	15.92	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	10.58	$kgCO_2/yr/m^2$	
Reduction DER/TER	33.55	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Mid-Terrace		
Fabric energy efficiency (F.E.E.)	35.34	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.16	m^2	
DER	16.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.96	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.96	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.58	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.11	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.11	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 210 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 210 - EPC	**Prop Type Ref**	As
Property	4 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	12.74	**TER**	16.95
Environmental	90 B	**% DER<TER**	24.85		
CO_2 Emissions (t/year)	0.93	**DFEE**	43.74	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.95	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.74	$kgCO_2/m^2$	Pass
	-4.21 (-24.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.74	$kWh/m^2/yr$	
	-6.8 (-13.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	4.65 m², No overhang 8.06 m², No overhang 7.65 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	0.80	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 210 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 210 - EPC	**Prop Type Ref**	As
Property	4 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	12.74	**TER**	16.95
Environmental	90 B	**% DER<TER**	24.85		
CO_2 Emissions (t/year)	0.93	**DFEE**	43.74	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

End-Terrace House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.95 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.27 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.65 m², No overhang
Windows facing East: 8.06 m², No overhang
Windows facing South: 7.65 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 0.80 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9000 (1b)	x	2.3900 (2b)	=	116.8710	(1b) - (3b)
First floor	48.8000 (1c)	x	2.6300 (2c)	=	128.3440	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2150	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3358	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2855	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3640	0.3568	0.3497	0.3140	0.3069	0.2712	0.2712	0.2641	0.2855	0.3069	0.3211	0.3354	(22b)
Effective ac	0.5662	0.5637	0.5611	0.5493	0.5471	0.5368	0.5368	0.5349	0.5407	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.3600	1.2357	25.1597			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9000	0.1800	8.8020			(28a)
External Wall	101.4200	22.4800	78.9400	0.2700	21.3138			(29a)
Main Roof	48.8000		48.8000	0.1600	7.8080			(30)
Total net area of external elements Aum(A, m2)			199.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2635			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8563	(36)
Total fabric heat loss (33) + (36) =	71.1198	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.8204	45.6123	45.4083	44.4500	44.2707	43.4361	43.4361	43.2816	43.7576	44.2707	44.6334	45.0126	(38)
Heat transfer coeff	116.9402	116.7321	116.5281	115.5698	115.3905	114.5560	114.5560	114.4014	114.8774	115.3905	115.7532	116.1324	(39)
Average = Sum(39)m / 12 =												115.5690	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1969	1.1948	1.1927	1.1829	1.1811	1.1725	1.1725	1.1709	1.1758	1.1811	1.1848	1.1887	(40)
HLP (average)												1.1829	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7172	(42)
Average daily hot water use (litres/day)	98.7333	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6066	104.6572	100.7079	96.7586	92.8093	88.8599	88.8599	92.8093	96.7586	100.7079	104.6572	108.6066	(44)
Energy conte	161.0604	140.8645	145.3595	126.7279	121.5985	104.9302	97.2333	111.5766	112.9092	131.5848	143.6351	155.9784	(45)
Energy content (annual)										Total = Sum(45)m =		1553.4585	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1591	21.1297	21.8039	19.0092	18.2398	15.7395	14.5850	16.7365	16.9364	19.7377	21.5453	23.3968	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8157	10.6625	11.7827	11.3647	11.7144	11.3030	11.6589	11.6949	11.3366	11.7538	11.4088	11.8050	(61)
Total heat required for water heating calculated for each month													
	172.8761	151.5270	157.1422	138.0926	133.3129	116.2332	108.8922	123.2715	124.2458	143.3386	155.0439	167.7834	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.8761	151.5270	157.1422	138.0926	133.3129	116.2332	108.8922	123.2715	124.2458	143.3386	155.0439	167.7834	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.7595	(64)
Heat gains from water heating, kWh/month													
	56.5065	49.5031	51.2777	44.9782	43.3601	37.7151	35.2448	40.0230	40.3765	46.6904	50.6109	54.8141	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5899	20.0641	16.3173	12.3532	9.2342	7.7959	8.4237	10.9495	14.6964	18.6604	21.7794	23.2177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.5550	255.1757	248.5715	234.5121	216.7645	200.0843	188.9409	186.3202	192.9244	206.9838	224.7314	241.4116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	(71)
Water heating gains (Table 5)													
	75.9496	73.6653	68.9217	62.4697	58.2797	52.3820	47.3720	53.7943	56.0784	62.7559	70.2929	73.6748	(72)
Total internal gains													
	417.8523	415.6630	400.5683	376.0929	351.0362	327.0201	311.4945	317.8218	330.4570	355.1580	383.5615	405.0620	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6500	10.6334	0.7200	0.7000	0.7700	17.2698	(74)
East	8.0600	19.6403	0.7200	0.7000	0.7700	55.2899	(76)
South	7.6500	46.7521	0.7200	0.7000	0.7700	124.9183	(78)

Solar gains	197.4781	345.7464	494.8070	644.4000	746.6454	751.1908	720.1626	643.0188	546.8225	388.2890	238.3154	167.8057	(83)
Total gains	615.3304	761.4093	895.3753	1020.4929	1097.6817	1078.2109	1031.6572	960.8406	877.2795	743.4470	621.8769	572.8676	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.0187	58.1222	58.2239	58.7067	58.7979	59.2263	59.2263	59.3063	59.0605	58.7979	58.6137	58.4223	
alpha	4.8679	4.8748	4.8816	4.9138	4.9199	4.9484	4.9484	4.9538	4.9374	4.9199	4.9076	4.8948	
util living area													
	0.9975	0.9927	0.9783	0.9320	0.8215	0.6441	0.4813	0.5348	0.7868	0.9617	0.9942	0.9982	(86)
MIT	19.7237	19.9287	20.2238	20.5726	20.8362	20.9630	20.9928	20.9881	20.9020	20.5363	20.0537	19.6835	(87)
Th 2	19.9225	19.9242	19.9258	19.9337	19.9352	19.9420	19.9420	19.9433	19.9394	19.9352	19.9322	19.9291	(88)
util rest of house													
	0.9967	0.9902	0.9709	0.9087	0.7661	0.5522	0.3694	0.4185	0.7046	0.9438	0.9918	0.9976	(89)
MIT 2	18.2283	18.5279	18.9546	19.4469	19.7821	19.9187	19.9395	19.9387	19.8656	19.4094	18.7170	18.1743	(90)
Living area fraction									fLA = Living area / (4) =			0.1927	(91)
MIT	18.5165	18.7979	19.1992	19.6639	19.9853	20.1200	20.1425	20.1410	20.0653	19.6266	18.9746	18.4652	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5165	18.7979	19.1992	19.6639	19.9853	20.1200	20.1425	20.1410	20.0653	19.6266	18.9746	18.4652	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9866	0.9641	0.9016	0.7690	0.5684	0.3910	0.4409	0.7155	0.9370	0.9887	0.9964	(94)
Useful gains	612.2514	751.1740	863.2692	920.0743	844.1297	612.8842	403.3750	423.6172	627.6950	696.5764	614.8663	570.7916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1662.4789	1622.3271	1479.8152	1243.9787	956.0428	632.3479	405.8175	427.9722	685.2818	1041.5826	1374.5282	1656.6497	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	781.3693	585.4148	458.7102	233.2112	83.2633	0.0000	0.0000	0.0000	0.0000	256.6846	546.9566	807.8784	(98)
Space heating												3753.4885	(98)
Space heating per m2											(98) / (4) =	38.4185	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4023.0316	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	781.3693	585.4148	458.7102	233.2112	83.2633	0.0000	0.0000	0.0000	0.0000	256.6846	546.9566	807.8784	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	837.4805	627.4543	491.6508	249.9584	89.2426	0.0000	0.0000	0.0000	0.0000	275.1175	586.2343	865.8933	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.8761	151.5270	157.1422	138.0926	133.3129	116.2332	108.8922	123.2715	124.2458	143.3386	155.0439	167.7834	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6258	89.5356	89.3533	88.9267	88.0495	86.7000	86.7000	86.7000	86.7000	88.9762	89.4794	89.6598	(217)
Fuel for water heating, kWh/month													
	192.8865	169.2366	175.8661	155.2881	151.4067	134.0637	125.5965	142.1817	143.3055	161.0977	173.2733	187.1334	(219)
Water heating fuel used												1911.3360	(219)
Annual totals kWh/year													
Space heating fuel - main system												4023.0316	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9445	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.80 * 853 * 1.00) =										-545.9391		-545.9391	(233)
Total delivered energy for all uses												5862.3729	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4023.0316	0.2160	868.9748	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.3360	0.2160	412.8486	(264)
Space and water heating			1281.8234	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.9445	0.5190	207.0522	(268)
Energy saving/generation technologies				
PV Unit	-545.9391	0.5190	-283.3424	(269)
Total CO2, kg/year			1244.4582	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.7400	ZC1
Total Floor Area	TFA	97.7000	
Assumed number of occupants	N	2.7172	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3182	ZC2
CO2 emissions from cooking, equation (L16)		1.8855	ZC3
Total CO2 emissions		29.9437	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.9437	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9000 (1b)	x	2.3900 (2b)	=	116.8710	(1b) - (3b)
First floor	48.8000 (1c)	x	2.6300 (2c)	=	128.3440	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2150	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3007	0.3007	0.2928	0.3165	0.3402	0.3561	0.3719	(22b)
Effective ac	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			20.3600	1.3258	26.9924			(27)
Ground floor			48.9000	0.1300	6.3570			(28a)
External Wall	101.4200	22.4800	78.9400	0.1800	14.2092			(29a)
Main Roof	48.8000		48.8000	0.1300	6.3440			(30)
Total net area of external elements Aum(A, m2)			199.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.4466			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2048	(36)
Total fabric heat loss					(33) + (36) =		67.6514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0488	46.7929	46.5422	45.3643	45.1440	44.1181	44.1181	43.9281	44.5132	45.1440	45.5898	46.0558	(38)
Heat transfer coeff	114.7002	114.4444	114.1936	113.0158	112.7954	111.7695	111.7695	111.5796	112.1647	112.7954	113.2412	113.7073	(39)
Average = Sum(39)m / 12 =												113.0147	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1740	1.1714	1.1688	1.1568	1.1545	1.1440	1.1440	1.1421	1.1481	1.1545	1.1591	1.1638	(40)
HLP (average)												1.1568	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7172	(42)
Average daily hot water use (litres/day)												98.7333	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6066	104.6572	100.7079	96.7586	92.8093	88.8599	88.8599	92.8093	96.7586	100.7079	104.6572	108.6066	(44)
Energy conte	161.0604	140.8645	145.3595	126.7279	121.5985	104.9302	97.2333	111.5766	112.9092	131.5848	143.6351	155.9784	(45)
Energy content (annual)										Total = Sum(45)m =		1553.4585	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1591	21.1297	21.8039	19.0092	18.2398	15.7395	14.5850	16.7365	16.9364	19.7377	21.5453	23.3968	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7166	47.2946	43.8213	45.2820	47.2946	47.7166	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0193	186.8919	196.3184	174.4445	168.8931	148.7516	142.5153	158.8712	160.6258	182.5437	192.9502	206.9373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0193	186.8919	196.3184	174.4445	168.8931	148.7516	142.5153	158.8712	160.6258	182.5437	192.9502	206.9373	(64)
								Total per year (kWh/year) = Sum(64)m =				2131.7622	(64)
Heat gains from water heating, kWh/month													
	66.2923	58.3443	61.0718	54.0662	52.2551	45.8446	43.6506	48.9229	49.4715	56.4917	60.0874	64.6025	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	135.8595	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5899	20.0641	16.3173	12.3532	9.2342	7.7959	8.4237	10.9495	14.6964	18.6604	21.7794	23.2177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.5550	255.1757	248.5715	234.5121	216.7645	200.0843	188.9409	186.3202	192.9244	206.9838	224.7314	241.4116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	36.5859	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	-108.6876	(71)
Water heating gains (Table 5)													
	89.1026	86.8219	82.0857	75.0919	70.2354	63.6731	58.6701	65.7566	68.7104	75.9297	83.4548	86.8314	(72)
Total internal gains													
	431.0053	428.8195	413.7323	388.7150	362.9919	338.3112	322.7926	329.7841	343.0889	368.3317	396.7234	418.2185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.6500	10.6334	0.6300	0.7000	0.7700	15.1111	(74)
East	8.0600	19.6403	0.6300	0.7000	0.7700	48.3787	(76)
South	7.6500	46.7521	0.6300	0.7000	0.7700	109.3035	(78)

Solar gains	172.7933	302.5281	432.9561	563.8500	653.3147	657.2919	630.1423	562.6415	478.4697	339.7529	208.5260	146.8299	(83)
Total gains	603.7986	731.3476	846.6885	952.5651	1016.3067	995.6031	952.9349	892.4255	821.5586	708.0846	605.2494	565.0485	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1518	59.2840	59.4142	60.0334	60.1507	60.7028	60.7028	60.8061	60.4889	60.1507	59.9139	59.6683	
alpha	4.9435	4.9523	4.9609	5.0022	5.0100	5.0469	5.0469	5.0537	5.0326	5.0100	4.9943	4.9779	
util living area													
	0.9977	0.9938	0.9821	0.9439	0.8465	0.6744	0.5070	0.5597	0.8084	0.9668	0.9948	0.9984	(86)
MIT	19.7433	19.9316	20.2104	20.5503	20.8188	20.9577	20.9917	20.9867	20.8944	20.5308	20.0672	19.7092	(87)
Th 2	19.9409	19.9430	19.9450	19.9547	19.9566	19.9651	19.9651	19.9666	19.9618	19.9566	19.9529	19.9490	(88)
util rest of house													
	0.9969	0.9917	0.9759	0.9239	0.7952	0.5829	0.3925	0.4417	0.7298	0.9510	0.9927	0.9978	(89)
MIT 2	18.2698	18.5456	18.9501	19.4354	19.7834	19.9378	19.9621	19.9613	19.8802	19.4192	18.7516	18.2259	(90)
Living area fraction										fLA = Living area / (4) =		0.1927	(91)
MIT	18.5538	18.8128	19.1930	19.6503	19.9829	20.1343	20.1605	20.1590	20.0757	19.6334	19.0051	18.5118	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5538	18.8128	19.1930	19.6503	19.9829	20.1343	20.1605	20.1590	20.0757	19.6334	19.0051	18.5118	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9884	0.9699	0.9167	0.7967	0.5987	0.4146	0.4644	0.7396	0.9445	0.9898	0.9966	(94)
Useful gains	601.0232	722.8748	821.1991	873.2340	809.6668	596.0987	395.1198	414.4775	607.5844	668.7935	599.0879	563.1395	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1634.9162	1592.2374	1449.4624	1214.9547	934.2749	618.5716	397.9603	419.4233	670.2634	1018.9295	1348.1516	1627.3540	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	769.2164	584.2116	467.4279	246.0389	92.7085	0.0000	0.0000	0.0000	0.0000	260.5012	539.3259	791.7756	(98)
Space heating												3751.2060	(98)
Space heating per m2											(98) / (4) =	38.3951	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4016.2806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	769.2164	584.2116	467.4279	246.0389	92.7085	0.0000	0.0000	0.0000	0.0000	260.5012	539.3259	791.7756	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	823.5722	625.4943	500.4582	263.4249	99.2596	0.0000	0.0000	0.0000	0.0000	278.9092	577.4367	847.7255	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0193	186.8919	196.3184	174.4445	168.8931	148.7516	142.5153	158.8712	160.6258	182.5437	192.9502	206.9373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0082	87.7257	87.1576	85.9168	83.6105	80.3000	80.3000	80.3000	80.3000	85.9460	87.5001	88.1039	(217)
Fuel for water heating, kWh/month													
	240.9087	213.0412	225.2454	203.0390	201.9998	185.2448	177.4786	197.8471	200.0321	212.3935	220.5142	234.8788	(219)
Water heating fuel used												2512.6233	(219)
Annual totals kWh/year													
Space heating fuel - main system												4016.2806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9445	(232)
Total delivered energy for all uses												7002.8483	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4016.2806	0.2160	867.5166	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2512.6233	0.2160	542.7266	(264)
Space and water heating			1410.2432	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.9445	0.5190	207.0522	(268)
Total CO2, kg/m2/year			1656.2204	(272)
Emissions per m2 for space and water heating			14.4344	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1193	(272b)
Emissions per m2 for pumps and fans			0.3984	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4344 * 1.00) + 2.1193 + 0.3984, rounded to 2 d.p.			16.9500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 210 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 210 - EPC	**Prop Type Ref**	As
Property	4 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	12.74	**TER**	16.95
Environmental	90 B	**% DER<TER**	24.85		
CO_2 Emissions (t/year)	0.93	**DFEE**	43.74	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.95	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.74	$kgCO_2/m^2$	Pass
	-4.21 (-24.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.74	$kWh/m^2/yr$	
	-6.8 (-13.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	4.65 m², No overhang 8.06 m², No overhang 7.65 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	0.80	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 210 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 210 - EPC	**Prop Type Ref**	As
Property	4 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	12.74	**TER**	16.95
Environmental	90 B	**% DER<TER**	24.85		
CO_2 Emissions (t/year)	0.93	**DFEE**	43.74	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	48.90 m²	2.39 m
1st Storey:	1.00 m	48.80 m²	2.63 m

7.0 Living Area	18.83	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	101.42	78.94

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	48.80	48.80

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	48.90

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.49	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
D2 (W13)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.01	0.060	No
Independently assessed	E3 Sill	14.41	0.009	No
Independently assessed	E4 Jamb	36.60	0.011	No
Independently assessed	E5 Ground floor (normal)	20.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.052	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.053	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.045	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.27	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.80	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£114	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 210 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 210 - EPC	**Prop Type Ref**	As
Property	4 Avocet Close, Boorley Green, Southampton, SO32 2ZN		

SAP Rating	88 B	**DER**	12.74	**TER**	16.95
Environmental	90 B	**% DER<TER**	24.85		
CO_2 Emissions (t/year)	0.93	**DFEE**	43.74	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.7	m^2	
DER	12.74	$kgCO_2/yr/m^2$	
TER	16.95	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.74	$kgCO_2/yr/m^2$	
Reduction DER/TER	24.85	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, End-Terrace	
Fabric energy efficiency (F.E.E.)	43.74	$kWh/m^2/yr$
CfSH ENE2 credits achieved	0.0	
CfSH ENE1 and 2 overall level achieved	0	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.7	m^2	
DER	17.84	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.32	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.04	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.04	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.94	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.32	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	32.14	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	32.14	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	8	%	

ENE7 credits achieved	0

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 211 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 211	**Prop Type Ref**	
Property	Moorgreen Det, Plot 211, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.00	**TER**	18.15
Environmental	94 A	**% DER<TER**	55.92		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.58	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.15 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER)  8.00 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.6 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.21 (max. 0.30)        0.21 (max. 0.70)          OK
Floor           0.15 (max. 0.25)        0.15 (max. 0.70)          OK
Roof            0.07 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.50 (design value)
Maximum                                 10.0                                            OK
-------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
-------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
-------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum                                 0.7                                             OK
-------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   1.31 m², No overhang
Windows facing North East:              1.02 m², No overhang
Windows facing East:                    5.07 m², No overhang
Windows facing South East:              1.02 m², No overhang
Windows facing South:                   6.53 m², No overhang
Windows facing West:                    5.94 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
-------------------------------------------------------------------------------------------------
10 Key features
Roof U-value                            0.07 W/m²K
Thermal bridging y-value                0.024 W/m²K
Photovoltaic array                      2.03 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800 (1b)	x	2.3900 (2b)	=	117.7792	(1b) - (3b)
First floor	47.9200 (1c)	x	2.6300 (2c)	=	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4301	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3333	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4250	0.4166	0.4083	0.3666	0.3583	0.3166	0.3166	0.3083	0.3333	0.3583	0.3750	0.3916	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6750	0.6666	0.6583	0.6166	0.6083	0.5666	0.5666	0.5583	0.5833	0.6083	0.6250	0.6416	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.8900	1.2357	25.8146			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1500	7.3920			(28a)
External Wall	142.9500	25.1300	117.8200	0.2100	24.7422			(29a)
Main Roof	47.9200		47.9200	0.0700	3.3544			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.8616			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7382	(36)
Total fabric heat loss					(33) + (36) =		73.5998	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.3061	53.6357	52.9653	49.6131	48.9427	45.5905	45.5905	44.9201	46.9314	48.9427	50.2835	51.6244	(38)
Heat transfer coeff	127.9059	127.2355	126.5651	123.2129	122.5425	119.1904	119.1904	118.5199	120.5312	122.5425	123.8834	125.2242	(39)
Average = Sum(39)m / 12 =												123.0453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3159	1.3090	1.3021	1.2676	1.2607	1.2262	1.2262	1.2193	1.2400	1.2607	1.2745	1.2883	(40)
HLP (average)												1.2659	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7120 (42)
Average daily hot water use (litres/day)		98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8272   10.6758   11.8037   11.3957   11.7548   11.3517   11.7152   11.7409   11.3757   11.7831   11.4274   11.8196 (61)
Total heat required for water heating calculated for each month
              172.6885  151.3661  156.9835  137.9669  133.2029  116.1522  108.8283  123.1796  124.1453  143.2052  154.8849  167.6052 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.6885  151.3661  156.9835  137.9669  133.2029  116.1522  108.8283  123.1796  124.1453  143.2052  154.8849  167.6052 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1690.2085 (64)
Heat gains from water heating, kWh/month
               56.4432   49.4485   51.2232   44.9339   43.3202   37.6841   35.2189   39.9886   40.3398   46.6436   50.5565   54.7536 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025  135.6025 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.4410   19.9319   16.2097   12.2718    9.1733    7.7445    8.3682   10.8773   14.5995   18.5374   21.6359   23.0647 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              251.7201  254.3321  247.7498  233.7368  216.0479  199.4229  188.3163  185.7043  192.2866  206.2996  223.9885  240.6135 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602   36.5602 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 -108.4820 (71)
Water heating gains (Table 5)
               75.8645   73.5840   68.8484   62.4081   58.2261   52.3390   47.3372   53.7481   56.0275   62.6930   70.2173   73.5936 (72)
Total internal gains
              416.7063  414.5288  399.4887  375.0975  350.1281  326.1872  310.7025  317.0104  329.5944  354.2108  382.5224  403.9525 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a       Specific data    Specific data        factor                W
                                                          W/m2       or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  1.3100            10.6334            0.4100           1.0000            0.7700            3.9579 (74)
Northeast                              1.0200            11.2829            0.4100           1.0000            0.7700            3.2699 (75)
East                                   5.0700            19.6403            0.4100           1.0000            0.7700           28.2926 (76)
Southeast                              1.0200            36.7938            0.4100           1.0000            0.7700           10.6633 (77)
South                                  6.5300            46.7521            0.4100           1.0000            0.7700           86.7423 (78)
West                                   5.9400            19.6403            0.4100           1.0000            0.7700           33.1475 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   166.0735  294.6347  428.5936  564.3346  655.6869  659.5045  632.4045  564.1437  476.2177  333.0545  201.1969  140.5741 (83)
Total gains   582.7798  709.1635  828.0823  939.4321 1005.8150  985.6917  943.1071  881.1542  805.8121  687.2653  583.7194  544.5267 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           45.8071   46.0485   46.2924   47.5518   47.8120   49.1567   49.1567   49.4347   48.6098   47.8120   47.2945   46.7881
alpha          4.0538    4.0699    4.0862    4.1701    4.1875    4.2771    4.2771    4.2956    4.2407    4.1875    4.1530    4.1192
util living area
               0.9962    0.9912    0.9784    0.9406    0.8541    0.6950    0.5351    0.5862    0.8217    0.9638    0.9926    0.9972 (86)

MIT           19.3768   19.5939   19.9274   20.3603   20.7039   20.9174   20.9790   20.9695   20.8204   20.3543   19.7978   19.3623 (87)
Th 2          19.8284   19.8338   19.8392   19.8663   19.8717   19.8991   19.8991   19.9046   19.8881   19.8717   19.8608   19.8500 (88)
util rest of house
               0.9951    0.9886    0.9715    0.9210    0.8054    0.6028    0.4111    0.4613    0.7468    0.9480    0.9899    0.9963 (89)
MIT 2         17.6790   17.9986   18.4847   19.1164   19.5762   19.8409   19.8905   19.8908   19.7394   19.1229   18.3151   17.6720 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.2037 (91)
MIT           18.0248   18.3236   18.7786   19.3697   19.8059   20.0602   20.1122   20.1105   19.9596   19.3737   18.6172   18.0163 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.0248   18.3236   18.7786   19.3697   19.8059   20.0602   20.1122   20.1105   19.9596   19.3737   18.6172   18.0163 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9923    0.9835    0.9628    0.9101    0.8021    0.6175    0.4361    0.4861    0.7524    0.9386    0.9854    0.9941 (94)
Useful gains  578.3067  697.4358  797.2888  855.0184  806.8130  608.6346  411.3083  428.3532  606.2948  645.0562  575.2064  541.3281 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1755.4860 1707.9531 1554.0360 1290.0086  993.3190  650.8033  418.6251  439.7699  706.2635 1075.1510 1426.7847 1730.1337 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              875.8214  679.0676  563.0199  313.1929  138.7604    0.0000    0.0000    0.0000    0.0000  319.9906  613.1364  884.4714 (98)
Space heating                                                                                                         4387.4605 (98)
Space heating per m2                                                                                    (98) / (4) =    45.1385 (99)


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8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4722.7777	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	875.8214	679.0676	563.0199	313.1929	138.7604	0.0000	0.0000	0.0000	0.0000	319.9906	613.1364	884.4714	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	942.7571	730.9662	606.0494	337.1291	149.3653	0.0000	0.0000	0.0000	0.0000	344.4462	659.9961	952.0683	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6885	151.3661	156.9835	137.9669	133.2029	116.1522	108.8283	123.1796	124.1453	143.2052	154.8849	167.6052	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3568	89.2992	89.1823	88.8966	88.3037	86.7000	86.7000	86.7000	86.7000	88.8857	89.2358	89.3745	(217)
Fuel for water heating, kWh/month													
	193.2572	169.5043	176.0254	155.1993	150.8464	133.9703	125.5228	142.0756	143.1895	161.1116	173.5681	187.5313	(219)
Water heating fuel used												1911.8018	(219)
Annual totals kWh/year													
Space heating fuel - main system												4722.7777	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.3156	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1068 * 1.00) =												-1734.5465	(233)
Total delivered energy for all uses												5371.3486	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4722.7777	0.2160	1020.1200	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.8018	0.2160	412.9492	(264)
Space and water heating			1433.0692	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.3156	0.5190	205.6878	(268)
Energy saving/generation technologies				
PV Unit	-1734.5465	0.5190	-900.2296	(269)
Total CO2, kg/year			777.4523	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.0000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.0000	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		25.2400	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.2400	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800 (1b)	x	2.3900 (2b)	=	117.7792	(1b) - (3b)
First floor	47.9200 (1c)	x	2.6300 (2c)	=	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1230	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3730	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0500	1.3258	26.5814			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.2900	118.6600	0.1800	21.3588			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8254			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.0691	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7638	123.5515	123.3435	122.3662	122.1834	121.3323	121.3323	121.1746	121.6601	122.1834	122.5533	122.9400	(39)
Average = Sum(39)m / 12 =												122.3654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2733	1.2711	1.2690	1.2589	1.2570	1.2483	1.2483	1.2467	1.2516	1.2570	1.2608	1.2648	(40)
HLP (average)												1.2589	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5335	20.0141	16.2766	12.3224	9.2111	7.7764	8.4027	10.9222	14.6597	18.6138	21.7251	23.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9479	427.7626	412.7125	387.7390	362.0884	337.4744	321.9974	328.9824	342.2524	367.4511	395.7671	417.1993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.2600	10.6334	0.6300	0.7000	0.7700	4.0946	(74)
Northeast	0.9800	11.2829	0.6300	0.7000	0.7700	3.3792	(75)
East	4.8600	19.6403	0.6300	0.7000	0.7700	29.1713	(76)
Southeast	0.9800	36.7938	0.6300	0.7000	0.7700	11.0198	(77)
South	6.2600	46.7521	0.6300	0.7000	0.7700	89.4431	(78)
West	5.7100	19.6403	0.6300	0.7000	0.7700	34.2732	(80)

Solar gains	171.3813	304.0701	442.3613	582.5218	676.8638	680.8229	652.8396	582.3428	491.5359	343.7322	207.6308	145.0646 (83)
Total gains	601.3292	731.8327	855.0738	970.2608	1038.9522	1018.2974	974.8369	911.3252	833.7883	711.1833	603.3979	562.2638 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5394	54.6331	54.7252	55.1623	55.2448	55.6324	55.6324	55.7047	55.4824	55.2448	55.0781	54.9048	
alpha	4.6360	4.6422	4.6483	4.6775	4.6830	4.7088	4.7088	4.7136	4.6988	4.6830	4.6719	4.6603	
util living area													
	0.9977	0.9939	0.9828	0.9475	0.8588	0.6984	0.5326	0.5867	0.8273	0.9698	0.9949	0.9983	(86)
MIT	19.6138	19.8071	20.1034	20.4682	20.7687	20.9380	20.9861	20.9784	20.8580	20.4494	19.9552	19.5765	(87)
Th 2	19.8618	19.8635	19.8652	19.8732	19.8746	19.8816	19.8816	19.8829	19.8789	19.8746	19.8716	19.8685	(88)
util rest of house													
	0.9969	0.9918	0.9767	0.9279	0.8074	0.6009	0.4049	0.4564	0.7478	0.9548	0.9928	0.9977	(89)
MIT 2	18.0258	18.3087	18.7386	19.2592	19.6526	19.8414	19.8767	19.8744	19.7683	19.2442	18.5314	17.9759	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.3493	18.6139	19.0166	19.5055	19.8800	20.0648	20.1027	20.0993	19.9903	19.4897	18.8215	18.3020	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3493	18.6139	19.0166	19.5055	19.8800	20.0648	20.1027	20.0993	19.9903	19.4897	18.8215	18.3020	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9884	0.9703	0.9199	0.8077	0.6182	0.4310	0.4829	0.7569	0.9478	0.9898	0.9964	(94)
Useful gains	598.4578	723.3192	829.6975	892.5274	839.1602	629.4773	420.1407	440.0825	631.1092	674.0440	597.2706	560.2622	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1738.7895	1694.3747	1543.8376	1297.7563	999.4583	663.0551	424.9905	448.2600	716.6163	1086.1719	1436.5046	1733.6980	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	848.4068	652.5493	531.3202	291.7648	119.2618	0.0000	0.0000	0.0000	0.0000	306.6232	604.2485	873.0362	(98)
Space heating												4227.2108	(98)
Space heating per m2											(98) / (4) =	43.4898	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4525.9216	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	848.4068	652.5493	531.3202	291.7648	119.2618	0.0000	0.0000	0.0000	0.0000	306.6232	604.2485	873.0362	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	908.3585	698.6609	568.8653	312.3820	127.6893	0.0000	0.0000	0.0000	0.0000	328.2903	646.9470	934.7283	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1840	87.9392	87.4349	86.3397	84.1961	80.3000	80.3000	80.3000	80.3000	86.3493	87.7311	88.2741	(217)
Fuel for water heating, kWh/month													
	240.2024	212.3259	224.3255	201.7945	200.3467	185.0158	177.2592	197.6025	199.7848	211.2131	219.7312	234.2073	(219)
Water heating fuel used												2503.8089	(219)
Annual totals kWh/year													
Space heating fuel - main system												4525.9216	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9493	(232)
Total delivered energy for all uses												7502.6798	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4525.9216	0.2160	977.5991	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2503.8089	0.2160	540.8227	(264)
Space and water heating			1518.4218	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9493	0.5190	206.5357	(268)
Total CO2, kg/m2/year			1763.8825	(272)
Emissions per m2 for space and water heating			15.6216	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1249	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6216 * 1.00) + 2.1249 + 0.4005, rounded to 2 d.p.			18.1500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 211 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 211	**Prop Type Ref**	
Property	Moorgreen Det, Plot 211, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.00	**TER**	18.15
Environmental	94 A	**% DER<TER**	55.92		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.58	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.15	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.00	$kgCO_2/m^2$	Pass
	-10.15 (-55.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.65	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.58	$kWh/m^2/yr$	
	-10.0 (-17.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.31 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	5.07 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	6.53 m², No overhang
Windows facing West	5.94 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 211 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 211	**Prop Type Ref**	
Property	Moorgreen Det, Plot 211, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.00	**TER**	18.15
Environmental	94 A	**% DER<TER**	55.92		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.58	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.84 m	49.28 m²	2.39 m
1st Storey:	28.25 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	142.95	117.82

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	47.92	47.92
Bay Roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.15	49.28

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.25	10
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.02	10
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	10
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	10
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	10
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	10
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	10
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	10
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	10
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	10

D1	Half Glazed Door	[1] External Wall	South			2.12	10
D2*	Half Glazed Door	[1] External Wall	North			2.12	10
D3 (W14)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.052	No
Independently assessed	E3 Sill	14.79	0.004	No
Independently assessed	E4 Jamb	44.40	0.005	No
Independently assessed	E5 Ground floor (normal)	28.84	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 211 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 211	**Prop Type Ref**	
Property	Moorgreen Det, Plot 211, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.00	**TER**	18.15
Environmental	94 A	**% DER<TER**	55.92		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.58	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	8.00	$kgCO_2/yr/m^2$	
TER	18.15	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.00	$kgCO_2/yr/m^2$	
Reduction DER/TER	55.92	%	
CfSH ENE1 credits achieved	5.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.58	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	19.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.88	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.88	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 212 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 212	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 212, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.22 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
										Total per year (kWh/year) = Sum(64)m =		1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
South	0.9600	46.7521	0.4100	1.0000	0.7700	12.7523	(78)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	71.6254	136.0533	216.2695	306.6842	370.3363	377.1839	359.8489	312.4091	248.3799	159.1833	88.5237	59.4335	(83)
Total gains	442.5659	504.9394	571.8046	640.6666	682.4306	668.1621	637.0887	595.5664	542.5870	475.1538	429.5125	419.1909	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9932	0.9880	0.9748	0.9369	0.8531	0.6972	0.5417	0.5913	0.8237	0.9587	0.9885	0.9945	(86)
MIT	19.3204	19.5119	19.8425	20.2991	20.6630	20.9023	20.9731	20.9622	20.7926	20.3095	19.7595	19.3211	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9916	0.9851	0.9684	0.9202	0.8131	0.6205	0.4359	0.4859	0.7627	0.9446	0.9852	0.9932	(89)
MIT 2	17.7233	18.0059	18.4889	19.1603	19.6582	19.9711	20.0364	20.0352	19.8458	19.1888	18.3880	17.7402	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9870	0.9784	0.9580	0.9071	0.8058	0.6302	0.4566	0.5057	0.7628	0.9331	0.9788	0.9893	(94)
Useful gains	436.8070	494.0117	547.8156	581.1377	549.8686	421.0558	290.8629	301.1697	413.8930	443.3717	420.4010	414.7198	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1236.6157	1198.4316	1088.5670	900.1027	695.4304	457.2497	298.2805	312.1860	495.3744	751.1687	999.2098	1213.9019	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating												3049.0345	(98)
Space heating per m2											(98) / (4) =	38.5466	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3282.0608	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	640.5357	509.5481	433.0668	247.2064	116.5748	0.0000	0.0000	0.0000	0.0000	246.5026	448.5924	640.0339	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1944	89.1395	89.0180	88.7175	88.1542	86.7000	86.7000	86.7000	86.7000	88.6874	89.0488	89.2102	(217)
Fuel for water heating, kWh/month													
	182.0167	159.6581	165.8537	146.3303	142.2362	126.1921	118.3152	133.8039	134.8180	151.9345	163.5725	176.6520	(219)
Water heating fuel used												1801.3832	(219)
Annual totals kWh/year													
Space heating fuel - main system												3282.0608	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4325.5790	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3282.0608	0.2160	708.9251	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.3832	0.2160	389.0988	(264)
Space and water heating			1098.0239	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			704.6920	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.9100	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.4542	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4542	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
							Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains 77.0410	146.3402	232.6216	329.8725	398.3373	405.7027	387.0570	336.0303	267.1598	171.2191	95.2169	63.9273	(83)
Total gains 462.3075	529.0520	601.1633	676.0325	721.8214	707.3713	675.0242	630.6705	573.6721	500.3239	450.1239	438.0457	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9982	0.9961	0.9889	0.9614	0.8803	0.7153	0.5438	0.6001	0.8524	0.9787	0.9963	0.9987	(86)
MIT	19.7968	19.9422	20.1944	20.5267	20.8015	20.9532	20.9909	20.9852	20.8786	20.5128	20.0954	19.7736	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9977	0.9948	0.9849	0.9468	0.8364	0.6271	0.4285	0.4823	0.7837	0.9680	0.9948	0.9982	(89)
MIT 2	18.3842	18.5981	18.9663	19.4480	19.8136	19.9887	20.0168	20.0159	19.9172	19.4371	18.8309	18.3572	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9926	0.9807	0.9405	0.8366	0.6430	0.4522	0.5064	0.7915	0.9629	0.9928	0.9973	(94)
Useful gains	460.6766	525.1371	589.5397	635.7798	603.9055	454.8733	305.2198	319.3700	454.0709	481.7418	446.8777	436.8668	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1263.2167	1224.6992	1111.6570	929.3842	715.9624	475.5555	307.8456	324.0264	514.2107	779.7991	1037.2929	1256.2284	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating												3006.8749	(98)
Space heating per m2											(98) / (4) =	38.0136	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3219.3521	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	639.2824	503.3252	415.9050	226.3331	89.2616	0.0000	0.0000	0.0000	0.0000	237.4246	455.1380	652.6821	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6193	87.3971	86.8895	85.7060	83.5252	80.3000	80.3000	80.3000	80.3000	85.7072	87.1092	87.7083	(217)
Fuel for water heating, kWh/month													
	229.9673	202.1623	211.5657	190.2393	188.9942	173.1411	165.8823	184.9199	186.9622	199.4624	209.4952	224.3184	(219)
Water heating fuel used												2367.1103	(219)
Annual totals kWh/year													
Space heating fuel - main system												3219.3521	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6025.8707	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3219.3521	0.2160	695.3801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2367.1103	0.2160	511.2958	(264)
Space and water heating			1206.6759	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1434.7288	(272)
Emissions per m2 for space and water heating			15.2551	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2551 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.1400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 212 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 212	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 212, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.14	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.91	$kgCO_2/m^2$	Pass
	-9.23 (-50.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.95	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.06	$kWh/m^2/yr$	
	-10.8 (-21.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.22 m², No overhang 0.96 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 212 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 212	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 212, Boorley Gardens, Southampton, SO32		

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Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 212 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 212	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 212, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.91	$kgCO_2/yr/m^2$	
TER	18.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.88	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 213 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 213	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 213, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 4.22 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
									Total per year (kWh/year) = Sum(64)m =			1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	61.7735	120.7111	199.0844	291.7449	359.3833	368.8476	350.7562	299.9579	231.9133	143.2549	76.9859	50.8323	(83)
Total gains	432.7140	489.5972	554.6195	625.7273	671.4776	659.8258	627.9960	583.1152	526.1204	459.2254	417.9747	410.5896	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9937	0.9892	0.9771	0.9410	0.8584	0.7031	0.5484	0.6014	0.8350	0.9628	0.9895	0.9949	(86)
MIT	19.3052	19.4888	19.8180	20.2807	20.6537	20.8992	20.9719	20.9598	20.7803	20.2880	19.7420	19.3078	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9922	0.9866	0.9713	0.9251	0.8192	0.6265	0.4418	0.4951	0.7759	0.9499	0.9865	0.9936	(89)
MIT 2	17.7013	17.9725	18.4539	19.1353	19.6470	19.9682	20.0357	20.0336	19.8325	19.1591	18.3626	17.7207	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9802	0.9614	0.9121	0.8115	0.6360	0.4625	0.5150	0.7751	0.9387	0.9805	0.9900	(94)
Useful gains	427.4590	479.9203	533.1993	570.7464	544.9185	419.6173	290.4455	300.2895	407.7872	431.0823	409.8052	406.4888	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1234.7632	1195.6327	1085.6481	898.0770	694.5090	457.0119	298.2147	312.0469	494.2855	748.7833	997.1579	1212.3061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating												3098.3798	(98)
Space heating per m2											(98) / (4) =	39.1704	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3335.1774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	646.5385	517.7166	442.4348	253.6900	119.8012	0.0000	0.0000	0.0000	0.0000	254.4343	455.2141	645.3478	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1995	89.1487	89.0316	88.7367	88.1759	86.7000	86.7000	86.7000	86.7000	88.7112	89.0579	89.2146	(217)
Fuel for water heating, kWh/month													
	182.0063	159.6416	165.8284	146.2986	142.2012	126.1921	118.3152	133.8039	134.8180	151.8938	163.5557	176.6432	(219)
Water heating fuel used												1801.1980	(219)
Annual totals kWh/year													
Space heating fuel - main system												3335.1774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4378.5104	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3335.1774	0.2160	720.3983	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.1980	0.2160	389.0588	(264)
Space and water heating			1109.4571	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			716.1252	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.0500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.5942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.5942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

	385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	66.4442	129.8380	214.1371	313.8037	386.5562	396.7361	377.2768	322.6377	249.4483	154.0863	82.8067	54.6757	(83)
Total gains	451.7107	512.5498	582.6788	659.9636	710.0403	698.4046	665.2440	617.2778	555.9605	483.1911	437.7137	428.7941	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9984	0.9966	0.9903	0.9648	0.8860	0.7220	0.5511	0.6114	0.8647	0.9816	0.9968	0.9988	(86)
MIT	19.7842	19.9228	20.1735	20.5109	20.7939	20.9511	20.9904	20.9839	20.8686	20.4943	20.0808	19.7626	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9979	0.9955	0.9868	0.9513	0.8433	0.6338	0.4346	0.4922	0.7987	0.9722	0.9955	0.9984	(89)
MIT 2	18.3658	18.5700	18.9363	19.4265	19.8049	19.9871	20.0166	20.0153	19.9074	19.4115	18.8097	18.3411	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9829	0.9450	0.8431	0.6497	0.4585	0.5166	0.8055	0.9673	0.9936	0.9976	(94)
Useful gains	450.2709	509.2300	572.6984	623.6777	598.6560	453.7339	305.0170	318.8569	447.8421	467.3686	434.9105	427.7450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1261.7099	1222.3907	1109.1972	927.6278	715.2339	475.4111	307.8197	323.9617	513.3738	777.7182	1035.5745	1254.9203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating												3066.4845	(98)
Space heating per m2											(98) / (4) =	38.7672	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3283.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	646.3711	513.1092	427.3610	234.3084	92.8630	0.0000	0.0000	0.0000	0.0000	247.2164	463.0387	658.9062	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6415	87.4376	86.9514	85.7929	83.6126	80.3000	80.3000	80.3000	80.3000	85.8086	87.1473	87.7270	(217)
Fuel for water heating, kWh/month													
	229.9091	202.0688	211.4149	190.0466	188.7965	173.1411	165.8823	184.9199	186.9622	199.2267	209.4037	224.2706	(219)
Water heating fuel used												2366.0425	(219)
Annual totals kWh/year													
Space heating fuel - main system												3283.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6088.6247	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3283.1739	0.2160	709.1656	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2366.0425	0.2160	511.0652	(264)
Space and water heating			1220.2308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1448.2836	(272)
Emissions per m2 for space and water heating			15.4264	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4264 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 213 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 213	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 213, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.05	$kgCO_2/m^2$	Pass
	-9.26 (-50.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.68	$kWh/m^2/yr$	
	-11.1 (-21.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 4.22 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 213 B2	**Issued on Date**	04/04/2025
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Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 213 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 213	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 213, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.05	$kgCO_2/yr/m^2$	
TER	18.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.57	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.68	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.66	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 214 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 214	**Prop Type Ref**	
Property	Rivermont Semi, Plot 214, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.36 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
               53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.4453   17.2711   14.0458   10.6336    7.9487    6.7107    7.2511    9.4253   12.6506   16.0628   18.7477   19.9857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
               71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
              370.9232  368.8708  355.5226  333.9730  312.0873  290.9722  277.2334  283.1489  294.1958  315.9563  340.9723  359.7396 (73)
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6. Solar gains

```
[Jan]                                    Area          Solar flux              g              FF            Access            Gains
                                           m2           Table 6a      Specific data  Specific data        factor                W
                                                           W/m2      or Table 6b    or Table 6c       Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
East                                     4.3600           19.6403           0.4100           1.0000           0.7700          24.3305 (76)
South                                    0.9600           46.7521           0.4100           1.0000           0.7700          12.7523 (78)
West                                     6.3300           19.6403           0.4100           1.0000           0.7700          35.3239 (80)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    72.4067  137.5816  218.7864  310.3550  374.8349  381.7891  364.2332  316.1752  251.3071  160.9967   89.4978   60.0760 (83)
Total gains   443.3299  506.4524  574.3091  644.3279  686.9221  672.7613  641.4666  599.3241  545.5030  476.9530  430.4701  419.8156 (84)
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7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.5606   47.8682   48.1798   49.8008   50.1381   51.8960   51.8960   52.2624   51.1783   50.1381   49.4679   48.8154
alpha          4.1707    4.1912    4.2120    4.3201    4.3425    4.4597    4.4597    4.4842    4.4119    4.3425    4.2979    4.2544
util living area
               0.9961    0.9926    0.9829    0.9520    0.8751    0.7194    0.5581    0.6101    0.8472    0.9704    0.9929    0.9969 (86)

MIT           19.4527   19.6277   19.9317   20.3545   20.6955   20.9168   20.9791   20.9696   20.8136   20.3615   19.8547   19.4534 (87)
Th 2          19.9456   19.9517   19.9577   19.9881   19.9943   20.0250   20.0250   20.0312   20.0127   19.9943   19.9820   19.9699 (88)
util rest of house
               0.9950    0.9905    0.9779    0.9370    0.8351    0.6377    0.4448    0.4970    0.7848    0.9585    0.9906    0.9960 (89)
MIT 2         17.8788   18.1378   18.5832   19.2084   19.6747   19.9612   20.0152   20.0154   19.8460   19.2309   18.4904   17.8959 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1956 (91)
MIT           18.1866   18.4292   18.8470   19.4325   19.8743   20.1481   20.2037   20.2020   20.0352   19.4520   18.7572   18.2005 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.1866   18.4292   18.8470   19.4325   19.8743   20.1481   20.2037   20.2020   20.0352   19.4520   18.7572   18.2005 (93)
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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9922    0.9861    0.9704    0.9265    0.8295    0.6489    0.4665    0.5181    0.7865    0.9497    0.9864    0.9938 (94)
Useful gains 439.8664  499.4003  557.2976  596.9808  569.8142  436.5428  299.2268  310.4907  429.0231  452.9549  424.6319  417.2016 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1283.0818 1242.0215 1126.1569  929.3955  716.4526  469.7993  305.1521  319.6921  509.6301  775.8462 1035.5610 1260.3494 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             627.3523  499.0414  423.2314  239.3387  109.0989    0.0000    0.0000    0.0000    0.0000  240.2311  439.8689  627.3019 (98)
Space heating                                                                                                              3205.4647 (98)
Space heating per m2                                                                                        (98) / (4) =     40.5242 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3450.4463	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	627.3523	499.0414	423.2314	239.3387	109.0989	0.0000	0.0000	0.0000	0.0000	240.2311	439.8689	627.3019	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	675.2985	537.1813	455.5774	257.6304	117.4369	0.0000	0.0000	0.0000	0.0000	258.5911	473.4865	675.2443	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2230	89.1697	89.0500	88.7481	88.1600	86.7000	86.7000	86.7000	86.7000	88.7233	89.0821	89.2387	(217)
Fuel for water heating, kWh/month													
	181.9583	159.6040	165.7941	146.2798	142.2268	126.1921	118.3152	133.8039	134.8180	151.8731	163.5113	176.5955	(219)
Water heating fuel used												1800.9722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3450.4463	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4493.2492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3450.4463	0.2160	745.2964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.9722	0.2160	389.0100	(264)
Space and water heating			1134.3064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			740.8165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.3700	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.9142	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9142	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	77.8813	147.9841	235.3288	333.8208	403.1761	410.6560	391.7728	340.0811	270.3084	173.1697	96.2647	64.6183	(83)
Total gains	463.0948	530.6487	603.8322	679.9518	726.6385	712.3063	679.7202	634.6956	576.7862	502.2306	451.1205	438.6822	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9982	0.9961	0.9890	0.9622	0.8836	0.7224	0.5516	0.6084	0.8571	0.9792	0.9963	0.9987	(86)
MIT	19.7621	19.9092	20.1655	20.5040	20.7873	20.9478	20.9894	20.9829	20.8684	20.4918	20.0664	19.7386	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9976	0.9947	0.9850	0.9477	0.8399	0.6328	0.4328	0.4873	0.7885	0.9686	0.9948	0.9982	(89)
MIT 2	18.3183	18.5348	18.9089	19.3997	19.7777	19.9635	19.9948	19.9934	19.8870	19.3912	18.7732	18.2907	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9925	0.9806	0.9410	0.8392	0.6480	0.4561	0.5109	0.7952	0.9631	0.9927	0.9972	(94)
Useful gains	461.4250	526.6658	592.1145	639.8316	609.8195	461.5487	310.0213	324.2914	458.6578	483.7181	447.8288	437.4716	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1286.6282	1247.5614	1132.5125	947.1311	729.7056	484.5702	313.0453	329.6062	523.6843	794.1890	1056.6395	1279.8042	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating												3106.9296	(98)
Space heating per m2											(98) / (4) =	39.2785	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3326.4771	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	657.3353	518.6743	430.4670	236.8904	95.4982	0.0000	0.0000	0.0000	0.0000	247.3131	469.3187	670.9802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6751	87.4601	86.9679	85.8203	83.6752	80.3000	80.3000	80.3000	80.3000	85.8096	87.1769	87.7625	(217)
Fuel for water heating, kWh/month													
	229.8210	202.0167	211.3750	189.9858	188.6553	173.1411	165.8823	184.9199	186.9622	199.2245	209.3325	224.1798	(219)
Water heating fuel used												2365.4962	(219)
Annual totals kWh/year													
Space heating fuel - main system												3326.4771	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6130.4447	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3326.4771	0.2160	718.5191	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.4962	0.2160	510.9472	(264)
Space and water heating			1229.4662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1457.0329	(272)
Emissions per m2 for space and water heating			15.5432	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5432 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 214 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 214	**Prop Type Ref**	
Property	Rivermont Semi, Plot 214, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.37	$kgCO_2/m^2$	Pass
	-9.05 (-49.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.83	$kWh/m^2/yr$	
	-10.7 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.36 m², No overhang 0.96 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 214 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 214	**Prop Type Ref**	
Property	Rivermont Semi, Plot 214, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.37	$kgCO_2/yr/m^2$	
TER	18.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	49.13	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.92	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 215 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 215	**Prop Type Ref**	
Property	Rivermont Semi, Plot 215, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 4.36 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
               53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.4453   17.2711   14.0458   10.6336    7.9487    6.7107    7.2511    9.4253   12.6506   16.0628   18.7477   19.9857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
               71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
              370.9232  368.8708  355.5226  333.9730  312.0873  290.9722  277.2334  283.1489  294.1958  315.9563  340.9723  359.7396 (73)
```

---

6. Solar gains

```
[Jan]                                    Area          Solar flux              g              FF          Access          Gains
                                           m2           Table 6a      Specific data  Specific data      factor              W
                                                           W/m2      or Table 6b    or Table 6c    Table 6d
-----------------------------------------------------------------------------------------------------------------------------
North                                    0.9600           10.6334           0.4100         1.0000          0.7700          2.9004 (74)
East                                     4.3600           19.6403           0.4100         1.0000          0.7700         24.3305 (76)
West                                     6.3300           19.6403           0.4100         1.0000          0.7700         35.3239 (80)
-----------------------------------------------------------------------------------------------------------------------------

Solar gains    62.5548  122.2394  201.6013  295.4156  363.8819  373.4527  355.1405  303.7240  234.8406  145.0683   77.9600   51.4748 (83)
Total gains   433.4780  491.1102  557.1239  629.3886  675.9692  664.4250  632.3739  586.8729  529.0364  461.0246  418.9323  411.2144 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.5606   47.8682   48.1798   49.8008   50.1381   51.8960   51.8960   52.2624   51.1783   50.1381   49.4679   48.8154
alpha          4.1707    4.1912    4.2120    4.3201    4.3425    4.4597    4.4597    4.4842    4.4119    4.3425    4.2979    4.2544
util living area
               0.9964    0.9934    0.9847    0.9555    0.8802    0.7254    0.5650    0.6205    0.8582    0.9737    0.9936    0.9971 (86)

MIT           19.4391   19.6068   19.9092   20.3374   20.6867   20.9139   20.9780   20.9675   20.8020   20.3416   19.8389   19.4414 (87)
Th 2          19.9456   19.9517   19.9577   19.9881   19.9943   20.0250   20.0250   20.0312   20.0127   19.9943   19.9820   19.9699 (88)
util rest of house
               0.9954    0.9915    0.9801    0.9414    0.8411    0.6439    0.4508    0.5065    0.7981    0.9629    0.9915    0.9963 (89)
MIT 2         17.8590   18.1075   18.5511   19.1850   19.6641   19.9587   20.0146   20.0142   19.8336   19.2033   18.4674   17.8784 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1956 (91)
MIT           18.1681   18.4007   18.8167   19.4103   19.8641   20.1455   20.2030   20.2007   20.0230   19.4259   18.7357   18.1841 (92)
Temperature adjustment                                                                                                     0.0000
adjusted MIT  18.1681   18.4007   18.8167   19.4103   19.8641   20.1455   20.2030   20.2007   20.0230   19.4259   18.7357   18.1841 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9928    0.9874    0.9730    0.9310    0.8352    0.6549    0.4726    0.5277    0.7988    0.9544    0.9876    0.9942 (94)
Useful gains 430.3443  484.9359  542.0950  585.9748  564.5661  435.1104  298.8625  309.6868  422.5920  440.0205  413.7520  408.8360 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1281.3640 1239.4092 1123.3973  927.4383  715.5575  469.5820  305.0988  319.5747  508.5789  773.5603 1033.6452 1258.8723 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             633.1587  507.0061  432.4889  245.8537  112.3376    0.0000    0.0000    0.0000    0.0000  248.1536  446.3231  632.4270 (98)
Space heating                                                                                                             3257.7486 (98)
Space heating per m2                                                                                    (98) / (4) =     41.1852 (99)
```

8c. Space cooling requirement

```
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3506.7262	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.1587	507.0061	432.4889	245.8537	112.3376	0.0000	0.0000	0.0000	0.0000	248.1536	446.3231	632.4270	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	681.5487	545.7547	465.5424	264.6434	120.9231	0.0000	0.0000	0.0000	0.0000	267.1190	480.4339	680.7610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2279	89.1786	89.0634	88.7678	88.1833	86.7000	86.7000	86.7000	86.7000	88.7473	89.0909	89.2429	(217)
Fuel for water heating, kWh/month													
	181.9483	159.5881	165.7691	146.2473	142.1893	126.1921	118.3152	133.8039	134.8180	151.8320	163.4951	176.5871	(219)
Water heating fuel used												1800.7855	(219)
Annual totals kWh/year													
Space heating fuel - main system												3506.7262	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4549.3423	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3506.7262	0.2160	757.4529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.7855	0.2160	388.9697	(264)
Space and water heating			1146.4225	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			752.9326	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.5200	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		28.0642	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0642	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	67.2845	131.4819	216.8443	317.7519	391.3949	401.6894	381.9926	326.6885	252.5968	156.0369	83.8545	55.3668	(83)
Total gains	452.4980	514.1465	585.3477	663.8829	714.8574	703.3397	669.9400	621.3029	559.0746	485.0979	438.7103	429.4306	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9984	0.9966	0.9904	0.9655	0.8891	0.7289	0.5589	0.6195	0.8690	0.9819	0.9968	0.9988	(86)
MIT	19.7496	19.8900	20.1447	20.4882	20.7796	20.9455	20.9888	20.9815	20.8582	20.4733	20.0518	19.7276	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9979	0.9954	0.9869	0.9521	0.8466	0.6395	0.4389	0.4972	0.8031	0.9726	0.9954	0.9984	(89)
MIT 2	18.3000	18.5068	18.8790	19.3781	19.7688	19.9617	19.9945	19.9927	19.8769	19.3655	18.7520	18.2747	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9828	0.9454	0.8455	0.6545	0.4624	0.5210	0.8088	0.9674	0.9935	0.9975	(94)
Useful gains	451.0208	510.7593	575.2587	627.6528	604.4347	460.3276	309.7951	323.7249	452.2013	469.2936	435.8608	428.3512	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1285.0885	1245.2019	1129.9957	945.3221	728.9393	484.4116	313.0159	329.5333	522.7943	792.0526	1054.8826	1278.4672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating												3166.4842	(98)
Space heating per m2											(98) / (4) =	40.0314	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3390.2400	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	664.3966	528.4213	441.8890	244.8843	99.1771	0.0000	0.0000	0.0000	0.0000	257.1014	477.1902	677.1802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6963	87.4988	87.0269	85.9033	83.7607	80.3000	80.3000	80.3000	80.3000	85.9066	87.2133	87.7804	(217)
Fuel for water heating, kWh/month													
	229.7654	201.9275	211.2315	189.8024	188.4628	173.1411	165.8823	184.9199	186.9622	198.9995	209.2451	224.1341	(219)
Water heating fuel used												2364.4739	(219)
Annual totals kWh/year													
Space heating fuel - main system												3390.2400	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6193.1853	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3390.2400	0.2160	732.2918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4739	0.2160	510.7264	(264)
Space and water heating			1243.0182	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1470.5849	(272)
Emissions per m2 for space and water heating			15.7145	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7145 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.5900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 215 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 215	**Prop Type Ref**	
Property	Rivermont Semi, Plot 215, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.52	$kgCO_2/m^2$	Pass
	-9.07 (-48.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.49	$kWh/m^2/yr$	
	-10.9 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 4.36 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 215 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 215	**Prop Type Ref**	
Property	Rivermont Semi, Plot 215, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 215 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 215	**Prop Type Ref**	
Property	Rivermont Semi, Plot 215, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.52	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.52	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.79	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.49	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.34	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.34	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 216 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 216	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 216, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.22 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
										Total per year (kWh/year) = Sum(64)m =		1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
South	0.9600	46.7521	0.4100	1.0000	0.7700	12.7523	(78)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	71.6254	136.0533	216.2695	306.6842	370.3363	377.1839	359.8489	312.4091	248.3799	159.1833	88.5237	59.4335	(83)
Total gains	442.5659	504.9394	571.8046	640.6666	682.4306	668.1621	637.0887	595.5664	542.5870	475.1538	429.5125	419.1909	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9932	0.9880	0.9748	0.9369	0.8531	0.6972	0.5417	0.5913	0.8237	0.9587	0.9885	0.9945	(86)
MIT	19.3204	19.5119	19.8425	20.2991	20.6630	20.9023	20.9731	20.9622	20.7926	20.3095	19.7595	19.3211	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9916	0.9851	0.9684	0.9202	0.8131	0.6205	0.4359	0.4859	0.7627	0.9446	0.9852	0.9932	(89)
MIT 2	17.7233	18.0059	18.4889	19.1603	19.6582	19.9711	20.0364	20.0352	19.8458	19.1888	18.3880	17.7402	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9870	0.9784	0.9580	0.9071	0.8058	0.6302	0.4566	0.5057	0.7628	0.9331	0.9788	0.9893	(94)
Useful gains	436.8070	494.0117	547.8156	581.1377	549.8686	421.0558	290.8629	301.1697	413.8930	443.3717	420.4010	414.7198	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1236.6157	1198.4316	1088.5670	900.1027	695.4304	457.2497	298.2805	312.1860	495.3744	751.1687	999.2098	1213.9019	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating												3049.0345	(98)
Space heating per m2											(98) / (4) =	38.5466	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3282.0608	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	640.5357	509.5481	433.0668	247.2064	116.5748	0.0000	0.0000	0.0000	0.0000	246.5026	448.5924	640.0339	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1944	89.1395	89.0180	88.7175	88.1542	86.7000	86.7000	86.7000	86.7000	88.6874	89.0488	89.2102	(217)
Fuel for water heating, kWh/month													
	182.0167	159.6581	165.8537	146.3303	142.2362	126.1921	118.3152	133.8039	134.8180	151.9345	163.5725	176.6520	(219)
Water heating fuel used												1801.3832	(219)
Annual totals kWh/year													
Space heating fuel - main system												3282.0608	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4325.5790	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3282.0608	0.2160	708.9251	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.3832	0.2160	389.0988	(264)
Space and water heating			1098.0239	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			704.6920	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.9100	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.4542	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4542	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
							Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains 77.0410	146.3402	232.6216	329.8725	398.3373	405.7027	387.0570	336.0303	267.1598	171.2191	95.2169	63.9273	(83)
Total gains 462.3075	529.0520	601.1633	676.0325	721.8214	707.3713	675.0242	630.6705	573.6721	500.3239	450.1239	438.0457	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9982	0.9961	0.9889	0.9614	0.8803	0.7153	0.5438	0.6001	0.8524	0.9787	0.9963	0.9987	(86)
MIT	19.7968	19.9422	20.1944	20.5267	20.8015	20.9532	20.9909	20.9852	20.8786	20.5128	20.0954	19.7736	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9977	0.9948	0.9849	0.9468	0.8364	0.6271	0.4285	0.4823	0.7837	0.9680	0.9948	0.9982	(89)
MIT 2	18.3842	18.5981	18.9663	19.4480	19.8136	19.9887	20.0168	20.0159	19.9172	19.4371	18.8309	18.3572	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9926	0.9807	0.9405	0.8366	0.6430	0.4522	0.5064	0.7915	0.9629	0.9928	0.9973	(94)
Useful gains	460.6766	525.1371	589.5397	635.7798	603.9055	454.8733	305.2198	319.3700	454.0709	481.7418	446.8777	436.8668	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1263.2167	1224.6992	1111.6570	929.3842	715.9624	475.5555	307.8456	324.0264	514.2107	779.7991	1037.2929	1256.2284	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating												3006.8749	(98)
Space heating per m2											(98) / (4) =	38.0136	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3219.3521	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	639.2824	503.3252	415.9050	226.3331	89.2616	0.0000	0.0000	0.0000	0.0000	237.4246	455.1380	652.6821	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6193	87.3971	86.8895	85.7060	83.5252	80.3000	80.3000	80.3000	80.3000	85.7072	87.1092	87.7083	(217)
Fuel for water heating, kWh/month													
	229.9673	202.1623	211.5657	190.2393	188.9942	173.1411	165.8823	184.9199	186.9622	199.4624	209.4952	224.3184	(219)
Water heating fuel used												2367.1103	(219)
Annual totals kWh/year													
Space heating fuel - main system												3219.3521	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6025.8707	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3219.3521	0.2160	695.3801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2367.1103	0.2160	511.2958	(264)
Space and water heating			1206.6759	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1434.7288	(272)
Emissions per m2 for space and water heating			15.2551	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2551 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.1400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 216 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 216	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 216, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.14	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.91	$kgCO_2/m^2$	Pass
	-9.23 (-50.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.95	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.06	$kWh/m^2/yr$	
	-10.8 (-21.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.22 m², No overhang 0.96 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 216 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 216	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 216, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 216 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 216	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 216, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.91	$kgCO_2/yr/m^2$	
TER	18.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.88	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 217 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 217	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 217, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 4.22 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
									Total per year (kWh/year) = Sum(64)m =			1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	61.7735	120.7111	199.0844	291.7449	359.3833	368.8476	350.7562	299.9579	231.9133	143.2549	76.9859	50.8323	(83)
Total gains	432.7140	489.5972	554.6195	625.7273	671.4776	659.8258	627.9960	583.1152	526.1204	459.2254	417.9747	410.5896	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9937	0.9892	0.9771	0.9410	0.8584	0.7031	0.5484	0.6014	0.8350	0.9628	0.9895	0.9949	(86)
MIT	19.3052	19.4888	19.8180	20.2807	20.6537	20.8992	20.9719	20.9598	20.7803	20.2880	19.7420	19.3078	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9922	0.9866	0.9713	0.9251	0.8192	0.6265	0.4418	0.4951	0.7759	0.9499	0.9865	0.9936	(89)
MIT 2	17.7013	17.9725	18.4539	19.1353	19.6470	19.9682	20.0357	20.0336	19.8325	19.1591	18.3626	17.7207	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9802	0.9614	0.9121	0.8115	0.6360	0.4625	0.5150	0.7751	0.9387	0.9805	0.9900	(94)
Useful gains	427.4590	479.9203	533.1993	570.7464	544.9185	419.6173	290.4455	300.2895	407.7872	431.0823	409.8052	406.4888	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1234.7632	1195.6327	1085.6481	898.0770	694.5090	457.0119	298.2147	312.0469	494.2855	748.7833	997.1579	1212.3061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating												3098.3798	(98)
Space heating per m2											(98) / (4) =	39.1704	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3335.1774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	646.5385	517.7166	442.4348	253.6900	119.8012	0.0000	0.0000	0.0000	0.0000	254.4343	455.2141	645.3478	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1995	89.1487	89.0316	88.7367	88.1759	86.7000	86.7000	86.7000	86.7000	88.7112	89.0579	89.2146	(217)
Fuel for water heating, kWh/month													
	182.0063	159.6416	165.8284	146.2986	142.2012	126.1921	118.3152	133.8039	134.8180	151.8938	163.5557	176.6432	(219)
Water heating fuel used												1801.1980	(219)
Annual totals kWh/year													
Space heating fuel - main system												3335.1774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4378.5104	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3335.1774	0.2160	720.3983	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.1980	0.2160	389.0588	(264)
Space and water heating			1109.4571	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			716.1252	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.0500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.5942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.5942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

	385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	66.4442	129.8380	214.1371	313.8037	386.5562	396.7361	377.2768	322.6377	249.4483	154.0863	82.8067	54.6757	(83)
Total gains	451.7107	512.5498	582.6788	659.9636	710.0403	698.4046	665.2440	617.2778	555.9605	483.1911	437.7137	428.7941	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9984	0.9966	0.9903	0.9648	0.8860	0.7220	0.5511	0.6114	0.8647	0.9816	0.9968	0.9988	(86)
MIT	19.7842	19.9228	20.1735	20.5109	20.7939	20.9511	20.9904	20.9839	20.8686	20.4943	20.0808	19.7626	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9979	0.9955	0.9868	0.9513	0.8433	0.6338	0.4346	0.4922	0.7987	0.9722	0.9955	0.9984	(89)
MIT 2	18.3658	18.5700	18.9363	19.4265	19.8049	19.9871	20.0166	20.0153	19.9074	19.4115	18.8097	18.3411	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9829	0.9450	0.8431	0.6497	0.4585	0.5166	0.8055	0.9673	0.9936	0.9976	(94)
Useful gains	450.2709	509.2300	572.6984	623.6777	598.6560	453.7339	305.0170	318.8569	447.8421	467.3686	434.9105	427.7450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1261.7099	1222.3907	1109.1972	927.6278	715.2339	475.4111	307.8197	323.9617	513.3738	777.7182	1035.5745	1254.9203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating												3066.4845	(98)
Space heating per m2											(98) / (4) =	38.7672	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3283.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	646.3711	513.1092	427.3610	234.3084	92.8630	0.0000	0.0000	0.0000	0.0000	247.2164	463.0387	658.9062	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6415	87.4376	86.9514	85.7929	83.6126	80.3000	80.3000	80.3000	80.3000	85.8086	87.1473	87.7270	(217)
Fuel for water heating, kWh/month													
	229.9091	202.0688	211.4149	190.0466	188.7965	173.1411	165.8823	184.9199	186.9622	199.2267	209.4037	224.2706	(219)
Water heating fuel used												2366.0425	(219)
Annual totals kWh/year													
Space heating fuel - main system												3283.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6088.6247	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3283.1739	0.2160	709.1656	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2366.0425	0.2160	511.0652	(264)
Space and water heating			1220.2308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1448.2836	(272)
Emissions per m2 for space and water heating			15.4264	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4264 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 217 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 217	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 217, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.05	$kgCO_2/m^2$	Pass
	-9.26 (-50.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.68	$kWh/m^2/yr$	
	-11.1 (-21.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 4.22 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 217 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 217	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 217, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 217 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 217	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 217, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.05	$kgCO_2/yr/m^2$	
TER	18.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.57	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.68	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.66	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 218 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 218	**Prop Type Ref**	
Property	Rivermont Semi, Plot 218, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.36 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
               53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.4453   17.2711   14.0458   10.6336    7.9487    6.7107    7.2511    9.4253   12.6506   16.0628   18.7477   19.9857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
               71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
              370.9232  368.8708  355.5226  333.9730  312.0873  290.9722  277.2334  283.1489  294.1958  315.9563  340.9723  359.7396 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g              FF            Access            Gains
                                           m2           Table 6a      Specific data  Specific data        factor                W
                                                           W/m2      or Table 6b    or Table 6c       Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
East                                     4.3600           19.6403           0.4100           1.0000           0.7700          24.3305 (76)
South                                    0.9600           46.7521           0.4100           1.0000           0.7700          12.7523 (78)
West                                     6.3300           19.6403           0.4100           1.0000           0.7700          35.3239 (80)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    72.4067  137.5816  218.7864  310.3550  374.8349  381.7891  364.2332  316.1752  251.3071  160.9967   89.4978   60.0760 (83)
Total gains   443.3299  506.4524  574.3091  644.3279  686.9221  672.7613  641.4666  599.3241  545.5030  476.9530  430.4701  419.8156 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.5606   47.8682   48.1798   49.8008   50.1381   51.8960   51.8960   52.2624   51.1783   50.1381   49.4679   48.8154
alpha          4.1707    4.1912    4.2120    4.3201    4.3425    4.4597    4.4597    4.4842    4.4119    4.3425    4.2979    4.2544
util living area
               0.9961    0.9926    0.9829    0.9520    0.8751    0.7194    0.5581    0.6101    0.8472    0.9704    0.9929    0.9969 (86)

MIT           19.4527   19.6277   19.9317   20.3545   20.6955   20.9168   20.9791   20.9696   20.8136   20.3615   19.8547   19.4534 (87)
Th 2          19.9456   19.9517   19.9577   19.9881   19.9943   20.0250   20.0250   20.0312   20.0127   19.9943   19.9820   19.9699 (88)
util rest of house
               0.9950    0.9905    0.9779    0.9370    0.8351    0.6377    0.4448    0.4970    0.7848    0.9585    0.9906    0.9960 (89)
MIT 2         17.8788   18.1378   18.5832   19.2084   19.6747   19.9612   20.0152   20.0154   19.8460   19.2309   18.4904   17.8959 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1956 (91)
MIT           18.1866   18.4292   18.8470   19.4325   19.8743   20.1481   20.2037   20.2020   20.0352   19.4520   18.7572   18.2005 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.1866   18.4292   18.8470   19.4325   19.8743   20.1481   20.2037   20.2020   20.0352   19.4520   18.7572   18.2005 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9922    0.9861    0.9704    0.9265    0.8295    0.6489    0.4665    0.5181    0.7865    0.9497    0.9864    0.9938 (94)
Useful gains 439.8664  499.4003  557.2976  596.9808  569.8142  436.5428  299.2268  310.4907  429.0231  452.9549  424.6319  417.2016 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1283.0818 1242.0215 1126.1569  929.3955  716.4526  469.7993  305.1521  319.6921  509.6301  775.8462 1035.5610 1260.3494 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             627.3523  499.0414  423.2314  239.3387  109.0989    0.0000    0.0000    0.0000    0.0000  240.2311  439.8689  627.3019 (98)
Space heating                                                                                                              3205.4647 (98)
Space heating per m2                                                                                        (98) / (4) =     40.5242 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3450.4463	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	627.3523	499.0414	423.2314	239.3387	109.0989	0.0000	0.0000	0.0000	0.0000	240.2311	439.8689	627.3019	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	675.2985	537.1813	455.5774	257.6304	117.4369	0.0000	0.0000	0.0000	0.0000	258.5911	473.4865	675.2443	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2230	89.1697	89.0500	88.7481	88.1600	86.7000	86.7000	86.7000	86.7000	88.7233	89.0821	89.2387	(217)
Fuel for water heating, kWh/month													
	181.9583	159.6040	165.7941	146.2798	142.2268	126.1921	118.3152	133.8039	134.8180	151.8731	163.5113	176.5955	(219)
Water heating fuel used												1800.9722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3450.4463	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4493.2492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3450.4463	0.2160	745.2964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.9722	0.2160	389.0100	(264)
Space and water heating			1134.3064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			740.8165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.3700	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.9142	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9142	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	77.8813	147.9841	235.3288	333.8208	403.1761	410.6560	391.7728	340.0811	270.3084	173.1697	96.2647	64.6183	(83)
Total gains	463.0948	530.6487	603.8322	679.9518	726.6385	712.3063	679.7202	634.6956	576.7862	502.2306	451.1205	438.6822	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9982	0.9961	0.9890	0.9622	0.8836	0.7224	0.5516	0.6084	0.8571	0.9792	0.9963	0.9987	(86)
MIT	19.7621	19.9092	20.1655	20.5040	20.7873	20.9478	20.9894	20.9829	20.8684	20.4918	20.0664	19.7386	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9976	0.9947	0.9850	0.9477	0.8399	0.6328	0.4328	0.4873	0.7885	0.9686	0.9948	0.9982	(89)
MIT 2	18.3183	18.5348	18.9089	19.3997	19.7777	19.9635	19.9948	19.9934	19.8870	19.3912	18.7732	18.2907	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9925	0.9806	0.9410	0.8392	0.6480	0.4561	0.5109	0.7952	0.9631	0.9927	0.9972	(94)
Useful gains	461.4250	526.6658	592.1145	639.8316	609.8195	461.5487	310.0213	324.2914	458.6578	483.7181	447.8288	437.4716	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1286.6282	1247.5614	1132.5125	947.1311	729.7056	484.5702	313.0453	329.6062	523.6843	794.1890	1056.6395	1279.8042	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating												3106.9296	(98)
Space heating per m2											(98) / (4) =	39.2785	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3326.4771	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	657.3353	518.6743	430.4670	236.8904	95.4982	0.0000	0.0000	0.0000	0.0000	247.3131	469.3187	670.9802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6751	87.4601	86.9679	85.8203	83.6752	80.3000	80.3000	80.3000	80.3000	85.8096	87.1769	87.7625	(217)
Fuel for water heating, kWh/month													
	229.8210	202.0167	211.3750	189.9858	188.6553	173.1411	165.8823	184.9199	186.9622	199.2245	209.3325	224.1798	(219)
Water heating fuel used												2365.4962	(219)
Annual totals kWh/year													
Space heating fuel - main system												3326.4771	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6130.4447	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3326.4771	0.2160	718.5191	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.4962	0.2160	510.9472	(264)
Space and water heating			1229.4662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1457.0329	(272)
Emissions per m2 for space and water heating			15.5432	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5432 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 218 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 218	**Prop Type Ref**	
Property	Rivermont Semi, Plot 218, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.37	$kgCO_2/m^2$	Pass
	-9.05 (-49.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.83	$kWh/m^2/yr$	
	-10.7 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.36 m², No overhang 0.96 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 218 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 218	**Prop Type Ref**	
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Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 218 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 218	**Prop Type Ref**	
Property	Rivermont Semi, Plot 218, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.37	$kgCO_2/yr/m^2$	
TER	18.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	49.13	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.92	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 219 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 219	**Prop Type Ref**	
Property	Rivermont AW Semi, Plot 219, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.32	**TER**	18.38
Environmental	94 A	**% DER<TER**	49.29		
CO_2 Emissions (t/year)	0.38	**DFEE**	40.75	**TFEE**	51.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.38 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.32 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.36 m², No overhang
Windows facing South: 1.44 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.1300	1.2357	14.9895			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	14.2500	74.8900	0.2100	15.7269			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.2019			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		200.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.0621 (36)
Total fabric heat loss	(33) + (36) =	46.2640 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.9254	92.3317	91.7379	88.7691	88.1753	85.2065	85.2065	84.6128	86.3941	88.1753	89.3629	90.5504	(39)

Average = Sum(39)m / 12 = 88.6207 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1748	1.1673	1.1598	1.1222	1.1147	1.0772	1.0772	1.0697	1.0922	1.1147	1.1297	1.1448	(40)
HLP (average)												1.1204	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
               53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.4041   17.2346   14.0161   10.6111    7.9319    6.6965    7.2358    9.4053   12.6238   16.0288   18.7080   19.9434 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
               71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
              370.8820  368.8343  355.4929  333.9505  312.0704  290.9580  277.2180  283.1290  294.1691  315.9223  340.9326  359.6973 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
East                                     4.3600           19.6403           0.4100           1.0000           0.7700           24.3305 (76)
South                                    1.4400           46.7521           0.4100           1.0000           0.7700           19.1285 (78)
West                                     6.3300           19.6403           0.4100           1.0000           0.7700           35.3239 (80)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    78.7828  148.0241  232.0883  325.3890  390.5013  396.8658  378.9641  330.4810  265.2025  172.2600   97.0557   65.5856 (83)
Total gains   449.6649  516.8583  587.5812  659.3394  702.5717  687.8239  656.1822  613.6099  559.3716  488.1823  437.9883  425.2829 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          47.2900   47.5941   47.9022   49.5042   49.8376   51.5740   51.5740   51.9359   50.8651   49.8376   49.1753   48.5304
alpha         4.1527    4.1729    4.1935    4.3003    4.3225    4.4383    4.4383    4.4624    4.3910    4.3225    4.2784    4.2354
util living area
               0.9958    0.9920    0.9816    0.9488    0.8691    0.7111    0.5499    0.6011    0.8395    0.9682    0.9925    0.9967 (86)

MIT           19.4513   19.6318   19.9397   20.3636   20.7024   20.9194   20.9798   20.9708   20.8193   20.3685   19.8563   19.4507 (87)
Th 2          19.9402   19.9463   19.9523   19.9827   19.9888   20.0195   20.0195   20.0257   20.0072   19.9888   19.9766   19.9644 (88)
util rest of house
               0.9947    0.9898    0.9762    0.9330    0.8278    0.6288    0.4372    0.4884    0.7753    0.9555    0.9900    0.9958 (89)
MIT 2         17.8732   18.1401   18.5909   19.2166   19.6781   19.9581   20.0101   20.0107   19.8469   19.2366   18.4889   17.8883 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1956 (91)
MIT           18.1818   18.4319   18.8547   19.4409   19.8784   20.1461   20.1998   20.1985   20.0371   19.4579   18.7563   18.1939 (92)
Temperature adjustment                                                                                                     0.0000
adjusted MIT  18.1818   18.4319   18.8547   19.4409   19.8784   20.1461   20.1998   20.1985   20.0371   19.4579   18.7563   18.1939 (93)
```

---

8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9918    0.9851    0.9683    0.9223    0.8226    0.6403    0.4588    0.5094    0.7776    0.9464    0.9856    0.9935 (94)
Useful gains  445.9665  509.1599  568.9670  608.1084  577.9019  440.4414  301.0456  312.5989  434.9566  462.0300  431.6891  422.5011 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1289.9717 1249.4206 1133.3914  935.7093  721.1342  472.5675  306.7246  321.3988  512.9263  781.0519 1041.6434 1267.1519 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              627.9399  497.4552  419.9318  235.8727  106.5648    0.0000    0.0000    0.0000    0.0000  237.3523  439.1671  628.4202 (98)
Space heating                                                                                                             3192.7038 (98)
Space heating per m2                                                                                        (98) / (4) =     40.3629 (99)
```

8c. Space cooling requirement

```
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3436.7102	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	627.9399	497.4552	419.9318	235.8727	106.5648	0.0000	0.0000	0.0000	0.0000	237.3523	439.1671	628.4202	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	675.9310	535.4738	452.0256	253.8996	114.7092	0.0000	0.0000	0.0000	0.0000	255.4922	472.7310	676.4480	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2235	89.1679	89.0451	88.7373	88.1414	86.7000	86.7000	86.7000	86.7000	88.7143	89.0811	89.2396	(217)
Fuel for water heating, kWh/month													
	181.9573	159.6072	165.8032	146.2976	142.2568	126.1921	118.3152	133.8039	134.8180	151.8885	163.5131	176.5937	(219)
Water heating fuel used												1801.0466	(219)
Annual totals kWh/year													
Space heating fuel - main system												3436.7102	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.6828	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4478.8606	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3436.7102	0.2160	742.3294	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.0466	0.2160	389.0261	(264)
Space and water heating			1131.3555	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.6828	0.5190	177.8524	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			737.4883	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.3200	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.8642	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.8642	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.1300	1.3258	16.0814			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	14.2500	74.8900	0.1800	13.4802			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3328	(36)
Total fabric heat loss (33) + (36) =	51.7214	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	90.6709	90.4305	90.1949	89.0882	88.8812	87.9173	87.9173	87.7388	88.2886	88.8812	89.3000	89.7379	(39)
Average = Sum(39)m / 12 =												89.0872	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1463	1.1432	1.1403	1.1263	1.1237	1.1115	1.1115	1.1092	1.1162	1.1237	1.1290	1.1345	(40)
HLP (average)												1.1263	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4082	18.1263	14.7413	11.1601	8.3423	7.0429	7.6102	9.8920	13.2770	16.8582	19.6760	20.9754	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.0404	382.5109	368.3783	346.0363	323.3917	301.5905	287.8828	294.5305	306.3651	328.9180	354.6889	373.8859	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
South	1.4400	46.7521	0.6300	0.7000	0.7700	20.5748	(78)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	84.7396	159.2161	249.6365	349.9916	420.0270	426.8728	407.6175	355.4685	285.2544	185.2845	104.3941	70.5445	(83)
Total gains	469.7799	541.7270	618.0148	696.0279	743.4186	728.4633	695.5003	649.9991	591.6196	514.2025	459.0830	444.4304	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5824	60.7434	60.9021	61.6586	61.8022	62.4798	62.4798	62.6069	62.2171	61.8022	61.5124	61.2122	
alpha	5.0388	5.0496	5.0601	5.1106	5.1201	5.1653	5.1653	5.1738	5.1478	5.1201	5.1008	5.0808	
util living area	0.9981	0.9957	0.9880	0.9593	0.8776	0.7143	0.5439	0.5998	0.8493	0.9773	0.9960	0.9986	(86)
MIT	19.7580	19.9105	20.1707	20.5108	20.7922	20.9494	20.9898	20.9836	20.8725	20.4968	20.0656	19.7334	(87)
Th 2	19.9632	19.9657	19.9681	19.9794	19.9816	19.9915	19.9915	19.9933	19.9877	19.9816	19.9773	19.9728	(88)
util rest of house	0.9975	0.9943	0.9837	0.9439	0.8324	0.6241	0.4256	0.4791	0.7788	0.9660	0.9944	0.9981	(89)
MIT 2	18.3073	18.5314	18.9109	19.4030	19.7767	19.9576	19.9877	19.9865	19.8843	19.3925	18.7668	18.2780	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.5910	18.8011	19.1573	19.6196	19.9753	20.1515	20.1837	20.1815	20.0776	19.6084	19.0208	18.5626	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5910	18.8011	19.1573	19.6196	19.9753	20.1515	20.1837	20.1815	20.0776	19.6084	19.0208	18.5626	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9918	0.9789	0.9370	0.8321	0.6395	0.4488	0.5026	0.7860	0.9603	0.9922	0.9971	(94)
Useful gains	467.9727	537.3054	604.9982	652.2041	618.6017	465.8404	312.1617	326.6974	465.0380	493.7885	455.4836	443.1260	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1295.7770	1257.0822	1141.6241	954.9926	735.5191	488.0768	315.0682	331.7850	527.7505	800.6804	1064.5270	1288.8714	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	615.8863	483.6900	399.2497	218.0077	86.9865	0.0000	0.0000	0.0000	0.0000	228.3276	438.5112	629.2346	(98)
Space heating												3099.8936	(98)
Space heating per m2											(98) / (4) =	39.1896	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3318.9439	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.8863	483.6900	399.2497	218.0077	86.9865	0.0000	0.0000	0.0000	0.0000	228.3276	438.5112	629.2346	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	659.4072	517.8693	427.4622	233.4129	93.1333	0.0000	0.0000	0.0000	0.0000	244.4621	469.4981	673.6987	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6813	87.4569	86.9520	85.7833	83.6191	80.3000	80.3000	80.3000	80.3000	85.7805	87.1778	87.7704	(217)
Fuel for water heating, kWh/month													
	229.8046	202.0242	211.4136	190.0679	188.7819	173.1411	165.8823	184.9199	186.9622	199.2919	209.3305	224.1597	(219)
Water heating fuel used												2365.7798	(219)
Annual totals kWh/year													
Space heating fuel - main system												3318.9439	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.4144	(232)
Total delivered energy for all uses												6120.1382	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3318.9439	0.2160	716.8919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.7798	0.2160	511.0084	(264)
Space and water heating			1227.9003	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	360.4144	0.5190	187.0551	(268)
Total CO2, kg/m2/year			1453.8804	(272)
Emissions per m2 for space and water heating			15.5234	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3648	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5234 * 1.00) + 2.3648 + 0.4921, rounded to 2 d.p.			18.3800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 219 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 219	**Prop Type Ref**	
Property	Rivermont AW Semi, Plot 219, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.32	**TER**	18.38
Environmental	94 A	**% DER<TER**	49.29		
CO_2 Emissions (t/year)	0.38	**DFEE**	40.75	**TFEE**	51.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.38	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.32	$kgCO_2/m^2$	Pass
	-9.06 (-49.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.46	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.75	$kWh/m^2/yr$	
	-10.8 (-21.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.36 m², No overhang 1.44 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 219 B2	**Issued on Date**	04/04/2025
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Environmental	94 A	**% DER<TER**	49.29		
CO_2 Emissions (t/year)	0.38	**DFEE**	40.75	**TFEE**	51.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	74.89

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
W8*	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.22	0.052	No
Independently assessed	E3 Sill	7.39	0.004	No
Independently assessed	E4 Jamb	25.95	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 219 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 219	**Prop Type Ref**	
Property	Rivermont AW Semi, Plot 219, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.32	**TER**	18.38
Environmental	94 A	**% DER<TER**	49.29		
CO_2 Emissions (t/year)	0.38	**DFEE**	40.75	**TFEE**	51.46
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.32	$kgCO_2/yr/m^2$	
TER	18.38	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.32	$kgCO_2/yr/m^2$	
Reduction DER/TER	49.29	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.75	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.89	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.43	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.43	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 220 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 220 - EPC	**Prop Type Ref**	As
Property	2 Bunting Road, Boorley Green, Southampton, SO32 2XY		

SAP Rating	87 B	**DER**	14.70	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.05		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.94	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.70	$kgCO_2/m^2$	Pass
	-4.16 (-22.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.21	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.94	$kWh/m^2/yr$	
	-5.3 (-8.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

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Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.71 m², No overhang
Windows facing East	5.94 m², No overhang
Windows facing South	1.31 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	5.25 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 220 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 220 - EPC	**Prop Type Ref**	As
Property	2 Bunting Road, Boorley Green, Southampton, SO32 2XY		

SAP Rating	87 B	**DER**	14.70	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.05		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.94	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.86 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.49 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.71 m², No overhang
Windows facing East: 5.94 m², No overhang
Windows facing South: 1.31 m², No overhang
Windows facing South West: 1.02 m², No overhang
Windows facing West: 5.25 m², No overhang
Windows facing North West: 1.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.4296	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3329	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4245	0.4162	0.4078	0.3662	0.3579	0.3163	0.3163	0.3080	0.3329	0.3579	0.3745	0.3912	(22b)
Effective ac	0.5901	0.5866	0.5832	0.5671	0.5640	0.5500	0.5500	0.5474	0.5554	0.5640	0.5701	0.5765	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2500	1.2357	26.2595			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1900	9.3632			(28a)
External Wall	142.9500	25.4900	117.4600	0.2700	31.7142			(29a)
Main Roof	47.9200		47.9200	0.1600	7.6672			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5625			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1602	(36)
Total fabric heat loss (33) + (36) =	86.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.4769	47.1954	46.9195	45.6237	45.3812	44.2526	44.2526	44.0436	44.6873	45.3812	45.8717	46.3844	(38)
Heat transfer coeff	134.1996	133.9181	133.6422	132.3464	132.1039	130.9753	130.9753	130.7663	131.4100	132.1039	132.5944	133.1072	(39)
Average = Sum(39)m / 12 =												132.3452	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3807	1.3778	1.3749	1.3616	1.3591	1.3475	1.3475	1.3453	1.3520	1.3591	1.3641	1.3694	(40)
HLP (average)												1.3616	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8152	10.6622	11.7823	11.3641	11.7138	11.3025	11.6584	11.6944	11.3361	11.7534	11.4085	11.8046	(61)
Total heat required for water heating calculated for each month													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
								Total per year (kWh/year) = Sum(64)m =				1689.8333	(64)
Heat gains from water heating, kWh/month													
	56.4402	49.4451	51.2179	44.9260	43.3100	37.6718	35.2047	39.9769	40.3299	46.6362	50.5517	54.7498	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4536	19.9431	16.2188	12.2787	9.1785	7.7489	8.3729	10.8834	14.6077	18.5478	21.6481	23.0777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	75.8605	73.5790	68.8412	62.3972	58.2123	52.3219	47.3182	53.7325	56.0138	62.6831	70.2107	73.5885	(72)
Total internal gains													
	416.7149	414.5350	399.4906	375.0934	350.1195	326.1744	310.6881	317.0009	329.5888	354.2112	382.5280	403.9605	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7100	10.6334	0.7200	0.7000	0.7700	24.9206	(74)
East	5.9400	19.6403	0.7200	0.7000	0.7700	40.7472	(76)
South	1.3100	46.7521	0.7200	0.7000	0.7700	21.3912	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	5.2500	19.6403	0.7200	0.7000	0.7700	36.0139	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	140.2006	263.3288	418.1372	603.1507	744.6112	767.2936	728.2420	619.9352	482.5711	307.3324	172.5689	116.8840	(83)
Total gains	556.9155	677.8638	817.6278	978.2441	1094.7307	1093.4680	1038.9302	936.9361	812.1599	661.5436	555.0969	520.8445	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.2982	50.4039	50.5080	51.0025	51.0961	51.5364	51.5364	51.6188	51.3659	51.0961	50.9071	50.7110	
alpha	4.3532	4.3603	4.3672	4.4002	4.4064	4.4358	4.4358	4.4413	4.4244	4.4064	4.3938	4.3807	
util living area													
	0.9982	0.9956	0.9865	0.9522	0.8588	0.6946	0.5358	0.6067	0.8576	0.9789	0.9964	0.9987	(86)
MIT	19.4374	19.6258	19.9500	20.3767	20.7315	20.9266	20.9817	20.9692	20.8041	20.3240	19.8004	19.4057	(87)
Th 2	19.7782	19.7804	19.7826	19.7929	19.7948	19.8038	19.8038	19.8055	19.8004	19.7948	19.7909	19.7869	(88)
util rest of house													
	0.9976	0.9940	0.9814	0.9334	0.8054	0.5921	0.3996	0.4660	0.7812	0.9675	0.9949	0.9982	(89)
MIT 2	17.7117	17.9882	18.4603	19.0728	19.5389	19.7572	19.7977	19.7935	19.6439	19.0115	18.2511	17.6711	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.0633	18.3218	18.7638	19.3384	19.7819	19.9954	20.0389	20.0330	19.8803	19.2788	18.5667	18.0245	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0633	18.3218	18.7638	19.3384	19.7819	19.9954	20.0389	20.0330	19.8803	19.2788	18.5667	18.0245	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9911	0.9754	0.9243	0.8047	0.6099	0.4274	0.4945	0.7874	0.9605	0.9924	0.9972	(94)
Useful gains	554.8069	671.8205	797.4869	904.2381	880.9106	666.9065	444.0764	463.3132	639.4622	635.4002	550.8677	519.3605	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1847.0233	1797.4233	1638.9580	1381.4811	1067.6464	706.6612	450.4052	475.0773	759.5852	1146.5068	1520.4251	1840.1346	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	961.4090	756.4051	626.0546	343.6149	138.9314	0.0000	0.0000	0.0000	0.0000	380.2634	698.0813	982.6559	(98)
Space heating												4887.4156	(98)
Space heating per m2											(98) / (4) =	50.2821	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5238.3875	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	961.4090	756.4051	626.0546	343.6149	138.9314	0.0000	0.0000	0.0000	0.0000	380.2634	698.0813	982.6559	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1030.4491	810.7236	671.0124	368.2904	148.9083	0.0000	0.0000	0.0000	0.0000	407.5706	748.2115	1053.2218	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7327	89.6791	89.5546	89.2386	88.5016	86.7000	86.7000	86.7000	86.7000	89.2859	89.6243	89.7570	(217)
Fuel for water heating, kWh/month													
	192.4344	168.7711	175.2697	154.5691	150.4629	133.9135	125.4573	142.0220	143.1438	160.3562	172.7946	186.7154	(219)
Water heating fuel used												1905.9100	(219)
Annual totals kWh/year													
Space heating fuel - main system												5238.3875	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.5383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6923.7261	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5238.3875	0.2160	1131.4917	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1905.9100	0.2160	411.6766	(264)
Space and water heating			1543.1683	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.5383	0.5190	205.8034	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1428.6917	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7000	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		31.9400	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9400	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1230	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3730	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.3200	118.6300	0.1800	21.3534			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8598			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.1035	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7982	123.5859	123.3778	122.4006	122.2178	121.3666	121.3666	121.2090	121.6945	122.2178	122.5876	122.9743	(39)
Average = Sum(39)m / 12 =												122.3997	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2736	1.2715	1.2693	1.2593	1.2574	1.2486	1.2486	1.2470	1.2520	1.2574	1.2612	1.2652	(40)
HLP (average)												1.2593	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5307	20.0116	16.2745	12.3209	9.2100	7.7755	8.4017	10.9208	14.6579	18.6115	21.7224	23.1569	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9451	427.7602	412.7105	387.7375	362.0872	337.4735	321.9963	328.9811	342.2506	367.4488	395.7644	417.1964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.3500	10.6334	0.6300	0.7000	0.7700	20.6356	(74)
East	5.6100	19.6403	0.6300	0.7000	0.7700	33.6730	(76)
South	1.2400	46.7521	0.6300	0.7000	0.7700	17.7172	(78)
Southwest	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(79)
West	4.9600	19.6403	0.6300	0.7000	0.7700	29.7715	(80)
Northwest	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(81)

Solar gains	115.9025	217.6887	345.6643	498.6167	615.5710	634.3285	602.0417	512.4959	398.9315	254.0647	142.6604	96.6273	(83)
Total gains	545.8476	645.4488	758.3748	886.3542	977.6582	971.8020	924.0381	841.4769	741.1821	621.5135	538.4248	513.8237	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5242	54.6179	54.7100	55.1468	55.2293	55.6166	55.6166	55.6889	55.4668	55.2293	55.0626	54.8895	
alpha	4.6349	4.6412	4.6473	4.6765	4.6820	4.7078	4.7078	4.7126	4.6978	4.6820	4.6708	4.6593	
util living area													
	0.9985	0.9964	0.9892	0.9615	0.8799	0.7219	0.5586	0.6271	0.8717	0.9818	0.9968	0.9989	(86)
MIT	19.5614	19.7270	20.0177	20.4043	20.7381	20.9286	20.9831	20.9716	20.8164	20.3737	19.8946	19.5305	(87)
Th 2	19.8615	19.8633	19.8649	19.8729	19.8744	19.8813	19.8813	19.8826	19.8786	19.8744	19.8714	19.8682	(88)
util rest of house													
	0.9979	0.9951	0.9852	0.9462	0.8328	0.6247	0.4263	0.4918	0.8021	0.9720	0.9955	0.9984	(89)
MIT 2	17.9492	18.1922	18.6159	19.1730	19.6178	19.8341	19.8753	19.8710	19.7276	19.1396	18.4432	17.9086	(90)
Living area fraction									fLA = Living area / (4) =			0.2037	(91)
MIT	18.2776	18.5048	18.9015	19.4238	19.8460	20.0571	20.1009	20.0952	19.9494	19.3910	18.7389	18.2390	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2776	18.5048	18.9015	19.4238	19.8460	20.0571	20.1009	20.0952	19.9494	19.3910	18.7389	18.2390	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9927	0.9803	0.9383	0.8314	0.6413	0.4533	0.5192	0.8074	0.9660	0.9934	0.9975	(94)
Useful gains	544.0666	640.7533	743.4360	831.6754	812.8308	623.2390	418.9032	436.8646	598.4582	600.3738	534.8747	512.5488	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1730.3998	1681.3627	1530.0653	1288.1225	995.5848	662.3084	424.8950	447.8939	711.8393	1074.4109	1426.7817	1726.4385	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	882.6319	699.2895	585.2523	328.6419	135.9690	0.0000	0.0000	0.0000	0.0000	352.6836	642.1730	903.1339	(98)
Space heating												4529.7751	(98)
Space heating per m2											(98) / (4) =	46.6026	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4849.8663	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	882.6319	699.2895	585.2523	328.6419	135.9690	0.0000	0.0000	0.0000	0.0000	352.6836	642.1730	903.1339	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	945.0020	748.7040	626.6084	351.8650	145.5771	0.0000	0.0000	0.0000	0.0000	377.6056	687.5514	966.9528	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2517	88.0657	87.6333	86.6250	84.5142	80.3000	80.3000	80.3000	80.3000	86.6837	87.8489	88.3305	(217)
Fuel for water heating, kWh/month													
	240.0183	212.0210	223.8177	201.1299	199.5927	185.0158	177.2592	197.6025	199.7848	210.3984	219.4365	234.0580	(219)
Water heating fuel used												2500.1346	(219)
Annual totals kWh/year													
Space heating fuel - main system												4849.8663	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9000	(232)
Total delivered energy for all uses												7822.9009	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4849.8663	0.2160	1047.5711	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2500.1346	0.2160	540.0291	(264)
Space and water heating			1587.6002	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9000	0.5190	206.5101	(268)
Total CO2, kg/m2/year			1833.0353	(272)
Emissions per m2 for space and water heating			16.3333	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1246	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3333 * 1.00) + 2.1246 + 0.4005, rounded to 2 d.p.			18.8600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 220 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 220 - EPC	**Prop Type Ref**	As
Property	2 Bunting Road, Boorley Green, Southampton, SO32 2XY		

SAP Rating	87 B	**DER**	14.70	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.05		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.94	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.70	$kgCO_2/m^2$	Pass
	-4.16 (-22.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.21	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.94	$kWh/m^2/yr$	
	-5.3 (-8.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.71 m², No overhang
Windows facing East	5.94 m², No overhang
Windows facing South	1.31 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	5.25 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 220 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 220 - EPC	**Prop Type Ref**	As
Property	2 Bunting Road, Boorley Green, Southampton, SO32 2XY		

SAP Rating	87 B	**DER**	14.70	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.05		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.94	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	49.28 m²	2.39 m
1st Storey:	1.00 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	142.95	117.46

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.92	47.92
Bay Roof	External Slope Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	49.28

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W3a	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.02	10
W3b	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.25	10
W3c	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.31	10
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.31	10
D1	Half Glazed Door	[1] External Wall	North				2.12	10
D2*	Half Glazed Door	[1] External Wall	South				2.12	10
D3 (W14)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.060	No
Independently assessed	E3 Sill	14.79	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.84	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.49	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£54	B 88	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 220 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 220 - EPC	**Prop Type Ref**	As
Property	2 Bunting Road, Boorley Green, Southampton, SO32 2XY		

SAP Rating	87 B	**DER**	14.70	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.05		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.94	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	14.70	$kgCO_2/yr/m^2$	
TER	18.86	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.70	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.05	%	
CfSH ENE1 credits achieved	3.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.94	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	20.88	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.12	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.12	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 221 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 221 - EPC	**Prop Type Ref**	Opp
Property	23 Crane Way , Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.36	$kgCO_2/m^2$	Pass
	-5.00 (-27.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.78	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	0.71 m², No overhang 7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	1.21	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 221 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 221 - EPC	**Prop Type Ref**	Opp
Property	23 Crane Way , Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 7.61 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3919	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3331	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4247	0.4164	0.4080	0.3664	0.3581	0.3164	0.3164	0.3081	0.3331	0.3581	0.3747	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5832	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6869	46.4099	46.1384	44.8631	44.6244	43.5137	43.5137	43.3080	43.9415	44.6244	45.1072	45.6118	(38)
Heat transfer coeff	123.2914	123.0144	122.7429	121.4675	121.2289	120.1181	120.1181	119.9124	120.5460	121.2289	121.7116	122.2163	(39)
Average = Sum(39)m / 12 =												121.4664	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2909	1.2880	1.2851	1.2718	1.2693	1.2576	1.2576	1.2555	1.2621	1.2693	1.2743	1.2796	(40)
HLP (average)												1.2718	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	101.0756	193.9140	312.5297	449.1331	547.0858	559.1611	532.6649	459.3403	360.9571	228.0639	125.2810	83.6334	(83)
Total gains	515.4262	605.9437	709.4306	821.6335	894.6819	882.9580	841.1538	774.2648	688.5647	580.2962	505.7458	485.3959	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.7965	53.9176	54.0369	54.6042	54.7117	55.2176	55.2176	55.3123	55.0216	54.7117	54.4947	54.2697	
alpha	4.5864	4.5945	4.6025	4.6403	4.6474	4.6812	4.6812	4.6875	4.6681	4.6474	4.6330	4.6180	
util living area													
	0.9987	0.9970	0.9912	0.9692	0.9033	0.7626	0.5998	0.6635	0.8916	0.9852	0.9974	0.9990	(86)
MIT	19.5195	19.6797	19.9668	20.3521	20.6928	20.9080	20.9768	20.9635	20.7901	20.3368	19.8583	19.4934	(87)
Th 2	19.8480	19.8503	19.8525	19.8630	19.8650	19.8742	19.8742	19.8759	19.8706	19.8650	19.8610	19.8568	(88)
util rest of house													
	0.9982	0.9959	0.9879	0.9564	0.8618	0.6670	0.4604	0.5243	0.8277	0.9770	0.9963	0.9987	(89)
MIT 2	17.8787	18.1143	18.5339	19.0939	19.5566	19.8112	19.8656	19.8605	19.6933	19.0809	18.3832	17.8466	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1289	18.3530	18.7523	19.2857	19.7298	19.9784	20.0350	20.0286	19.8605	19.2724	18.6081	18.0976	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1289	18.3530	18.7523	19.2857	19.7298	19.9784	20.0350	20.0286	19.8605	19.2724	18.6081	18.0976	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9937	0.9831	0.9477	0.8558	0.6769	0.4815	0.5448	0.8270	0.9707	0.9943	0.9978	(94)
Useful gains	513.9352	602.1311	697.4506	778.6276	765.6493	597.6853	404.9829	421.8257	569.4647	563.2784	502.8542	484.3287	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1704.9818	1654.9083	1503.8872	1261.5308	973.4429	646.0392	412.6082	435.1181	694.4002	1051.3417	1400.6711	1698.5169	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	886.1386	707.4663	599.9889	347.6903	154.5984	0.0000	0.0000	0.0000	0.0000	363.1191	646.4282	903.3560	(98)
Space heating												4608.7859	(98)
Space heating per m2											(98) / (4) =	48.2545	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4939.7491	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	886.1386	707.4663	599.9889	347.6903	154.5984	0.0000	0.0000	0.0000	0.0000	363.1191	646.4282	903.3560	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	949.7735	758.2704	643.0749	372.6585	165.7003	0.0000	0.0000	0.0000	0.0000	389.1952	692.8491	968.2272	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6947	89.6462	89.5316	89.2504	88.6012	86.7000	86.7000	86.7000	86.7000	89.2550	89.5834	89.7190	(217)
Fuel for water heating, kWh/month													
	191.7299	168.1453	174.6041	153.9259	149.6918	133.3829	124.9657	141.4577	142.5727	159.7665	172.1716	186.0335	(219)
Water heating fuel used												1898.4479	(219)
Annual totals kWh/year													
Space heating fuel - main system												4939.7491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 908 * 1.00) =										-878.8029		-878.8029	(233)
Total delivered energy for all uses												6450.0927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4939.7491	0.2160	1066.9858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.4479	0.2160	410.0647	(264)
Space and water heating			1477.0506	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-878.8029	0.5190	-456.0987	(269)
Total CO2, kg/year			1275.6244	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3600	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.7229	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7229	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	88.4412	169.6748	273.4635	392.9914	478.7001	489.2660	466.0818	401.9227	315.8375	199.5559	109.6209	73.1792	(83)
Total gains	515.9454	594.8616	683.5290	778.0222	838.1637	824.2694	785.7842	728.7213	655.9850	564.9625	503.2481	488.0989	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9988	0.9972	0.9920	0.9714	0.9069	0.7628	0.5950	0.6563	0.8895	0.9853	0.9975	0.9991	(86)
MIT	19.6573	19.8031	20.0657	20.4187	20.7308	20.9246	20.9828	20.9725	20.8235	20.4113	19.9706	19.6328	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9983	0.9962	0.9890	0.9598	0.8680	0.6723	0.4651	0.5261	0.8278	0.9775	0.9964	0.9987	(89)
MIT 2	18.1383	18.3529	18.7368	19.2506	19.6752	19.9045	19.9503	19.9466	19.8033	19.2477	18.6053	18.1083	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9849	0.9521	0.8629	0.6822	0.4848	0.5454	0.8282	0.9718	0.9946	0.9980	(94)
Useful gains	514.5604	591.4861	673.1793	740.7798	723.2773	562.3057	380.9619	397.4717	543.2797	549.0275	500.5266	487.0997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1591.8642	1543.6060	1401.1479	1173.6210	905.1423	601.8689	386.6629	407.4927	648.1230	981.7885	1308.2997	1585.9494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating												4151.0155	(98)
Space heating per m2											(98) / (4) =	43.4616	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4444.3420	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	858.1521	685.0370	579.8807	333.6677	144.8689	0.0000	0.0000	0.0000	0.0000	344.7261	622.6944	875.3150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0900	87.9086	87.4816	86.5092	84.5130	80.3000	80.3000	80.3000	80.3000	86.4748	87.6619	88.1676	(217)
Fuel for water heating, kWh/month													
	239.6601	211.7000	223.4799	200.5185	198.7227	184.2067	176.4840	196.7383	198.9111	210.2419	219.1890	233.7177	(219)
Water heating fuel used												2493.5700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4444.3420	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7428.6107	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4444.3420	0.2160	959.9779	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.5700	0.2160	538.6111	(264)
Space and water heating			1498.5890	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1753.2616	(272)
Emissions per m2 for space and water heating			15.6904	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6904 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.3600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 221 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 221 - EPC	**Prop Type Ref**	Opp
Property	23 Crane Way , Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.36	$kgCO_2/m^2$	Pass
	-5.00 (-27.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.78	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 221 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 221 - EPC	**Prop Type Ref**	Opp
Property	23 Crane Way , Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W9)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.50	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£52	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 221 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 221 - EPC	**Prop Type Ref**	Opp
Property	23 Crane Way , Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.36	$kgCO_2/yr/m^2$	
TER	18.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.36	$kgCO_2/yr/m^2$	
Reduction DER/TER	27.22	%	
CfSH ENE1 credits achieved	3.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.78	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	13	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 222 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 222 - EPC	**Prop Type Ref**	Opp
Property	21 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.31	**TER**	17.31
Environmental	90 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	0.94	**DFEE**	45.20	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.31	$kgCO_2/m^2$	Pass
	-4.00 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.42	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.20	$kWh/m^2/yr$	
	-5.2 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North Windows facing East Windows facing West	0.71 m², No overhang 7.61 m², No overhang 5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 222 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 222 - EPC	**Prop Type Ref**	Opp
Property	21 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.31	**TER**	17.31
Environmental	90 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	0.94	**DFEE**	45.20	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.31 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.37 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 7.61 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.3854	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3276	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4176	0.4094	0.4013	0.3603	0.3521	0.3112	0.3112	0.3030	0.3276	0.3521	0.3685	0.3849	(22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5741	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3700	1.2357	16.5219			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.1800	8.6058			(28a)
External Wall	98.3600	15.4900	82.8700	0.2700	22.3749			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3146			(33)
Party Wall 1			45.1900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0412	(36)
Total fabric heat loss	(33) + (36) = 62.3557	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4522	46.1843	45.9217	44.6884	44.4576	43.3834	43.3834	43.1844	43.7972	44.4576	44.9244	45.4125	(38)
Heat transfer coeff	108.8079	108.5400	108.2775	107.0441	106.8133	105.7391	105.7391	105.5402	106.1529	106.8133	107.2801	107.7682	(39)
Average = Sum(39)m / 12 =												107.0430	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1392	1.1364	1.1337	1.1208	1.1183	1.1071	1.1071	1.1050	1.1114	1.1183	1.1232	1.1283	(40)
HLP (average)												1.1208	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
									Total per year (kWh/year) = Sum(64)m =			1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.6139	412.2635	397.0911	372.6444	347.7038	323.8877	308.5871	315.0522	327.7789	352.4498	380.7187	402.0332	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	89.4819	174.9265	288.3430	421.7968	518.5997	531.7472	505.8798	433.3282	335.6912	207.5841	111.5385	73.6154	(83)
Total gains	504.0958	587.1900	685.4341	794.4412	866.3035	855.6349	814.4669	748.3804	663.4701	560.0339	492.2571	475.6485	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9573	61.1078	61.2560	61.9618	62.0956	62.7265	62.7265	62.8447	62.4820	62.0956	61.8254	61.5454	
alpha	5.0638	5.0739	5.0837	5.1308	5.1397	5.1818	5.1818	5.1896	5.1655	5.1397	5.1217	5.1030	
util living area													
	0.9989	0.9974	0.9916	0.9669	0.8886	0.7268	0.5573	0.6228	0.8762	0.9851	0.9977	0.9992	(86)
MIT	19.7058	19.8547	20.1219	20.4789	20.7789	20.9457	20.9888	20.9808	20.8504	20.4470	20.0118	19.6818	(87)
Th 2	19.9689	19.9712	19.9734	19.9839	19.9859	19.9950	19.9950	19.9967	19.9915	19.9859	19.9819	19.9778	(88)
util rest of house													
	0.9985	0.9965	0.9885	0.9539	0.8459	0.6371	0.4372	0.4997	0.8121	0.9772	0.9967	0.9989	(89)
MIT 2	18.2350	18.4542	18.8448	19.3632	19.7654	19.9583	19.9908	19.9886	19.8659	19.3264	18.6919	18.2062	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4593	18.6677	19.0395	19.5333	19.9199	20.1088	20.1430	20.1399	20.0160	19.4972	18.8931	18.4312	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4593	18.6677	19.0395	19.5333	19.9199	20.1088	20.1430	20.1399	20.0160	19.4972	18.8931	18.4312	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9947	0.9844	0.9464	0.8427	0.6481	0.4555	0.5182	0.8139	0.9718	0.9951	0.9982	(94)
Useful gains	502.9101	584.0626	674.7572	751.8214	730.0214	554.5458	370.9831	387.8312	540.0264	544.2376	489.8592	474.8133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1540.6399	1494.3461	1357.7443	1138.2311	877.9970	582.4944	374.6302	394.7046	627.9970	950.3436	1265.1697	1533.6675	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	772.0710	611.7105	508.1424	278.2150	110.0939	0.0000	0.0000	0.0000	0.0000	302.1429	558.2236	787.7875	(98)
Space heating												3928.3868	(98)
Space heating per m2											(98) / (4) =	41.1306	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4210.4896	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	772.0710	611.7105	508.1424	278.2150	110.0939	0.0000	0.0000	0.0000	0.0000	302.1429	558.2236	787.7875	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	827.5144	655.6383	544.6328	298.1940	117.9999	0.0000	0.0000	0.0000	0.0000	323.8402	598.3104	844.3596	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6221	89.5648	89.4264	89.0773	88.2967	86.7000	86.7000	86.7000	86.7000	89.1136	89.4955	89.6492	(217)
Fuel for water heating, kWh/month													
	191.8852	168.2982	174.8095	154.2250	150.2082	133.3829	124.9657	141.4577	142.5727	160.0200	172.3408	186.1784	(219)
Water heating fuel used												1900.3444	(219)
Annual totals kWh/year													
Space heating fuel - main system												4210.4896	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6017.8935	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4210.4896	0.2160	909.4657	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1900.3444	0.2160	410.4744	(264)
Space and water heating			1319.9401	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1271.7040	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3100	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.6729	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.6729	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	98.3600	15.4900	82.8700	0.1800	14.9166			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6023			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.8436	(36)
Total fabric heat loss (33) + (36) =	57.4459	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	103.5372	103.2833	103.0344	101.8656	101.6469	100.6289	100.6289	100.4404	101.0210	101.6469	102.0893	102.5518	(39)
Average = Sum(39)m / 12 =												101.8645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0840	1.0814	1.0788	1.0665	1.0643	1.0536	1.0536	1.0516	1.0577	1.0643	1.0689	1.0737	(40)
HLP (average)												1.0665	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.7675	425.4207	410.2557	385.1748	359.5713	335.0943	319.8006	326.9262	340.3189	365.6241	393.8812	415.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	78.2967	153.0607	252.3001	369.0722	453.7747	465.2788	442.6448	379.1622	293.7298	181.6361	97.5961	64.4134	(83)
Total gains	506.0642	578.4814	662.5558	754.2470	813.3461	800.3731	762.4454	706.0884	634.0487	547.2601	491.4773	479.6038	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.0605	64.2179	64.3730	65.1117	65.2518	65.9119	65.9119	66.0356	65.6560	65.2518	64.9690	64.6760	
alpha	5.2707	5.2812	5.2915	5.3408	5.3501	5.3941	5.3941	5.4024	5.3771	5.3501	5.3313	5.3117	
util living area													
	0.9989	0.9975	0.9924	0.9705	0.8985	0.7398	0.5673	0.6298	0.8802	0.9855	0.9977	0.9992	(86)
MIT	19.7822	19.9188	20.1667	20.5002	20.7857	20.9481	20.9898	20.9827	20.8610	20.4828	20.0731	19.7599	(87)
Th 2	20.0139	20.0161	20.0182	20.0282	20.0301	20.0389	20.0389	20.0405	20.0355	20.0301	20.0263	20.0223	(88)
util rest of house													
	0.9985	0.9967	0.9896	0.9589	0.8590	0.6533	0.4504	0.5106	0.8187	0.9780	0.9968	0.9989	(89)
MIT 2	18.3788	18.5800	18.9426	19.4282	19.8135	20.0031	20.0350	20.0330	19.9176	19.4108	18.8134	18.3522	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.5928	18.7841	19.1292	19.5916	19.9617	20.1472	20.1805	20.1778	20.0614	19.5742	19.0054	18.5668	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5928	18.7841	19.1292	19.5916	19.9617	20.1472	20.1805	20.1778	20.0614	19.5742	19.0054	18.5668	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9860	0.9521	0.8557	0.6639	0.4682	0.5285	0.8207	0.9729	0.9952	0.9983	(94)
Useful gains	504.8980	575.6154	653.2816	718.1372	695.9594	531.3433	356.9439	373.1995	520.3598	532.4545	489.1248	478.7698	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1479.8343	1433.9925	1301.2418	1089.1061	839.7731	558.2044	360.3048	379.4441	602.2293	912.1993	1215.4163	1473.3435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	725.3526	576.8294	482.0824	267.0976	106.9974	0.0000	0.0000	0.0000	0.0000	282.5301	522.9299	739.9629	(98)
Space heating												3703.7822	(98)
Space heating per m2											(98) / (4) =	38.7790	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3965.5056	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	725.3526	576.8294	482.0824	267.0976	106.9974	0.0000	0.0000	0.0000	0.0000	282.5301	522.9299	739.9629	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	776.6088	617.5903	516.1481	285.9717	114.5583	0.0000	0.0000	0.0000	0.0000	302.4948	559.8821	792.2515	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9074	87.7090	87.2342	86.1343	83.9501	80.3000	80.3000	80.3000	80.3000	86.1570	87.4446	87.9894	(217)
Fuel for water heating, kWh/month													
	240.1582	212.1817	224.1137	201.3912	200.0553	184.2067	176.4840	196.7383	198.9111	211.0174	219.7337	234.1910	(219)
Water heating fuel used												2499.1823	(219)
Annual totals kWh/year													
Space heating fuel - main system												3965.5056	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Total delivered energy for all uses												6960.0369	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3965.5056	0.2160	856.5492	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2499.1823	0.2160	539.8234	(264)
Space and water heating			1396.3726	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Total CO2, kg/m2/year			1653.4588	(272)
Emissions per m2 for space and water heating			14.6202	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2842	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6202 * 1.00) + 2.2842 + 0.4075, rounded to 2 d.p.			17.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 222 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 222 - EPC	**Prop Type Ref**	Opp
Property	21 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.31	**TER**	17.31
Environmental	90 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	0.94	**DFEE**	45.20	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.31	$kgCO_2/m^2$	Pass
	-4.00 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.42	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.20	$kWh/m^2/yr$	
	-5.2 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.71 m², No overhang 7.61 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 222 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 222 - EPC	**Prop Type Ref**	Opp
Property	21 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.31	**TER**	17.31
Environmental	90 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	0.94	**DFEE**	45.20	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	98.36	82.87

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	45.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	47.81

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W8)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.33	0.060	No
Independently assessed	E3 Sill	8.73	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	19.63	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.63	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.63	0.030	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.02	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.02	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.02	0.045	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.37	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	

In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£53	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 222 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 222 - EPC	**Prop Type Ref**	Opp
Property	21 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.31	**TER**	17.31
Environmental	90 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	0.94	**DFEE**	45.20	**TFEE**	50.42
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.31	$kgCO_2/yr/m^2$	
TER	17.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.31	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.12	%	
CfSH ENE1 credits achieved	3.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	45.20	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	18.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.10	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.10	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	32.90	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	32.90	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 223 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 223 - EPC	**Prop Type Ref**	As
Property	19 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.22	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.93	**DFEE**	44.78	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.20	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.22	$kgCO_2/m^2$	Pass
	-3.98 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.78	$kWh/m^2/yr$	
	-5.1 (-10.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 223 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 223 - EPC	**Prop Type Ref**	As
Property	19 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.22	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.93	**DFEE**	44.78	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.20 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.22 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.49 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.61 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669 (8)
Pressure test		Yes
Measured/design AP50		4.4900
Infiltration rate		0.3914 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3327 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4241	0.4158	0.4075	0.3659	0.3576	0.3160	0.3160	0.3077	0.3327	0.3576	0.3742	0.3909	(22b)
Effective ac	0.5899	0.5865	0.5830	0.5670	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5700	0.5764	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3700	1.2357	16.5219			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.1800	8.6058			(28a)
External Wall	98.3600	15.4900	82.8700	0.2700	22.3749			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3146			(33)
Party Wall 1			45.1900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0412 (36)
Total fabric heat loss (33) + (36) =	62.3557 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6687	46.3924	46.1216	44.8495	44.6115	43.5036	43.5036	43.2984	43.9303	44.6115	45.0930	45.5963	(38)
Heat transfer coeff	109.0244	108.7481	108.4773	107.2052	106.9672	105.8593	105.8593	105.6541	106.2860	106.9672	107.4487	107.9521	(39)
Average = Sum(39)m / 12 =												107.2041	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1415	1.1386	1.1358	1.1225	1.1200	1.1084	1.1084	1.1062	1.1128	1.1200	1.1250	1.1303	(40)
HLP (average)												1.1224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.6139	412.2635	397.0911	372.6444	347.7038	323.8877	308.5871	315.0522	327.7789	352.4498	380.7187	402.0332	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	98.4387	188.8748	303.9668	435.3788	528.5576	539.3261	514.1464	444.6482	350.6617	222.0653	122.0280	81.4351	(83)
Total gains	513.0527	601.1383	701.0579	808.0233	876.2613	863.2138	822.7335	759.7004	678.4406	574.5151	502.7467	483.4683	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8363	60.9908	61.1431	61.8686	62.0063	62.6552	62.6552	62.7769	62.4037	62.0063	61.7284	61.4406	
alpha	5.0558	5.0661	5.0762	5.1246	5.1338	5.1770	5.1770	5.1851	5.1602	5.1338	5.1152	5.0960	
util living area													
	0.9988	0.9971	0.9908	0.9647	0.8851	0.7228	0.5528	0.6155	0.8684	0.9835	0.9975	0.9991	(86)
MIT	19.7116	19.8654	20.1341	20.4884	20.7833	20.9469	20.9891	20.9817	20.8573	20.4587	20.0200	19.6869	(87)
Th 2	19.9671	19.9694	19.9717	19.9825	19.9846	19.9940	19.9940	19.9958	19.9904	19.9846	19.9805	19.9762	(88)
util rest of house													
	0.9984	0.9961	0.9874	0.9510	0.8416	0.6329	0.4333	0.4931	0.8022	0.9748	0.9964	0.9988	(89)
MIT 2	18.2421	18.4685	18.8611	19.3751	19.7693	19.9582	19.9900	19.9881	19.8718	19.3419	18.7029	18.2126	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4661	18.6814	19.0551	19.5448	19.9238	20.1089	20.1423	20.1396	20.0220	19.5121	18.9037	18.4373	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4661	18.6814	19.0551	19.5448	19.9238	20.1089	20.1423	20.1396	20.0220	19.5121	18.9037	18.4373	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9941	0.9830	0.9434	0.8386	0.6440	0.4515	0.5115	0.8047	0.9691	0.9947	0.9981	(94)
Useful gains	511.7476	597.6055	689.1603	762.2874	734.8270	555.9140	371.4633	388.5929	545.9495	556.7614	500.0677	482.5542	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1544.4553	1498.7066	1361.9470	1141.1797	879.6814	583.1710	374.9834	395.0990	629.4269	953.3073	1268.2895	1536.9482	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	768.3345	605.5399	500.5533	272.8025	107.7717	0.0000	0.0000	0.0000	0.0000	295.0301	553.1197	784.4692	(98)
Space heating												3887.6209	(98)
Space heating per m2											(98) / (4) =	40.7038	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4166.7962	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	768.3345	605.5399	500.5533	272.8025	107.7717	0.0000	0.0000	0.0000	0.0000	295.0301	553.1197	784.4692	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	823.5096	649.0246	536.4987	292.3928	115.5109	0.0000	0.0000	0.0000	0.0000	316.2167	592.8400	840.8030	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6194	89.5588	89.4164	89.0614	88.2777	86.7000	86.7000	86.7000	86.7000	89.0946	89.4898	89.6470	(217)
Fuel for water heating, kWh/month													
	191.8910	168.3094	174.8291	154.2526	150.2404	133.3829	124.9657	141.4577	142.5727	160.0542	172.3519	186.1831	(219)
Water heating fuel used												1900.4905	(219)
Annual totals kWh/year													
Space heating fuel - main system												4166.7962	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5974.3463	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4166.7962	0.2160	900.0280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1900.4905	0.2160	410.5060	(264)
Space and water heating			1310.5339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1262.2978	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.2200	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.5829	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.5829	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.3700	1.3258	17.7254			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	98.3600	15.4900	82.8700	0.1800	14.9166			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			193.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6023			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.8436	(36)
Total fabric heat loss (33) + (36) =	57.4459	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	103.5372	103.2833	103.0344	101.8656	101.6469	100.6289	100.6289	100.4404	101.0210	101.6469	102.0893	102.5518	(39)
Average = Sum(39)m / 12 =												101.8645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0840	1.0814	1.0788	1.0665	1.0643	1.0536	1.0536	1.0516	1.0577	1.0643	1.0689	1.0737	(40)
HLP (average)												1.0665	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8019	21.1406	17.1927	13.0160	9.7296	8.2141	8.8757	11.5369	15.4849	19.6616	22.9480	24.4634	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.7675	425.4207	410.2557	385.1748	359.5713	335.0943	319.8006	326.9262	340.3189	365.6241	393.8812	415.1903	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	86.1339	165.2654	265.9710	380.9565	462.4879	471.9104	449.8781	389.0671	306.8290	194.3072	106.7745	71.2557	(83)
Total gains	513.9014	590.6861	676.2267	766.1312	822.0592	807.0047	769.6787	715.9934	647.1479	559.9312	500.6557	486.4461	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.0605	64.2179	64.3730	65.1117	65.2518	65.9119	65.9119	66.0356	65.6560	65.2518	64.9690	64.6760	
alpha	5.2707	5.2812	5.2915	5.3408	5.3501	5.3941	5.3941	5.4024	5.3771	5.3501	5.3313	5.3117	
util living area													
	0.9988	0.9973	0.9917	0.9686	0.8950	0.7355	0.5625	0.6224	0.8727	0.9840	0.9975	0.9991	(86)
MIT	19.7900	19.9308	20.1797	20.5102	20.7907	20.9495	20.9902	20.9836	20.8677	20.4944	20.0821	19.7667	(87)
Th 2	20.0139	20.0161	20.0182	20.0282	20.0301	20.0389	20.0389	20.0405	20.0355	20.0301	20.0263	20.0223	(88)
util rest of house													
	0.9984	0.9963	0.9886	0.9564	0.8547	0.6489	0.4463	0.5040	0.8093	0.9758	0.9965	0.9988	(89)
MIT 2	18.3902	18.5974	18.9614	19.4420	19.8193	20.0042	20.0351	20.0335	19.9244	19.4271	18.8265	18.3622	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.6036	18.8007	19.1471	19.6048	19.9674	20.1483	20.1807	20.1783	20.0682	19.5898	19.0179	18.5763	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6036	18.8007	19.1471	19.6048	19.9674	20.1483	20.1807	20.1783	20.0682	19.5898	19.0179	18.5763	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9946	0.9848	0.9495	0.8516	0.6596	0.4640	0.5218	0.8119	0.9705	0.9948	0.9981	(94)
Useful gains	512.6319	587.4814	665.9490	727.4158	700.1021	532.2657	357.1049	373.6169	525.4013	543.4152	498.0561	485.5432	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1480.9502	1435.7080	1303.0855	1090.4543	840.3528	558.3223	360.3252	379.4967	602.9148	913.7853	1216.6952	1474.3125	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	720.4288	570.0083	474.0296	261.3877	104.3465	0.0000	0.0000	0.0000	0.0000	275.5553	517.4202	735.6444	(98)
Space heating												3658.8208	(98)
Space heating per m2											(98) / (4) =	38.3082	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3917.3671	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	720.4288	570.0083	474.0296	261.3877	104.3465	0.0000	0.0000	0.0000	0.0000	275.5553	517.4202	735.6444	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	771.3371	610.2873	507.5263	279.8584	111.7200	0.0000	0.0000	0.0000	0.0000	295.0271	553.9831	787.6278	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8945	87.6854	87.1975	86.0810	83.8918	80.3000	80.3000	80.3000	80.3000	86.0954	87.4224	87.9786	(217)
Fuel for water heating, kWh/month													
	240.1932	212.2387	224.2081	201.5159	200.1942	184.2067	176.4840	196.7383	198.9111	211.1685	219.7894	234.2197	(219)
Water heating fuel used												2499.8678	(219)
Annual totals kWh/year													
Space heating fuel - main system												3917.3671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												420.3491	(232)
Total delivered energy for all uses												6912.5840	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3917.3671	0.2160	846.1513	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2499.8678	0.2160	539.9715	(264)
Space and water heating			1386.1227	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	420.3491	0.5190	218.1612	(268)
Total CO2, kg/m2/year			1643.2089	(272)
Emissions per m2 for space and water heating			14.5129	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2842	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5129 * 1.00) + 2.2842 + 0.4075, rounded to 2 d.p.			17.2000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 223 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 223 - EPC	**Prop Type Ref**	As
Property	19 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.22	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.93	**DFEE**	44.78	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.20	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.22	$kgCO_2/m^2$	Pass
	-3.98 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.78	$kWh/m^2/yr$	
	-5.1 (-10.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 223 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 223 - EPC	**Prop Type Ref**	As
Property	19 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.22	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.93	**DFEE**	44.78	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	98.36	82.87

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing		0.00	45.19

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	47.81

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W8)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.33	0.060	No
Independently assessed	E3 Sill	8.73	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	19.63	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	19.63	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.63	0.030	No
Independently assessed	E16 Corner (normal)	10.02	0.033	No
Independently assessed	E18 Party wall between dwellings	10.02	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.02	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.02	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.02	0.045	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.49	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	

In Winter	90.3
In Summer	86.7
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 223 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 223 - EPC	**Prop Type Ref**	As
Property	19 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.22	**TER**	17.20
Environmental	90 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.93	**DFEE**	44.78	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.22	$kgCO_2/yr/m^2$	
TER	17.20	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.22	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.16	%	
CfSH ENE1 credits achieved	3.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	44.78	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	18.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.00	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.00	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.44	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	32.80	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	32.80	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 224 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 224 - EPC	**Prop Type Ref**	Opp
Property	17 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	$kgCO_2/m^2$	Pass
	-5.01 (-27.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.76	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 224 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 224 - EPC	**Prop Type Ref**	Opp
Property	17 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.35 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.20 (max. 0.25)        0.20 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.48 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   0.71 m², No overhang
Windows facing East:                    7.61 m², No overhang
Windows facing South:                   0.71 m², No overhang
Windows facing West:                    5.05 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.019 W/m²K
Photovoltaic array                      1.21 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3909	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3322	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4236	0.4153	0.4070	0.3655	0.3572	0.3156	0.3156	0.3073	0.3322	0.3572	0.3738	0.3904	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5698	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6506	46.3750	46.1048	44.8360	44.5986	43.4935	43.4935	43.2888	43.9192	44.5986	45.0788	45.5809	(38)
Heat transfer coeff	123.2550	122.9794	122.7093	121.4405	121.2031	120.0980	120.0980	119.8933	120.5236	121.2031	121.6833	122.1854	(39)
Average = Sum(39)m / 12 =												121.4393	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2905	1.2876	1.2848	1.2715	1.2690	1.2574	1.2574	1.2553	1.2619	1.2690	1.2740	1.2793	(40)
HLP (average)												1.2715	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939	(42)
Average daily hot water use (litres/day)	98.1799	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	101.0756	193.9140	312.5297	449.1331	547.0858	559.1611	532.6649	459.3403	360.9571	228.0639	125.2810	83.6334	(83)
Total gains	515.4262	605.9437	709.4306	821.6335	894.6819	882.9580	841.1538	774.2648	688.5647	580.2962	505.7458	485.3959	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8123	53.9329	54.0516	54.6164	54.7234	55.2269	55.2269	55.3212	55.0319	54.7234	54.5074	54.2834	
alpha	4.5875	4.5955	4.6034	4.6411	4.6482	4.6818	4.6818	4.6881	4.6688	4.6482	4.6338	4.6189	
util living area													
	0.9987	0.9970	0.9912	0.9692	0.9033	0.7625	0.5997	0.6634	0.8915	0.9852	0.9974	0.9990	(86)
MIT	19.5200	19.6802	19.9672	20.3524	20.6929	20.9080	20.9769	20.9635	20.7902	20.3370	19.8586	19.4938	(87)
Th 2	19.8483	19.8506	19.8528	19.8632	19.8652	19.8743	19.8743	19.8760	19.8708	19.8652	19.8612	19.8571	(88)
util rest of house													
	0.9982	0.9959	0.9879	0.9564	0.8618	0.6669	0.4603	0.5242	0.8277	0.9770	0.9963	0.9987	(89)
MIT 2	17.8797	18.1152	18.5347	19.0945	19.5570	19.8114	19.8658	19.8607	19.6935	19.0814	18.3839	17.8474	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1297	18.3538	18.7531	19.2863	19.7302	19.9786	20.0352	20.0288	19.8607	19.2728	18.6087	18.0984	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1297	18.3538	18.7531	19.2863	19.7302	19.9786	20.0352	20.0288	19.8607	19.2728	18.6087	18.0984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9937	0.9831	0.9476	0.8557	0.6769	0.4814	0.5448	0.8270	0.9707	0.9943	0.9978	(94)
Useful gains	513.9357	602.1315	697.4498	778.6191	765.6170	597.6374	404.9398	421.7862	569.4400	563.2765	502.8545	484.3290	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1704.5829	1654.5362	1503.5640	1261.3115	973.2805	645.9538	412.5572	435.0667	694.3029	1051.1703	1400.4157	1698.1757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	885.8415	707.2160	599.7490	347.5385	154.5016	0.0000	0.0000	0.0000	0.0000	362.9930	646.2440	903.1019	(98)
Space heating												4607.1855	(98)
Space heating per m2											(98) / (4) =	48.2377	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4938.0338	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	885.8415	707.2160	599.7490	347.5385	154.5016	0.0000	0.0000	0.0000	0.0000	362.9930	646.2440	903.1019	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	949.4550	758.0021	642.8178	372.4957	165.5966	0.0000	0.0000	0.0000	0.0000	389.0601	692.6517	967.9549	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6945	89.6460	89.5314	89.2501	88.6007	86.7000	86.7000	86.7000	86.7000	89.2547	89.5833	89.7189	(217)
Fuel for water heating, kWh/month													
	191.7303	168.1457	174.6046	153.9265	149.6928	133.3829	124.9657	141.4577	142.5727	159.7670	172.1720	186.0338	(219)
Water heating fuel used												1898.4516	(219)
Annual totals kWh/year													
Space heating fuel - main system												4938.0338	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 908 * 1.00) =										-878.8029		-878.8029	(233)
Total delivered energy for all uses												6448.3812	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4938.0338	0.2160	1066.6153	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.4516	0.2160	410.0656	(264)
Space and water heating			1476.6809	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-878.8029	0.5190	-456.0987	(269)
Total CO2, kg/year			1275.2547	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3500	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.7129	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7129	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	88.4412	169.6748	273.4635	392.9914	478.7001	489.2660	466.0818	401.9227	315.8375	199.5559	109.6209	73.1792	(83)
Total gains	515.9454	594.8616	683.5290	778.0222	838.1637	824.2694	785.7842	728.7213	655.9850	564.9625	503.2481	488.0989	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9988	0.9972	0.9920	0.9714	0.9069	0.7628	0.5950	0.6563	0.8895	0.9853	0.9975	0.9991	(86)
MIT	19.6573	19.8031	20.0657	20.4187	20.7308	20.9246	20.9828	20.9725	20.8235	20.4113	19.9706	19.6328	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9983	0.9962	0.9890	0.9598	0.8680	0.6723	0.4651	0.5261	0.8278	0.9775	0.9964	0.9987	(89)
MIT 2	18.1383	18.3529	18.7368	19.2506	19.6752	19.9045	19.9503	19.9466	19.8033	19.2477	18.6053	18.1083	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9849	0.9521	0.8629	0.6822	0.4848	0.5454	0.8282	0.9718	0.9946	0.9980	(94)
Useful gains	514.5604	591.4861	673.1793	740.7798	723.2773	562.3057	380.9619	397.4717	543.2797	549.0275	500.5266	487.0997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1591.8642	1543.6060	1401.1479	1173.6210	905.1423	601.8689	386.6629	407.4927	648.1230	981.7885	1308.2997	1585.9494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating												4151.0155	(98)
Space heating per m2											(98) / (4) =	43.4616	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4444.3420	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	858.1521	685.0370	579.8807	333.6677	144.8689	0.0000	0.0000	0.0000	0.0000	344.7261	622.6944	875.3150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0900	87.9086	87.4816	86.5092	84.5130	80.3000	80.3000	80.3000	80.3000	86.4748	87.6619	88.1676	(217)
Fuel for water heating, kWh/month													
	239.6601	211.7000	223.4799	200.5185	198.7227	184.2067	176.4840	196.7383	198.9111	210.2419	219.1890	233.7177	(219)
Water heating fuel used												2493.5700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4444.3420	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7428.6107	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4444.3420	0.2160	959.9779	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.5700	0.2160	538.6111	(264)
Space and water heating			1498.5890	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1753.2616	(272)
Emissions per m2 for space and water heating			15.6904	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6904 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.3600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 224 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 224 - EPC	**Prop Type Ref**	Opp
Property	17 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	$kgCO_2/m^2$	Pass
	-5.01 (-27.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.76	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 224 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 224 - EPC	**Prop Type Ref**	Opp
Property	17 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W9)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 224 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 224 - EPC	**Prop Type Ref**	Opp
Property	17 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.35	$kgCO_2/yr/m^2$	
TER	18.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.35	$kgCO_2/yr/m^2$	
Reduction DER/TER	27.28	%	
CfSH ENE1 credits achieved	3.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.76	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	13	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 225 -BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 225 - EPC	**Prop Type Ref**	Opp
Property	15 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	$kgCO_2/m^2$	Pass
	-5.01 (-27.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.76	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	0.71 m², No overhang 7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	1.21	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 225 -BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 225 - EPC	**Prop Type Ref**	Opp
Property	15 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 7.61 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3904	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3318	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4231	0.4148	0.4065	0.3650	0.3567	0.3152	0.3152	0.3069	0.3318	0.3567	0.3733	0.3899	(22b)
Effective ac	0.5895	0.5860	0.5826	0.5666	0.5636	0.5497	0.5497	0.5471	0.5550	0.5636	0.5697	0.5760	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6324	46.3575	46.0881	44.8225	44.5857	43.4834	43.4834	43.2793	43.9080	44.5857	45.0647	45.5655	(38)
Heat transfer coeff	123.2369	122.9620	122.6925	121.4270	121.1902	120.0879	120.0879	119.8838	120.5125	121.1902	121.6692	122.1700	(39)
Average = Sum(39)m / 12 =												121.4258	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2903	1.2874	1.2846	1.2714	1.2689	1.2573	1.2573	1.2552	1.2618	1.2689	1.2739	1.2791	(40)
HLP (average)												1.2713	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	101.0756	193.9140	312.5297	449.1331	547.0858	559.1611	532.6649	459.3403	360.9571	228.0639	125.2810	83.6334	(83)
Total gains	515.4262	605.9437	709.4306	821.6335	894.6819	882.9580	841.1538	774.2648	688.5647	580.2962	505.7458	485.3959	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8202	53.9406	54.0590	54.6225	54.7292	55.2315	55.2315	55.3256	55.0370	54.7292	54.5137	54.2903	
alpha	4.5880	4.5960	4.6039	4.6415	4.6486	4.6821	4.6821	4.6884	4.6691	4.6486	4.6342	4.6194	
util living area													
	0.9987	0.9970	0.9912	0.9691	0.9033	0.7625	0.5997	0.6634	0.8915	0.9852	0.9974	0.9990	(86)
MIT	19.5203	19.6804	19.9674	20.3526	20.6930	20.9081	20.9769	20.9635	20.7902	20.3371	19.8588	19.4940	(87)
Th 2	19.8484	19.8507	19.8529	19.8633	19.8653	19.8744	19.8744	19.8761	19.8709	19.8653	19.8613	19.8572	(88)
util rest of house													
	0.9982	0.9959	0.9879	0.9564	0.8618	0.6669	0.4603	0.5242	0.8277	0.9770	0.9963	0.9987	(89)
MIT 2	17.8801	18.1156	18.5351	19.0948	19.5572	19.8115	19.8659	19.8607	19.6937	19.0816	18.3842	17.8477	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1301	18.3542	18.7534	19.2865	19.7304	19.9787	20.0352	20.0289	19.8609	19.2730	18.6090	18.0987	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1301	18.3542	18.7534	19.2865	19.7304	19.9787	20.0352	20.0289	19.8609	19.2730	18.6090	18.0987	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9937	0.9831	0.9476	0.8557	0.6768	0.4814	0.5447	0.8270	0.9707	0.9943	0.9978	(94)
Useful gains	513.9359	602.1318	697.4494	778.6149	765.6009	597.6135	404.9183	421.7665	569.4277	563.2755	502.8547	484.3292	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1704.3838	1654.3505	1503.4027	1261.2020	973.1995	645.9112	412.5317	435.0411	694.2544	1051.0848	1400.2881	1698.0054	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	885.6932	707.0910	599.6293	347.4627	154.4534	0.0000	0.0000	0.0000	0.0000	362.9301	646.1521	902.9751	(98)
Space heating												4606.3868	(98)
Space heating per m2											(98) / (4) =	48.2294	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4937.1777	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	885.6932	707.0910	599.6293	347.4627	154.4534	0.0000	0.0000	0.0000	0.0000	362.9301	646.1521	902.9751	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	949.2961	757.8682	642.6894	372.4145	165.5449	0.0000	0.0000	0.0000	0.0000	388.9926	692.5531	967.8190	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6944	89.6459	89.5312	89.2499	88.6004	86.7000	86.7000	86.7000	86.7000	89.2546	89.5832	89.7188	(217)
Fuel for water heating, kWh/month													
	191.7305	168.1459	174.6049	153.9268	149.6933	133.3829	124.9657	141.4577	142.5727	159.7672	172.1721	186.0339	(219)
Water heating fuel used												1898.4535	(219)
Annual totals kWh/year													
Space heating fuel - main system												4937.1777	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 908 * 1.00) =										-878.8029		-878.8029	(233)
Total delivered energy for all uses												6447.5270	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4937.1777	0.2160	1066.4304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.4535	0.2160	410.0660	(264)
Space and water heating			1476.4964	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-878.8029	0.5190	-456.0987	(269)
Total CO2, kg/year			1275.0702	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3500	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.7129	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7129	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	88.4412	169.6748	273.4635	392.9914	478.7001	489.2660	466.0818	401.9227	315.8375	199.5559	109.6209	73.1792	(83)
Total gains	515.9454	594.8616	683.5290	778.0222	838.1637	824.2694	785.7842	728.7213	655.9850	564.9625	503.2481	488.0989	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9988	0.9972	0.9920	0.9714	0.9069	0.7628	0.5950	0.6563	0.8895	0.9853	0.9975	0.9991	(86)
MIT	19.6573	19.8031	20.0657	20.4187	20.7308	20.9246	20.9828	20.9725	20.8235	20.4113	19.9706	19.6328	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9983	0.9962	0.9890	0.9598	0.8680	0.6723	0.4651	0.5261	0.8278	0.9775	0.9964	0.9987	(89)
MIT 2	18.1383	18.3529	18.7368	19.2506	19.6752	19.9045	19.9503	19.9466	19.8033	19.2477	18.6053	18.1083	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9849	0.9521	0.8629	0.6822	0.4848	0.5454	0.8282	0.9718	0.9946	0.9980	(94)
Useful gains	514.5604	591.4861	673.1793	740.7798	723.2773	562.3057	380.9619	397.4717	543.2797	549.0275	500.5266	487.0997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1591.8642	1543.6060	1401.1479	1173.6210	905.1423	601.8689	386.6629	407.4927	648.1230	981.7885	1308.2997	1585.9494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating												4151.0155	(98)
Space heating per m2											(98) / (4) =	43.4616	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4444.3420	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	858.1521	685.0370	579.8807	333.6677	144.8689	0.0000	0.0000	0.0000	0.0000	344.7261	622.6944	875.3150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0900	87.9086	87.4816	86.5092	84.5130	80.3000	80.3000	80.3000	80.3000	86.4748	87.6619	88.1676	(217)
Fuel for water heating, kWh/month													
	239.6601	211.7000	223.4799	200.5185	198.7227	184.2067	176.4840	196.7383	198.9111	210.2419	219.1890	233.7177	(219)
Water heating fuel used												2493.5700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4444.3420	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7428.6107	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4444.3420	0.2160	959.9779	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.5700	0.2160	538.6111	(264)
Space and water heating			1498.5890	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1753.2616	(272)
Emissions per m2 for space and water heating			15.6904	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6904 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.3600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 225 -BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 225 - EPC	**Prop Type Ref**	Opp
Property	15 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	$kgCO_2/m^2$	Pass
	-5.01 (-27.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.76	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 225 -BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 225 - EPC	**Prop Type Ref**	Opp
Property	15 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W9)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.47	m³/(h.m²) @ 50 Pa
19.0 Mechanical Ventilation		
Summer Overheating		
Windows open in hot weather	Windows fully open	
Cross ventilation possible	Yes	
Night Ventilation	No	
Air change rate	8.00	
Mechanical Ventilation		
Mechanical Ventilation System Present	No	

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£52	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 225 -BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 225 - EPC	**Prop Type Ref**	Opp
Property	15 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.35	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.28		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.76	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.35	$kgCO_2/yr/m^2$	
TER	18.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.35	$kgCO_2/yr/m^2$	
Reduction DER/TER	27.28	%	
CfSH ENE1 credits achieved	3.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.76	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	13	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 226 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 226 - EPC	**Prop Type Ref**	Opp
Property	11 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.36	$kgCO_2/m^2$	Pass
	-5.00 (-27.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.78	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	0.71 m², No overhang 7.61 m², No overhang 0.71 m², No overhang 5.05 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	1.21	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 226 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 226 - EPC	**Prop Type Ref**	Opp
Property	11 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 7.61 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3919	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3331	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4247	0.4164	0.4080	0.3664	0.3581	0.3164	0.3164	0.3081	0.3331	0.3581	0.3747	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5832	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6869	46.4099	46.1384	44.8631	44.6244	43.5137	43.5137	43.3080	43.9415	44.6244	45.1072	45.6118	(38)
Heat transfer coeff	123.2914	123.0144	122.7429	121.4675	121.2289	120.1181	120.1181	119.9124	120.5460	121.2289	121.7116	122.2163	(39)
Average = Sum(39)m / 12 =												121.4664	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2909	1.2880	1.2851	1.2718	1.2693	1.2576	1.2576	1.2555	1.2621	1.2693	1.2743	1.2796	(40)
HLP (average)												1.2718	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	101.0756	193.9140	312.5297	449.1331	547.0858	559.1611	532.6649	459.3403	360.9571	228.0639	125.2810	83.6334	(83)
Total gains	515.4262	605.9437	709.4306	821.6335	894.6819	882.9580	841.1538	774.2648	688.5647	580.2962	505.7458	485.3959	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.7965	53.9176	54.0369	54.6042	54.7117	55.2176	55.2176	55.3123	55.0216	54.7117	54.4947	54.2697	
alpha	4.5864	4.5945	4.6025	4.6403	4.6474	4.6812	4.6812	4.6875	4.6681	4.6474	4.6330	4.6180	
util living area													
	0.9987	0.9970	0.9912	0.9692	0.9033	0.7626	0.5998	0.6635	0.8916	0.9852	0.9974	0.9990	(86)
MIT	19.5195	19.6797	19.9668	20.3521	20.6928	20.9080	20.9768	20.9635	20.7901	20.3368	19.8583	19.4934	(87)
Th 2	19.8480	19.8503	19.8525	19.8630	19.8650	19.8742	19.8742	19.8759	19.8706	19.8650	19.8610	19.8568	(88)
util rest of house													
	0.9982	0.9959	0.9879	0.9564	0.8618	0.6670	0.4604	0.5243	0.8277	0.9770	0.9963	0.9987	(89)
MIT 2	17.8787	18.1143	18.5339	19.0939	19.5566	19.8112	19.8656	19.8605	19.6933	19.0809	18.3832	17.8466	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1289	18.3530	18.7523	19.2857	19.7298	19.9784	20.0350	20.0286	19.8605	19.2724	18.6081	18.0976	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1289	18.3530	18.7523	19.2857	19.7298	19.9784	20.0350	20.0286	19.8605	19.2724	18.6081	18.0976	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9937	0.9831	0.9477	0.8558	0.6769	0.4815	0.5448	0.8270	0.9707	0.9943	0.9978	(94)
Useful gains	513.9352	602.1311	697.4506	778.6276	765.6493	597.6853	404.9829	421.8257	569.4647	563.2784	502.8542	484.3287	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1704.9818	1654.9083	1503.8872	1261.5308	973.4429	646.0392	412.6082	435.1181	694.4002	1051.3417	1400.6711	1698.5169	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	886.1386	707.4663	599.9889	347.6903	154.5984	0.0000	0.0000	0.0000	0.0000	363.1191	646.4282	903.3560	(98)
Space heating												4608.7859	(98)
Space heating per m2											(98) / (4) =	48.2545	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4939.7491	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	886.1386	707.4663	599.9889	347.6903	154.5984	0.0000	0.0000	0.0000	0.0000	363.1191	646.4282	903.3560	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	949.7735	758.2704	643.0749	372.6585	165.7003	0.0000	0.0000	0.0000	0.0000	389.1952	692.8491	968.2272	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6947	89.6462	89.5316	89.2504	88.6012	86.7000	86.7000	86.7000	86.7000	89.2550	89.5834	89.7190	(217)
Fuel for water heating, kWh/month													
	191.7299	168.1453	174.6041	153.9259	149.6918	133.3829	124.9657	141.4577	142.5727	159.7665	172.1716	186.0335	(219)
Water heating fuel used												1898.4479	(219)
Annual totals kWh/year													
Space heating fuel - main system												4939.7491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 908 * 1.00) =										-878.8029		-878.8029	(233)
Total delivered energy for all uses												6450.0927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4939.7491	0.2160	1066.9858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.4479	0.2160	410.0647	(264)
Space and water heating			1477.0506	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-878.8029	0.5190	-456.0987	(269)
Total CO2, kg/year			1275.6244	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3600	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		30.7229	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.7229	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	88.4412	169.6748	273.4635	392.9914	478.7001	489.2660	466.0818	401.9227	315.8375	199.5559	109.6209	73.1792	(83)
Total gains	515.9454	594.8616	683.5290	778.0222	838.1637	824.2694	785.7842	728.7213	655.9850	564.9625	503.2481	488.0989	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9988	0.9972	0.9920	0.9714	0.9069	0.7628	0.5950	0.6563	0.8895	0.9853	0.9975	0.9991	(86)
MIT	19.6573	19.8031	20.0657	20.4187	20.7308	20.9246	20.9828	20.9725	20.8235	20.4113	19.9706	19.6328	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9983	0.9962	0.9890	0.9598	0.8680	0.6723	0.4651	0.5261	0.8278	0.9775	0.9964	0.9987	(89)
MIT 2	18.1383	18.3529	18.7368	19.2506	19.6752	19.9045	19.9503	19.9466	19.8033	19.2477	18.6053	18.1083	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3698	18.5740	18.9394	19.4287	19.8361	20.0600	20.1077	20.1030	19.9588	19.4251	18.8134	18.3407	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9943	0.9849	0.9521	0.8629	0.6822	0.4848	0.5454	0.8282	0.9718	0.9946	0.9980	(94)
Useful gains	514.5604	591.4861	673.1793	740.7798	723.2773	562.3057	380.9619	397.4717	543.2797	549.0275	500.5266	487.0997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1591.8642	1543.6060	1401.1479	1173.6210	905.1423	601.8689	386.6629	407.4927	648.1230	981.7885	1308.2997	1585.9494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating												4151.0155	(98)
Space heating per m2											(98) / (4) =	43.4616	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4444.3420	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.5140	639.8246	541.6086	311.6457	135.3076	0.0000	0.0000	0.0000	0.0000	321.9742	581.5966	817.5442	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	858.1521	685.0370	579.8807	333.6677	144.8689	0.0000	0.0000	0.0000	0.0000	344.7261	622.6944	875.3150	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0900	87.9086	87.4816	86.5092	84.5130	80.3000	80.3000	80.3000	80.3000	86.4748	87.6619	88.1676	(217)
Fuel for water heating, kWh/month													
	239.6601	211.7000	223.4799	200.5185	198.7227	184.2067	176.4840	196.7383	198.9111	210.2419	219.1890	233.7177	(219)
Water heating fuel used												2493.5700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4444.3420	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7428.6107	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4444.3420	0.2160	959.9779	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.5700	0.2160	538.6111	(264)
Space and water heating			1498.5890	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1753.2616	(272)
Emissions per m2 for space and water heating			15.6904	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6904 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.3600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 226 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 226 - EPC	**Prop Type Ref**	Opp
Property	11 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.36	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.36	$kgCO_2/m^2$	Pass
	-5.00 (-27.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.78	$kWh/m^2/yr$	
	-3.3 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	7.61 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 226 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 226 - EPC	**Prop Type Ref**	Opp
Property	11 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
D2 (W9)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.50	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£52	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 226 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 226 - EPC	**Prop Type Ref**	Opp
Property	11 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.36	**TER**	18.36
Environmental	90 B	**% DER<TER**	27.22		
CO_2 Emissions (t/year)	0.91	**DFEE**	52.78	**TFEE**	56.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.36	$kgCO_2/yr/m^2$	
TER	18.36	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.36	$kgCO_2/yr/m^2$	
Reduction DER/TER	27.22	%	
CfSH ENE1 credits achieved	3.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.78	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.93	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	13	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 227 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 227 - EPC	**Prop Type Ref**	Opp
Property	9 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	89 B	**DER**	12.43	**TER**	16.78
Environmental	89 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	1.09	**DFEE**	49.36	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.78	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.43	$kgCO_2/m^2$	Pass
	-4.35 (-25.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.26	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.36	$kWh/m^2/yr$	
	-5.9 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	8.18 m², No overhang
Windows facing South East	1.04 m², No overhang
Windows facing South	6.50 m², No overhang
Windows facing South West	1.04 m², No overhang
Windows facing West	7.10 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 227 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 227 - EPC	**Prop Type Ref**	Opp
Property	9 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	89 B	**DER**	12.43	**TER**	16.78
Environmental	89 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	1.09	**DFEE**	49.36	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.78 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.43 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.16 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 8.18 m², No overhang
Windows facing South East: 1.04 m², No overhang
Windows facing South: 6.50 m², No overhang
Windows facing South West: 1.04 m², No overhang
Windows facing West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3409	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2898	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3695	0.3622	0.3550	0.3188	0.3115	0.2753	0.2753	0.2681	0.2898	0.3115	0.3260	0.3405	(22b)
Effective ac	0.5683	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5580	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4279	56.1647	55.9067	54.6949	54.4682	53.4128	53.4128	53.2174	53.8193	54.4682	54.9269	55.4064	(38)
Heat transfer coeff	153.8502	153.5870	153.3290	152.1173	151.8905	150.8351	150.8351	150.6397	151.2417	151.8905	152.3492	152.8287	(39)
Average = Sum(39)m / 12 =												152.1162	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2827	1.2805	1.2784	1.2683	1.2664	1.2576	1.2576	1.2560	1.2610	1.2664	1.2702	1.2742	(40)
HLP (average)												1.2683	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165 (61)
Total heat required for water heating calculated for each month												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349 (64)
Heat gains from water heating, kWh/month												
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.1800	19.6403	0.7200	0.7000	0.7700	56.1131	(76)
Southeast	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(77)
South	6.5000	46.7521	0.7200	0.7000	0.7700	106.1397	(78)
Southwest	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(79)
West	7.1000	19.6403	0.7200	0.7000	0.7700	48.7045	(80)

Solar gains	237.6876	424.4065	621.4069	819.9394	950.8095	954.6603	916.1906	819.2501	691.5001	481.1172	288.5237	200.7869	(83)
Total gains	695.8621	880.3115	1060.6973	1232.1867	1335.1460	1312.4290	1256.9041	1166.5168	1052.8356	869.7296	708.5111	644.7378	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1381	54.2309	54.3222	54.7549	54.8366	55.2203	55.2203	55.2920	55.0719	54.8366	54.6716	54.5000	
alpha	4.6092	4.6154	4.6215	4.6503	4.6558	4.6814	4.6814	4.6861	4.6715	4.6558	4.6448	4.6333	
util living area													
	0.9982	0.9945	0.9826	0.9430	0.8456	0.6796	0.5151	0.5719	0.8200	0.9711	0.9959	0.9988	(86)
MIT	19.5667	19.7783	20.0964	20.4797	20.7825	20.9436	20.9876	20.9801	20.8617	20.4364	19.9180	19.5271	(87)
Th 2	19.8544	19.8561	19.8578	19.8658	19.8673	19.8742	19.8742	19.8755	19.8715	19.8673	19.8642	19.8611	(88)
util rest of house													
	0.9976	0.9926	0.9764	0.9220	0.7917	0.5818	0.3899	0.4430	0.7389	0.9565	0.9941	0.9983	(89)
MIT 2	17.9520	18.2617	18.7231	19.2685	19.6611	19.8383	19.8699	19.8678	19.7648	19.2207	18.4723	17.8987	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.1841	18.4797	18.9205	19.4426	19.8223	19.9972	20.0306	20.0277	19.9225	19.3955	18.6801	18.1328	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1841	18.4797	18.9205	19.4426	19.8223	19.9972	20.0306	20.0277	19.9225	19.3955	18.6801	18.1328	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9891	0.9692	0.9122	0.7892	0.5933	0.4079	0.4612	0.7432	0.9481	0.9913	0.9972	(94)
Useful gains	693.1889	870.7402	1028.0488	1123.9598	1053.6763	778.6842	512.6440	538.0470	782.4162	824.6013	702.3512	642.9627	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2136.0779	2085.6700	1904.4284	1603.7160	1233.7007	814.0821	517.4518	546.4750	880.5971	1335.9482	1764.2216	2129.3278	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1073.5094	816.4328	652.0265	345.4245	133.9382	0.0000	0.0000	0.0000	0.0000	380.4421	764.5467	1105.8556	(98)
Space heating												5272.1758	(98)
Space heating per m2											(98) / (4) =	43.9568	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5650.7779	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1073.5094	816.4328	652.0265	345.4245	133.9382	0.0000	0.0000	0.0000	0.0000	380.4421	764.5467	1105.8556	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1150.5996	875.0620	698.8494	370.2299	143.5564	0.0000	0.0000	0.0000	0.0000	407.7622	819.4499	1185.2686	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7685	89.7009	89.5590	89.2178	88.4392	86.7000	86.7000	86.7000	86.7000	89.2621	89.6554	89.7949	(217)
Fuel for water heating, kWh/month													
	198.8897	174.4473	181.1701	159.7866	155.5841	138.3272	129.5472	146.7160	147.8942	165.7658	178.5673	192.9606	(219)
Water heating fuel used												1969.6560	(219)
Annual totals kWh/year													
Space heating fuel - main system												5650.7779	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 853 * 1.00) =										-825.7330		-825.7330	(233)
Total delivered energy for all uses												7322.0449	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5650.7779	0.2160	1220.5680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1969.6560	0.2160	425.4457	(264)
Space and water heating			1646.0137	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-825.7330	0.5190	-428.5554	(269)
Total CO2, kg/year			1491.1498	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.4300	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.0825	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0825	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990	(76)
Southeast	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(77)
South	6.5000	46.7521	0.6300	0.7000	0.7700	92.8723	(78)
Southwest	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(79)
West	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(80)

Solar gains	207.9766	371.3557	543.7310	717.4469	831.9583	835.3278	801.6668	716.8439	605.0626	420.9775	252.4582	175.6885	(83)
Total gains	679.3001	840.4134	996.1818	1142.8653	1228.8025	1204.9166	1154.2081	1076.6253	979.5795	822.7605	685.6039	632.7921	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9984	0.9954	0.9858	0.9523	0.8648	0.7025	0.5344	0.5901	0.8357	0.9749	0.9964	0.9989	(86)
MIT	19.6212	19.8153	20.1127	20.4804	20.7777	20.9427	20.9877	20.9805	20.8627	20.4523	19.9613	19.5882	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9979	0.9938	0.9806	0.9344	0.8154	0.6076	0.4104	0.4633	0.7594	0.9622	0.9949	0.9985	(89)
MIT 2	18.0600	18.3447	18.7774	19.3056	19.6967	19.8834	19.9165	19.9147	19.8089	19.2770	18.5660	18.0177	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.2844	18.5560	18.9694	19.4744	19.8521	20.0356	20.0705	20.0679	19.9604	19.4460	18.7666	18.2434	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2844	18.5560	18.9694	19.4744	19.8521	20.0356	20.0705	20.0679	19.9604	19.4460	18.7666	18.2434	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9909	0.9744	0.9252	0.8123	0.6185	0.4282	0.4813	0.7630	0.9547	0.9924	0.9976	(94)
Useful gains	677.0043	832.7469	970.7198	1057.4305	998.1403	745.2505	494.1938	518.1294	747.3818	785.4527	680.3936	631.2462	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2064.0790	2011.0742	1832.2598	1537.6495	1183.0846	781.6142	499.0359	526.5255	845.6947	1283.7783	1699.8710	2054.6894	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1031.9836	791.8359	640.9857	345.7577	137.5985	0.0000	0.0000	0.0000	0.0000	370.7542	734.0237	1059.0417	(98)
Space heating												5111.9811	(98)
Space heating per m2											(98) / (4) =	42.6212	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5473.2132	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1031.9836	791.8359	640.9857	345.7577	137.5985	0.0000	0.0000	0.0000	0.0000	370.7542	734.0237	1059.0417	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1104.9075	847.7901	686.2802	370.1902	147.3218	0.0000	0.0000	0.0000	0.0000	396.9531	785.8926	1133.8776	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4619	88.2356	87.7607	86.6615	84.4558	80.3000	80.3000	80.3000	80.3000	86.7401	88.0474	88.5395	(217)
Fuel for water heating, kWh/month													
	246.0625	217.4126	229.5101	208.2706	206.9960	191.7458	183.7071	204.7903	206.9573	215.7729	224.8685	239.9055	(219)
Water heating fuel used												2575.9991	(219)
Annual totals kWh/year													
Space heating fuel - main system												5473.2132	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8576.5562	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5473.2132	0.2160	1182.2140	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2575.9991	0.2160	556.4158	(264)
Space and water heating			1738.6299	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2012.3213	(272)
Emissions per m2 for space and water heating			14.4958	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4958 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			16.7800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 227 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 227 - EPC	**Prop Type Ref**	Opp
Property	9 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	89 B	**DER**	12.43	**TER**	16.78
Environmental	89 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	1.09	**DFEE**	49.36	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.78	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.43	$kgCO_2/m^2$	Pass
	-4.35 (-25.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.26	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.36	$kWh/m^2/yr$	
	-5.9 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East	8.18 m², No overhang		
Windows facing South East	1.04 m², No overhang		
Windows facing South	6.50 m², No overhang		
Windows facing South West	1.04 m², No overhang		
Windows facing West	7.10 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	1.21	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 227 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 227 - EPC	**Prop Type Ref**	Opp
Property	9 Crane Way, Boorley Green, Southampton, SO32 2TF		

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Environmental	89 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	1.09	**DFEE**	49.36	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.16	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 227 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 227 - EPC	**Prop Type Ref**	Opp
Property	9 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	89 B	**DER**	12.43	**TER**	16.78
Environmental	89 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	1.09	**DFEE**	49.36	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	12.43	$kgCO_2/yr/m^2$	
TER	16.78	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.43	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.91	%	
CfSH ENE1 credits achieved	3.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	49.36	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	18.12	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.77	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.77	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.19	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.19	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 228 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 228 - EPC	**Prop Type Ref**	Opp
Property	1 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.65	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.93	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.65	$kgCO_2/m^2$	Pass
	-4.21 (-22.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.21	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.93	$kWh/m^2/yr$	
	-5.3 (-8.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.71 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	5.25 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	1.31 m², No overhang
Windows facing West	5.94 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.82	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 228 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 228 - EPC	**Prop Type Ref**	Opp
Property	1 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.65	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.93	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.86 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.65 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.71 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 5.25 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 1.31 m², No overhang
Windows facing West: 5.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.82 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800 (1b)	x	2.3900 (2b)	=	117.7792	(1b) - (3b)
First floor	47.9200 (1c)	x	2.6300 (2c)	=	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4286	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3321	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3321	0.3571	0.3737	0.3903	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2500	1.2357	26.2595			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1900	9.3632			(28a)
External Wall	142.9500	25.4900	117.4600	0.2700	31.7142			(29a)
Main Roof	47.9200		47.9200	0.1600	7.6672			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5625			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1602	(36)
Total fabric heat loss (33) + (36) =	86.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.4432	47.1630	46.8884	45.5986	45.3572	44.2338	44.2338	44.0258	44.6666	45.3572	45.8454	46.3558	(38)
Heat transfer coeff	134.1659	133.8857	133.6111	132.3213	132.0800	130.9566	130.9566	130.7485	131.3893	132.0800	132.5682	133.0785	(39)
Average = Sum(39)m / 12 =												132.3201	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3803	1.3774	1.3746	1.3613	1.3588	1.3473	1.3473	1.3451	1.3517	1.3588	1.3639	1.3691	(40)
HLP (average)												1.3613	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8152	10.6622	11.7823	11.3641	11.7138	11.3025	11.6584	11.6944	11.3361	11.7534	11.4085	11.8046	(61)
Total heat required for water heating calculated for each month													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
								Total per year (kWh/year) = Sum(64)m =				1689.8333	(64)
Heat gains from water heating, kWh/month													
	56.4402	49.4451	51.2179	44.9260	43.3100	37.6718	35.2047	39.9769	40.3299	46.6362	50.5517	54.7498	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4536	19.9431	16.2188	12.2787	9.1785	7.7489	8.3729	10.8834	14.6077	18.5478	21.6481	23.0777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	75.8605	73.5790	68.8412	62.3972	58.2123	52.3219	47.3182	53.7325	56.0138	62.6831	70.2107	73.5885	(72)
Total internal gains													
	416.7149	414.5350	399.4906	375.0934	350.1195	326.1744	310.6881	317.0009	329.5888	354.2112	382.5280	403.9605	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.7100	10.6334	0.7200	0.7000	0.7700	24.9206	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2500	19.6403	0.7200	0.7000	0.7700	36.0139	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.3100	46.7521	0.7200	0.7000	0.7700	21.3912	(78)
West	5.9400	19.6403	0.7200	0.7000	0.7700	40.7472	(80)

Solar gains	140.2006	263.3288	418.1372	603.1507	744.6112	767.2936	728.2420	619.9352	482.5711	307.3324	172.5689	116.8840	(83)
Total gains	556.9155	677.8638	817.6278	978.2441	1094.7307	1093.4680	1038.9302	936.9361	812.1599	661.5436	555.0969	520.8445	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.3109	50.4161	50.5197	51.0122	51.1054	51.5438	51.5438	51.6258	51.3741	51.1054	50.9172	50.7219	
alpha	4.3541	4.3611	4.3680	4.4008	4.4070	4.4363	4.4363	4.4417	4.4249	4.4070	4.3945	4.3815	
util living area													
	0.9982	0.9956	0.9865	0.9522	0.8587	0.6945	0.5358	0.6067	0.8575	0.9789	0.9964	0.9987	(86)
MIT	19.4378	19.6262	19.9504	20.3770	20.7317	20.9266	20.9817	20.9692	20.8042	20.3242	19.8007	19.4060	(87)
Th 2	19.7785	19.7807	19.7829	19.7931	19.7950	19.8040	19.8040	19.8056	19.8005	19.7950	19.7911	19.7871	(88)
util rest of house													
	0.9976	0.9940	0.9814	0.9334	0.8053	0.5920	0.3995	0.4659	0.7812	0.9675	0.9949	0.9982	(89)
MIT 2	17.7125	17.9890	18.4610	19.0732	19.5393	19.7574	19.7978	19.7937	19.6442	19.0119	18.2517	17.6718	(90)
Living area fraction									fLA = Living area / (4) =			0.2037	(91)
MIT	18.0640	18.3225	18.7644	19.3388	19.7822	19.9955	20.0390	20.0332	19.8805	19.2792	18.5672	18.0251	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0640	18.3225	18.7644	19.3388	19.7822	19.9955	20.0390	20.0332	19.8805	19.2792	18.5672	18.0251	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9911	0.9754	0.9243	0.8046	0.6099	0.4274	0.4945	0.7873	0.9605	0.9924	0.9972	(94)
Useful gains	554.8074	671.8210	797.4852	904.2251	880.8675	666.8541	444.0344	463.2743	639.4338	635.3975	550.8680	519.3609	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1846.6568	1797.0806	1638.6592	1381.2765	1067.4929	706.5806	450.3574	475.0292	759.4938	1146.3482	1520.1901	1839.8212	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	961.1360	756.1745	625.8335	343.4770	138.8493	0.0000	0.0000	0.0000	0.0000	380.1474	697.9119	982.4225	(98)
Space heating												4885.9519	(98)
Space heating per m2											(98) / (4) =	50.2670	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5236.8187	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	961.1360	756.1745	625.8335	343.4770	138.8493	0.0000	0.0000	0.0000	0.0000	380.1474	697.9119	982.4225	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1030.1564	810.4764	670.7754	368.1426	148.8202	0.0000	0.0000	0.0000	0.0000	407.4463	748.0299	1052.9716	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7326	89.6790	89.5544	89.2383	88.5010	86.7000	86.7000	86.7000	86.7000	89.2857	89.6242	89.7569	(217)
Fuel for water heating, kWh/month													
	192.4347	168.7714	175.2702	154.5696	150.4638	133.9135	125.4573	142.0220	143.1438	160.3566	172.7948	186.7157	(219)
Water heating fuel used												1905.9133	(219)
Annual totals kWh/year													
Space heating fuel - main system												5236.8187	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.5383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.82 * 1068 * 1.00) =										-700.6542		-700.6542	(233)
Total delivered energy for all uses												6913.6161	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5236.8187	0.2160	1131.1528	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1905.9133	0.2160	411.6773	(264)
Space and water heating			1542.8301	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.5383	0.5190	205.8034	(268)
Energy saving/generation technologies				
PV Unit	-700.6542	0.5190	-363.6395	(269)
Total CO2, kg/year			1423.9189	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.6500	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		31.8900	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8900	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1230	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3730	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.3200	118.6300	0.1800	21.3534			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8598			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.1035	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7982	123.5859	123.3778	122.4006	122.2178	121.3666	121.3666	121.2090	121.6945	122.2178	122.5876	122.9743	(39)
Average = Sum(39)m / 12 =												122.3997	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2736	1.2715	1.2693	1.2593	1.2574	1.2486	1.2486	1.2470	1.2520	1.2574	1.2612	1.2652	(40)
HLP (average)												1.2593	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5307	20.0116	16.2745	12.3209	9.2100	7.7755	8.4017	10.9208	14.6579	18.6115	21.7224	23.1569	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9451	427.7602	412.7105	387.7375	362.0872	337.4735	321.9963	328.9811	342.2506	367.4488	395.7644	417.1964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.3500	10.6334	0.6300	0.7000	0.7700	20.6356	(74)
Northeast	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(75)
East	4.9600	19.6403	0.6300	0.7000	0.7700	29.7715	(76)
Southeast	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(77)
South	1.2400	46.7521	0.6300	0.7000	0.7700	17.7172	(78)
West	5.6100	19.6403	0.6300	0.7000	0.7700	33.6730	(80)

Solar gains	115.9025	217.6887	345.6643	498.6167	615.5710	634.3285	602.0417	512.4959	398.9315	254.0647	142.6604	96.6273 (83)
Total gains	545.8476	645.4488	758.3748	886.3542	977.6582	971.8020	924.0381	841.4769	741.1821	621.5135	538.4248	513.8237 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5242	54.6179	54.7100	55.1468	55.2293	55.6166	55.6166	55.6889	55.4668	55.2293	55.0626	54.8895	
alpha	4.6349	4.6412	4.6473	4.6765	4.6820	4.7078	4.7078	4.7126	4.6978	4.6820	4.6708	4.6593	
util living area													
	0.9985	0.9964	0.9892	0.9615	0.8799	0.7219	0.5586	0.6271	0.8717	0.9818	0.9968	0.9989	(86)
MIT	19.5614	19.7270	20.0177	20.4043	20.7381	20.9286	20.9831	20.9716	20.8164	20.3737	19.8946	19.5305	(87)
Th 2	19.8615	19.8633	19.8649	19.8729	19.8744	19.8813	19.8813	19.8826	19.8786	19.8744	19.8714	19.8682	(88)
util rest of house													
	0.9979	0.9951	0.9852	0.9462	0.8328	0.6247	0.4263	0.4918	0.8021	0.9720	0.9955	0.9984	(89)
MIT 2	17.9492	18.1922	18.6159	19.1730	19.6178	19.8341	19.8753	19.8710	19.7276	19.1396	18.4432	17.9086	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.2776	18.5048	18.9015	19.4238	19.8460	20.0571	20.1009	20.0952	19.9494	19.3910	18.7389	18.2390	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2776	18.5048	18.9015	19.4238	19.8460	20.0571	20.1009	20.0952	19.9494	19.3910	18.7389	18.2390	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9927	0.9803	0.9383	0.8314	0.6413	0.4533	0.5192	0.8074	0.9660	0.9934	0.9975	(94)
Useful gains	544.0666	640.7533	743.4360	831.6754	812.8308	623.2390	418.9032	436.8646	598.4582	600.3738	534.8747	512.5488	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1730.3998	1681.3627	1530.0653	1288.1225	995.5848	662.3084	424.8950	447.8939	711.8393	1074.4109	1426.7817	1726.4385	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	882.6319	699.2895	585.2523	328.6419	135.9690	0.0000	0.0000	0.0000	0.0000	352.6836	642.1730	903.1339	(98)
Space heating												4529.7751	(98)
Space heating per m2											(98) / (4) =	46.6026	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4849.8663	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	882.6319	699.2895	585.2523	328.6419	135.9690	0.0000	0.0000	0.0000	0.0000	352.6836	642.1730	903.1339	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	945.0020	748.7040	626.6084	351.8650	145.5771	0.0000	0.0000	0.0000	0.0000	377.6056	687.5514	966.9528	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2517	88.0657	87.6333	86.6250	84.5142	80.3000	80.3000	80.3000	80.3000	86.6837	87.8489	88.3305	(217)
Fuel for water heating, kWh/month													
	240.0183	212.0210	223.8177	201.1299	199.5927	185.0158	177.2592	197.6025	199.7848	210.3984	219.4365	234.0580	(219)
Water heating fuel used												2500.1346	(219)
Annual totals kWh/year													
Space heating fuel - main system												4849.8663	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9000	(232)
Total delivered energy for all uses												7822.9009	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4849.8663	0.2160	1047.5711	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2500.1346	0.2160	540.0291	(264)
Space and water heating			1587.6002	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9000	0.5190	206.5101	(268)
Total CO2, kg/m2/year			1833.0353	(272)
Emissions per m2 for space and water heating			16.3333	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1246	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3333 * 1.00) + 2.1246 + 0.4005, rounded to 2 d.p.			18.8600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 228 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 228 - EPC	**Prop Type Ref**	Opp
Property	1 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.65	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.93	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.65	$kgCO_2/m^2$	Pass
	-4.21 (-22.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.21	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.93	$kWh/m^2/yr$	
	-5.3 (-8.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.71 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	5.25 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	1.31 m², No overhang
Windows facing West	5.94 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.82	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 228 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 228 - EPC	**Prop Type Ref**	Opp
Property	1 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.65	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.93	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	49.28 m²	2.39 m
1st Storey:	1.00 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	142.95	117.46

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.92	47.92
Bay Roof	External Slope Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	49.28

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W3a	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.02	10
W3b	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.25	10
W3c	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	10
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00	1.31	10
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	1.31	10
D1	Half Glazed Door	[1] External Wall	North			2.12	10
D2*	Half Glazed Door	[1] External Wall	South			2.12	10
D3 (W14)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.060	No
Independently assessed	E3 Sill	14.79	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.84	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.47	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.82	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£119	B 88	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 228 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 228 - EPC	**Prop Type Ref**	Opp
Property	1 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.65	**TER**	18.86
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.93	**TFEE**	60.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	14.65	$kgCO_2/yr/m^2$	
TER	18.86	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.65	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.32	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.93	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	20.87	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.11	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.11	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.37	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.37	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 229 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 229 - EPC	**Prop Type Ref**	Opp
Property	2 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.08	**TER**	16.93
Environmental	89 B	**% DER<TER**	22.75		
CO_2 Emissions (t/year)	1.24	**DFEE**	52.35	**TFEE**	56.96
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.93	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.08	$kgCO_2/m^2$	Pass
	-3.85 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.96	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.35	$kWh/m^2/yr$	
	-4.7 (-8.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.09 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	8.13 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	1.42 m², No overhang
Windows facing West	8.11 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.23	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 229 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 229 - EPC	**Prop Type Ref**	Opp
Property	2 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.08	**TER**	16.93
Environmental	89 B	**% DER<TER**	22.75		
CO_2 Emissions (t/year)	1.24	**DFEE**	52.35	**TFEE**	56.96
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.08 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.41 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.09 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 8.13 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 1.42 m², No overhang
Windows facing West: 8.11 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.23 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.3900	(2b) =	154.7525	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1554	(8)
Pressure test		Yes	
Measured/design AP50		4.4100	
Infiltration rate		0.3759	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3195	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4074	0.3994	0.3914	0.3515	0.3435	0.3035	0.3035	0.2955	0.3195	0.3435	0.3594	0.3754	(22b)
Effective ac	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5510	0.5590	0.5646	0.5705	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7900	1.2357	25.6911			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	169.5200	25.0300	144.4900	0.2700	39.0123			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7259			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7408	(36)
Total fabric heat loss (33) + (36) =	99.4667	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.9051	61.5630	61.2276	59.6524	59.3577	57.9858	57.9858	57.7318	58.5143	59.3577	59.9539	60.5772	(38)
Heat transfer coeff	161.3718	161.0297	160.6943	159.1191	158.8244	157.4525	157.4525	157.1984	157.9809	158.8244	159.4206	160.0439	(39)
Average = Sum(39)m / 12 =												159.1177	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2582	1.2555	1.2529	1.2406	1.2383	1.2276	1.2276	1.2256	1.2317	1.2383	1.2429	1.2478	(40)
HLP (average)												1.2406	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8298	10.6749	11.7954	11.3844	11.7346	11.3197	11.6743	11.7134	11.3542	11.7653	11.4214	11.8186	(61)
Total heat required for water heating calculated for each month													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.6449	(64)
Heat gains from water heating, kWh/month													
	58.7405	51.4569	53.2939	46.7381	45.0491	39.1723	36.5952	41.5727	41.9445	48.5155	52.6031	56.9775	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9522	76.5728	71.6316	64.9141	60.5498	54.4060	49.1871	55.8773	58.2562	65.2090	73.0599	76.5827	(72)
Total internal gains													
	471.3429	468.9646	451.7446	423.7583	394.8343	367.4205	349.9206	356.6097	371.2674	399.4890	431.8997	456.6924	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0900	10.6334	0.7200	0.7000	0.7700	4.0482	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	8.1300	19.6403	0.7200	0.7000	0.7700	55.7701	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.4200	46.7521	0.7200	0.7000	0.7700	23.1874	(78)
West	8.1100	19.6403	0.7200	0.7000	0.7700	55.6329	(80)

Solar gains	155.7664	294.1494	465.7073	661.2800	801.8400	818.7356	780.2141	674.6616	534.7908	343.4349	192.1437	129.5237	(83)
Total gains	627.1093	763.1140	917.4519	1085.0382	1196.6743	1186.1561	1130.1347	1031.2712	906.0582	742.9239	624.0434	586.2162	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1952	55.3124	55.4279	55.9766	56.0804	56.5691	56.5691	56.6605	56.3799	56.0804	55.8707	55.6531	
alpha	4.6797	4.6875	4.6952	4.7318	4.7387	4.7713	4.7713	4.7774	4.7587	4.7387	4.7247	4.7102	
util living area													
	0.9992	0.9977	0.9923	0.9699	0.9002	0.7533	0.5886	0.6571	0.8931	0.9874	0.9982	0.9994	(86)
MIT	19.5148	19.6844	19.9796	20.3712	20.7118	20.9175	20.9801	20.9671	20.7974	20.3383	19.8530	19.4872	(87)
Th 2	19.8738	19.8759	19.8779	19.8877	19.8895	19.8980	19.8980	19.8996	19.8947	19.8895	19.8858	19.8819	(88)
util rest of house													
	0.9989	0.9969	0.9894	0.9575	0.8583	0.6585	0.4533	0.5207	0.8306	0.9804	0.9974	0.9992	(89)
MIT 2	17.8894	18.1388	18.5704	19.1392	19.6007	19.8418	19.8906	19.8857	19.7226	19.1010	18.3926	17.8546	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.1123	18.3508	18.7637	19.3082	19.7531	19.9893	20.0400	20.0340	19.8700	19.2707	18.5929	18.0785	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1123	18.3508	18.7637	19.3082	19.7531	19.9893	20.0400	20.0340	19.8700	19.2707	18.5929	18.0785	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9951	0.9851	0.9488	0.8520	0.6672	0.4717	0.5387	0.8288	0.9745	0.9959	0.9986	(94)
Useful gains	625.9157	759.3869	903.7389	1029.5319	1019.6129	791.4416	533.0817	555.5862	750.9713	724.0063	621.5009	585.4029	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2228.9121	2165.9730	1970.7008	1656.1424	1279.0266	848.5647	541.6436	571.2611	911.5450	1377.1156	1832.1999	2221.1663	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1192.6293	945.2259	793.8197	451.1596	193.0038	0.0000	0.0000	0.0000	0.0000	485.9133	871.7033	1217.0079	(98)
Space heating												6150.4627	(98)
Space heating per m2											(98) / (4) =	47.9531	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6592.1358	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1192.6293	945.2259	793.8197	451.1596	193.0038	0.0000	0.0000	0.0000	0.0000	485.9133	871.7033	1217.0079	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1278.2736	1013.1038	850.8250	483.5580	206.8636	0.0000	0.0000	0.0000	0.0000	520.8074	934.3015	1304.4029	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8119	89.7679	89.6651	89.4047	88.7609	86.7000	86.7000	86.7000	86.7000	89.4293	89.7191	89.8327	(217)
Fuel for water heating, kWh/month													
	199.9715	175.3480	182.0208	160.3836	155.9218	139.1236	130.2852	147.5630	148.7497	166.4225	179.4922	194.0200	(219)
Water heating fuel used												1979.3020	(219)
Annual totals kWh/year													
Space heating fuel - main system												6592.1358	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.23 * 908 * 1.00) =										-893.3286		-893.3286	(233)
Total delivered energy for all uses												8237.4376	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6592.1358	0.2160	1423.9013	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.3020	0.2160	427.5292	(264)
Space and water heating			1851.4306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Energy saving/generation technologies				
PV Unit	-893.3286	0.5190	-463.6375	(269)
Total CO2, kg/year			1678.0845	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0800	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		28.2063	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.2063	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1243	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3743	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3977	0.3897	0.3500	0.3420	0.3023	0.3023	0.2943	0.3182	0.3420	0.3579	0.3738	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.7900	1.3258	27.5625			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	169.5200	25.0300	144.4900	0.1800	26.0082			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4937			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3325	(36)
Total fabric heat loss (33) + (36) =	88.8262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.8313	61.4921	61.1595	59.5975	59.3053	57.9449	57.9449	57.6929	58.4689	59.3053	59.8965	60.5146	(38)
Heat transfer coeff	150.6576	150.3183	149.9857	148.4238	148.1315	146.7711	146.7711	146.5192	147.2951	148.1315	148.7227	149.3408	(39)
Average = Sum(39)m / 12 =												148.4224	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1746	1.1720	1.1694	1.1572	1.1549	1.1443	1.1443	1.1424	1.1484	1.1549	1.1595	1.1644	(40)
HLP (average)												1.1572	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.4911	482.1166	464.9043	436.9286	407.4451	379.3395	361.8472	369.2276	384.4483	412.6589	445.0572	469.8444	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0900	10.6334	0.6300	0.7000	0.7700	3.5422	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	8.1300	19.6403	0.6300	0.7000	0.7700	48.7989	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
South	1.4200	46.7521	0.6300	0.7000	0.7700	20.2890	(78)
West	8.1100	19.6403	0.6300	0.7000	0.7700	48.6788	(80)

Solar gains	136.2956	257.3807	407.4939	578.6200	701.6100	716.3936	682.6873	590.3289	467.9419	300.5056	168.1258	113.3333 (83)
Total gains	620.7867	739.4973	872.3982	1015.5486	1109.0551	1095.7331	1044.5345	959.5565	852.3902	713.1645	613.1829	583.1777 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1205	59.2539	59.3853	60.0102	60.1286	60.6860	60.6860	60.7903	60.4701	60.1286	59.8896	59.6417	
alpha	4.9414	4.9503	4.9590	5.0007	5.0086	5.0457	5.0457	5.0527	5.0313	5.0086	4.9926	4.9761	
util living area													
	0.9993	0.9980	0.9935	0.9740	0.9096	0.7644	0.5962	0.6626	0.8982	0.9885	0.9984	0.9995	(86)
MIT	19.6181	19.7732	20.0456	20.4101	20.7302	20.9254	20.9831	20.9720	20.8164	20.3887	19.9364	19.5934	(87)
Th 2	19.9404	19.9425	19.9446	19.9544	19.9562	19.9648	19.9648	19.9664	19.9615	19.9562	19.9525	19.9486	(88)
util rest of house													
	0.9990	0.9973	0.9910	0.9633	0.8715	0.6744	0.4670	0.5328	0.8395	0.9823	0.9977	0.9993	(89)
MIT 2	18.0867	18.3150	18.7135	19.2449	19.6815	19.9129	19.9583	19.9542	19.8029	19.2218	18.5610	18.0562	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.2967	18.5150	18.8962	19.4047	19.8253	20.0517	20.0989	20.0938	19.9419	19.3818	18.7497	18.2670	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2967	18.5150	18.8962	19.4047	19.8253	20.0517	20.0989	20.0938	19.9419	19.3818	18.7497	18.2670	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9959	0.9874	0.9558	0.8657	0.6828	0.4846	0.5500	0.8381	0.9771	0.9964	0.9988	(94)
Useful gains	619.7454	736.4300	861.4137	970.6200	960.1351	748.2085	506.1758	527.7243	714.4031	696.8506	610.9619	582.4613	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2108.7108	2046.5766	1859.2555	1559.1455	1203.6114	800.1553	513.5354	541.2140	860.4872	1300.8638	1732.5695	2100.7806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1107.7902	880.4185	742.3944	423.7384	181.1464	0.0000	0.0000	0.0000	0.0000	449.3858	807.5575	1129.6296	(98)
Space heating												5722.0607	(98)
Space heating per m2											(98) / (4) =	44.6130	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6126.4034	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1107.7902	880.4185	742.3944	423.7384	181.1464	0.0000	0.0000	0.0000	0.0000	449.3858	807.5575	1129.6296	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1186.0709	942.6323	794.8548	453.6813	193.9469	0.0000	0.0000	0.0000	0.0000	481.1411	864.6226	1209.4535	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5633	88.4028	88.0283	87.1164	85.1248	80.3000	80.3000	80.3000	80.3000	87.1659	88.2072	88.6285	(217)
Fuel for water heating, kWh/month													
	246.9731	218.0459	229.8948	208.1367	206.6699	192.9601	184.8705	206.0873	207.8790	215.7082	225.5287	240.8184	(219)
Water heating fuel used												2583.5727	(219)
Annual totals kWh/year													
Space heating fuel - main system												6126.4034	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Total delivered energy for all uses												9269.3044	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6126.4034	0.2160	1323.3031	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2583.5727	0.2160	558.0517	(264)
Space and water heating			1881.3548	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Total CO2, kg/m2/year			2171.6463	(272)
Emissions per m2 for space and water heating			14.6683	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9598	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6683 * 1.00) + 1.9598 + 0.3035, rounded to 2 d.p.			16.9300	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 229 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 229 - EPC	**Prop Type Ref**	Opp
Property	2 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.08	**TER**	16.93
Environmental	89 B	**% DER<TER**	22.75		
CO_2 Emissions (t/year)	1.24	**DFEE**	52.35	**TFEE**	56.96
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.93	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.08	$kgCO_2/m^2$	Pass
	-3.85 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.96	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.35	$kWh/m^2/yr$	
	-4.7 (-8.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.09 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	8.13 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	1.42 m², No overhang
Windows facing West	8.11 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.23	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 229 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 229 - EPC	**Prop Type Ref**	Opp
Property	2 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.08	**TER**	16.93
Environmental	89 B	**% DER<TER**	22.75		
CO_2 Emissions (t/year)	1.24	**DFEE**	52.35	**TFEE**	56.96
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.75 m²	2.39 m
1st Storey:	1.00 m	63.51 m²	2.63 m

7.0 Living Area	17.59	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	169.52	144.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	63.51	63.51
Bay Roof	External Plane Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1a	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.02	10
W1b	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.25	10
W1c	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.02	10
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.71	10
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	10
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.09	10
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	1.50	10
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00	0.71	10
D1	Half Glazed Door	[1] External Wall	East			2.12	10
D2	Half Glazed Door	[1] External Wall	South			2.12	10
D3 w12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	3.80	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.72	0.060	No
Independently assessed	E3 Sill	13.89	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	34.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.55	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.86	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.41	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.23	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 229 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 229 - EPC	**Prop Type Ref**	Opp
Property	2 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.08	**TER**	16.93
Environmental	89 B	**% DER<TER**	22.75		
CO_2 Emissions (t/year)	1.24	**DFEE**	52.35	**TFEE**	56.96
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.26	m^2	
DER	13.08	$kgCO_2/yr/m^2$	
TER	16.93	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.08	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.75	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.35	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.26	m^2	
DER	18.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.31	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.31	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 230 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 230 - EPC	**Prop Type Ref**	Opp
Property	11 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	13.54	**TER**	17.21
Environmental	88 B	**% DER<TER**	21.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.39	**TFEE**	57.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.21	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.54	$kgCO_2/m^2$	Pass
	-3.67 (-21.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.18	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.39	$kWh/m^2/yr$	
	-5.8 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

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ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.18 m², No overhang
Windows facing North East	1.04 m², No overhang
Windows facing East	6.50 m², No overhang
Windows facing South East	1.04 m², No overhang
Windows facing South	7.10 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.81	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 230 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 230 - EPC	**Prop Type Ref**	Opp
Property	11 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	13.54	**TER**	17.21
Environmental	88 B	**% DER<TER**	21.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.39	**TFEE**	57.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.21 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.18 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 6.50 m², No overhang
Windows facing South East: 1.04 m², No overhang
Windows facing South: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3559	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3025	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3857	0.3782	0.3706	0.3328	0.3252	0.2874	0.2874	0.2799	0.3025	0.3252	0.3404	0.3555	(22b)
Effective ac	0.5744	0.5715	0.5687	0.5554	0.5529	0.5413	0.5413	0.5392	0.5458	0.5529	0.5579	0.5632	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.0375	56.7506	56.4694	55.1486	54.9015	53.7512	53.7512	53.5382	54.1943	54.9015	55.4014	55.9241	(38)
Heat transfer coeff	154.4598	154.1729	153.8917	152.5710	152.3239	151.1735	151.1735	150.9605	151.6166	152.3239	152.8238	153.3464	(39)
Average = Sum(39)m / 12 =												152.5698	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2878	1.2854	1.2831	1.2721	1.2700	1.2604	1.2604	1.2586	1.2641	1.2700	1.2742	1.2785	(40)
HLP (average)												1.2721	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165 (61)
Total heat required for water heating calculated for each month												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349 (64)
Heat gains from water heating, kWh/month												
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1800	10.6334	0.7200	0.7000	0.7700	30.3801	(74)
Northeast	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(75)
East	6.5000	19.6403	0.7200	0.7000	0.7700	44.5887	(76)
Southeast	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(77)
South	7.1000	46.7521	0.7200	0.7000	0.7700	115.9372	(78)

Solar gains	208.3695	366.2663	530.3485	704.6074	831.4884	843.7832	805.8992	708.6300	590.3840	412.7645	251.6649	176.9591	(83)
Total gains	666.5440	822.1713	969.6389	1116.8547	1215.8249	1201.5518	1146.6128	1055.8967	951.7195	801.3769	671.6524	620.9099	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.9245	54.0248	54.1236	54.5921	54.6806	55.0967	55.0967	55.1745	54.9357	54.6806	54.5018	54.3160	
alpha	4.5950	4.6017	4.6082	4.6395	4.6454	4.6731	4.6731	4.6783	4.6624	4.6454	4.6335	4.6211	
util living area													
	0.9985	0.9959	0.9877	0.9592	0.8795	0.7247	0.5601	0.6227	0.8600	0.9787	0.9967	0.9989	(86)
MIT	19.5380	19.7289	20.0263	20.4065	20.7338	20.9257	20.9824	20.9717	20.8253	20.3871	19.8860	19.5035	(87)
Th 2	19.8504	19.8523	19.8541	19.8628	19.8644	19.8720	19.8720	19.8734	19.8691	19.8644	19.8611	19.8577	(88)
util rest of house													
	0.9980	0.9944	0.9832	0.9432	0.8320	0.6270	0.4265	0.4869	0.7870	0.9675	0.9953	0.9986	(89)
MIT 2	17.9074	18.1872	18.6205	19.1681	19.6040	19.8229	19.8657	19.8619	19.7278	19.1507	18.4237	17.8618	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.1418	18.4088	18.8225	19.3461	19.7664	19.9814	20.0262	20.0214	19.8856	19.3285	18.6339	18.0978	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1418	18.4088	18.8225	19.3461	19.7664	19.9814	20.0262	20.0214	19.8856	19.3285	18.6339	18.0978	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9916	0.9773	0.9336	0.8272	0.6374	0.4456	0.5060	0.7882	0.9599	0.9929	0.9976	(94)
Useful gains	664.3747	815.2249	947.5872	1042.6659	1005.6962	765.8477	510.9497	534.2774	750.1893	769.2255	666.8751	619.4346	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2138.0025	2082.6888	1896.3349	1593.7666	1228.7060	813.5275	517.9527	546.6959	877.1886	1329.5524	1762.6525	2131.1771	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1096.3791	851.7357	705.8683	396.7925	165.9193	0.0000	0.0000	0.0000	0.0000	416.8832	788.9597	1124.7364	(98)
Space heating												5547.2744	(98)
Space heating per m2											(98) / (4) =	46.2504	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5945.6317	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1096.3791	851.7357	705.8683	396.7925	165.9193	0.0000	0.0000	0.0000	0.0000	416.8832	788.9597	1124.7364	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1175.1116	912.9000	756.5577	425.2867	177.8342	0.0000	0.0000	0.0000	0.0000	446.8202	845.6160	1205.5053	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7780	89.7218	89.6046	89.3197	88.6316	86.7000	86.7000	86.7000	86.7000	89.3284	89.6719	89.8022	(217)
Fuel for water heating, kWh/month													
	198.8687	174.4068	181.0779	159.6042	155.2462	138.3272	129.5472	146.7160	147.8942	165.6429	178.5345	192.9449	(219)
Water heating fuel used												1968.8107	(219)
Annual totals kWh/year													
Space heating fuel - main system												5945.6317	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												7749.6766	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5945.6317	0.2160	1284.2564	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.8107	0.2160	425.2631	(264)
Space and water heating			1709.5196	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1624.0061	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5400	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		29.1925	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.1925	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1800	10.6334	0.6300	0.7000	0.7700	26.5826	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	6.5000	19.6403	0.6300	0.7000	0.7700	39.0151	(76)
Southeast	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(77)
South	7.1000	46.7521	0.6300	0.7000	0.7700	101.4451	(78)

Solar gains	182.3233	320.4830	464.0550	616.5315	727.5523	738.3103	705.1618	620.0513	516.5860	361.1689	220.2068	154.8392 (83)
Total gains	653.6468	789.5407	916.5058	1041.9498	1124.3966	1107.8992	1057.7031	979.8327	891.1029	762.9519	653.3525	611.9427 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9987	0.9965	0.9898	0.9657	0.8944	0.7446	0.5774	0.6382	0.8715	0.9813	0.9971	0.9990	(86)
MIT	19.6016	19.7769	20.0549	20.4168	20.7336	20.9260	20.9829	20.9728	20.8301	20.4108	19.9368	19.5722	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9982	0.9952	0.9860	0.9520	0.8515	0.6507	0.4462	0.5059	0.8034	0.9714	0.9958	0.9987	(89)
MIT 2	18.0313	18.2888	18.6947	19.2194	19.6462	19.8707	19.9146	19.9112	19.7771	19.2197	18.5303	17.9943	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.2570	18.5027	18.8902	19.3915	19.8025	20.0224	20.0682	20.0638	19.9284	19.3909	18.7325	18.2211	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2570	18.5027	18.8902	19.3915	19.8025	20.0224	20.0682	20.0638	19.9284	19.3909	18.7325	18.2211	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9928	0.9810	0.9434	0.8464	0.6605	0.4650	0.5244	0.8042	0.9646	0.9937	0.9979	(94)
Useful gains	651.7584	783.8812	899.0508	982.9287	951.6460	731.7216	491.8030	513.8335	716.6251	735.9503	649.2443	610.6422	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2060.0360	2003.2121	1820.6246	1525.5959	1175.8836	779.7045	498.7021	525.9295	841.0835	1275.7861	1694.9081	2051.4167	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1047.7585	819.3904	685.6508	390.7204	166.8327	0.0000	0.0000	0.0000	0.0000	401.6378	752.8780	1071.9362	(98)
Space heating												5336.8049	(98)
Space heating per m2											(98) / (4) =	44.4956	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5713.9238	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1047.7585	819.3904	685.6508	390.7204	166.8327	0.0000	0.0000	0.0000	0.0000	401.6378	752.8780	1071.9362	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1121.7971	877.2916	734.1015	418.3302	178.6218	0.0000	0.0000	0.0000	0.0000	430.0191	806.0792	1147.6833	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4856	88.2932	87.8899	86.9445	84.9337	80.3000	80.3000	80.3000	80.3000	86.9247	88.0929	88.5578	(217)
Fuel for water heating, kWh/month													
	245.9967	217.2707	229.1727	207.5926	205.8314	191.7458	183.7071	204.7903	206.9573	215.3147	224.7525	239.8559	(219)
Water heating fuel used												2572.9877	(219)
Annual totals kWh/year													
Space heating fuel - main system												5713.9238	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8814.2555	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5713.9238	0.2160	1234.2075	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2572.9877	0.2160	555.7654	(264)
Space and water heating			1789.9729	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2063.6644	(272)
Emissions per m2 for space and water heating			14.9239	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9239 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.2100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 230 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 230 - EPC	**Prop Type Ref**	Opp
Property	11 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	13.54	**TER**	17.21
Environmental	88 B	**% DER<TER**	21.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.39	**TFEE**	57.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.21	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.54	$kgCO_2/m^2$	Pass
	-3.67 (-21.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.18	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.39	$kWh/m^2/yr$	
	-5.8 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	8.18 m², No overhang		
Windows facing North East	1.04 m², No overhang		
Windows facing East	6.50 m², No overhang		
Windows facing South East	1.04 m², No overhang		
Windows facing South	7.10 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 230 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 230 - EPC	**Prop Type Ref**	Opp
Property	11 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	13.54	**TER**	17.21
Environmental	88 B	**% DER<TER**	21.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.39	**TFEE**	57.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South							2.12	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.46	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£133	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 230 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 230 - EPC	**Prop Type Ref**	Opp
Property	11 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	13.54	**TER**	17.21
Environmental	88 B	**% DER<TER**	21.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.39	**TFEE**	57.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	13.54	$kgCO_2/yr/m^2$	
TER	17.21	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.54	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.31	%	
CfSH ENE1 credits achieved	3.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.39	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	18.68	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.33	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.33	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.69	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.34	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.34	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 231- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 231 - EPC	**Prop Type Ref**	Opp
Property	9 Grouse Road, Boorley Green, Southampton, SO32 3XB		

SAP Rating	88 B	**DER**	12.78	**TER**	16.46
Environmental	89 B	**% DER<TER**	22.37		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.33	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.78	$kgCO_2/m^2$	Pass
	-3.68 (-22.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.33	$kWh/m^2/yr$	
	-5.9 (-11.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.80 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.80 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.81	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 231- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 231 - EPC	**Prop Type Ref**	Opp
Property	9 Grouse Road, Boorley Green, Southampton, SO32 3XB		

SAP Rating	88 B	**DER**	12.78	**TER**	16.46
Environmental	89 B	**% DER<TER**	22.37		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.33	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.78 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.80 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.61 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South: 5.73 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			3.8000	
Infiltration rate			0.3135	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2665	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3398	0.3331	0.3265	0.2932	0.2865	0.2532	0.2532	0.2465	0.2665	0.2865	0.2998	0.3132	(22b)
Effective ac	0.5577	0.5555	0.5533	0.5430	0.5410	0.5321	0.5321	0.5304	0.5355	0.5410	0.5449	0.5490	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.5914	59.3519	59.1171	58.0143	57.8080	56.8475	56.8475	56.6696	57.2174	57.8080	58.2254	58.6617	(38)
Heat transfer coeff	136.1889	135.9494	135.7146	134.6118	134.4055	133.4450	133.4450	133.2671	133.8149	134.4055	134.8229	135.2592	(39)
Average = Sum(39)m / 12 =												134.6108	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1042	1.1022	1.1003	1.0914	1.0897	1.0819	1.0819	1.0805	1.0849	1.0897	1.0931	1.0966	(40)
HLP (average)												1.0914	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8285	10.6738	11.7943	11.3835	11.7328	11.3182	11.6730	11.7118	11.3533	11.7643	11.4203	11.8175 (61)

Total heat required for water heating calculated for each month

	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300 (64)

Total per year (kWh/year) = Sum(64)m = 1751.0299 (64)

Heat gains from water heating, kWh/month

	58.5471	51.2878	53.1194	46.5860	44.9029	39.0462	36.4783	41.4386	41.8089	48.3575	52.4307	56.7903 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139 (71)

Water heating gains (Table 5)

	78.6923	76.3211	71.3970	64.7028	60.3533	54.2308	49.0300	55.6970	58.0679	64.9967	72.8204	76.3310 (72)

Total internal gains

	465.6605	463.1249	445.9303	418.1472	389.5413	362.4942	345.3075	352.1389	366.7803	394.7980	426.8781	451.3133 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.7200	0.7000	0.7700	28.2631	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	5.7300	46.7521	0.7200	0.7000	0.7700	93.5662	(78)
North	0.6500	15.2954	0.7200	0.7000	1.0000	4.5097	(82)

Solar gains	136.0800	234.7016	333.1708	440.0556	522.8710	533.6376	508.3290	443.4186	369.2180	262.2248	163.4171	116.2380	(83)
Total gains	601.7405	697.8265	779.1010	858.2027	912.4123	896.1318	853.6364	795.5575	735.9984	657.0227	590.2953	567.5512	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8926	63.0034	63.1124	63.6295	63.7272	64.1858	64.1858	64.2715	64.0084	63.7272	63.5299	63.3249	
alpha	5.1928	5.2002	5.2075	5.2420	5.2485	5.2791	5.2791	5.2848	5.2672	5.2485	5.2353	5.2217	
util living area													
	0.9993	0.9982	0.9951	0.9832	0.9398	0.8198	0.6549	0.7152	0.9190	0.9898	0.9984	0.9995	(86)
MIT	19.7153	19.8538	20.0837	20.3958	20.6978	20.9080	20.9783	20.9660	20.8097	20.4245	20.0115	19.6889	(87)
Th 2	19.9974	19.9990	20.0006	20.0079	20.0092	20.0156	20.0156	20.0168	20.0132	20.0092	20.0065	20.0036	(88)
util rest of house													
	0.9990	0.9976	0.9933	0.9761	0.9117	0.7388	0.5247	0.5882	0.8692	0.9843	0.9977	0.9993	(89)
MIT 2	18.2692	18.4728	18.8095	19.2666	19.6879	19.9471	20.0067	20.0009	19.8422	19.3124	18.7092	18.2350	(90)
Living area fraction										fLA = Living area / (4) =		0.1432	(91)
MIT	18.4763	18.6706	18.9919	19.4283	19.8325	20.0847	20.1458	20.1391	19.9807	19.4717	18.8957	18.4432	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4763	18.6706	18.9919	19.4283	19.8325	20.0847	20.1458	20.1391	19.9807	19.4717	18.8957	18.4432	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9963	0.9905	0.9703	0.9053	0.7453	0.5431	0.6055	0.8672	0.9798	0.9965	0.9988	(94)
Useful gains	600.7668	695.2358	771.6970	832.6750	826.0501	667.8759	463.5764	481.7141	638.2337	643.7822	588.2198	566.8733	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1930.6542	1872.1001	1695.3332	1417.2286	1093.0515	731.9075	473.1727	498.3015	786.9253	1192.3985	1590.3280	1926.5178	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	989.4362	790.8528	687.1854	420.8786	198.6490	0.0000	0.0000	0.0000	0.0000	408.1706	721.5179	1011.5755	(98)
Space heating												5228.2659	(98)
Space heating per m2											(98) / (4) =	42.3891	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5603.7148	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	989.4362	790.8528	687.1854	420.8786	198.6490	0.0000	0.0000	0.0000	0.0000	408.1706	721.5179	1011.5755	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1060.4890	847.6450	736.5331	451.1024	212.9143	0.0000	0.0000	0.0000	0.0000	437.4819	773.3311	1084.2181	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7292	89.6835	89.5879	89.3594	88.7890	86.7000	86.7000	86.7000	86.7000	89.3114	89.6228	89.7538	(217)
Fuel for water heating, kWh/month													
	199.5074	174.9456	181.5914	159.9527	155.3767	138.6856	129.8794	147.0972	148.2792	166.1099	179.1062	193.5629	(219)
Water heating fuel used												1974.0941	(219)
Annual totals kWh/year													
Space heating fuel - main system												5603.7148	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												7461.1576	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5603.7148	0.2160	1210.4024	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.0941	0.2160	426.4043	(264)
Space and water heating			1636.8067	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1576.2647	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.7800	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.2131	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.2131	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 231- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 231 - EPC	**Prop Type Ref**	Opp
Property	9 Grouse Road, Boorley Green, Southampton, SO32 3XB		

SAP Rating	88 B	**DER**	12.78	**TER**	16.46
Environmental	89 B	**% DER<TER**	22.37		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.33	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.78	$kgCO_2/m^2$	Pass
	-3.68 (-22.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.33	$kWh/m^2/yr$	
	-5.9 (-11.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.80 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.61 m², No overhang
Windows facing East	1.42 m², No overhang
Windows facing South	5.73 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.80 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 231- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 231 - EPC	**Prop Type Ref**	Opp
Property	9 Grouse Road, Boorley Green, Southampton, SO32 3XB		

SAP Rating	88 B	**DER**	12.78	**TER**	16.46
Environmental	89 B	**% DER<TER**	22.37		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.33	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.80	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£129	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 231- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 231 - EPC	**Prop Type Ref**	Opp
Property	9 Grouse Road, Boorley Green, Southampton, SO32 3XB		

SAP Rating	88 B	**DER**	12.78	**TER**	16.46
Environmental	89 B	**% DER<TER**	22.37		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.33	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	12.78	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.78	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.37	%	
CfSH ENE1 credits achieved	3.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	46.33	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.04	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.04	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.69	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.12	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.12	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 232 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 232 - EPC	**Prop Type Ref**	As
Property	7 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	12.98	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.15		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.26	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.98	$kgCO_2/m^2$	Pass
	-3.48 (-21.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.26	$kWh/m^2/yr$	
	-4.9 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.81	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 232 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 232 - EPC	**Prop Type Ref**	As
Property	7 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	12.98	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.15		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.26	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.98 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.89 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.61 m², No overhang
Windows facing South: 5.73 m², No overhang
Windows facing West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			4.8900	
Infiltration rate			0.3680	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3989	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2894	0.3128	0.3363	0.3519	0.3676	(22b)
Effective ac	0.5795	0.5765	0.5734	0.5592	0.5565	0.5442	0.5442	0.5419	0.5489	0.5565	0.5619	0.5676	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.9222	61.5921	61.2686	59.7492	59.4649	58.1415	58.1415	57.8964	58.6512	59.4649	60.0400	60.6412	(38)
Heat transfer coeff	138.5197	138.1896	137.8661	136.3467	136.0624	134.7390	134.7390	134.4939	135.2487	136.0624	136.6375	137.2387	(39)
Average = Sum(39)m / 12 =												136.3453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1231	1.1204	1.1178	1.1055	1.1031	1.0924	1.0924	1.0904	1.0966	1.1031	1.1078	1.1127	(40)
HLP (average)												1.1054	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.7200	0.7000	0.7700	28.2631	(74)
South	5.7300	46.7521	0.7200	0.7000	0.7700	93.5662	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
North	0.6500	15.2954	0.7200	0.7000	1.0000	4.5097	(82)

```
Solar gains    136.0800   234.7016   333.1708   440.0556   522.8710   533.6376   508.3290   443.4186   369.2180   262.2248   163.4171   116.2380 (83)
Total gains    601.7405   697.8265   779.1010   858.2027   912.4123   896.1318   853.6364   795.5575   735.9984   657.0227   590.2953   567.5512 (84)
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7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           61.8344    61.9821    62.1275    62.8199    62.9511    63.5694    63.5694    63.6853    63.3298    62.9511    62.6861    62.4115
alpha          5.1223     5.1321     5.1418     5.1880     5.1967     5.2380     5.2380     5.2457     5.2220     5.1967     5.1791     5.1608
util living area
               0.9993     0.9982     0.9952     0.9835     0.9413     0.8231     0.6595     0.7193     0.9207     0.9900     0.9984     0.9995 (86)

MIT           19.6900    19.8300    20.0627    20.3815    20.6878    20.9040    20.9770    20.9643    20.8035    20.4128    19.9948    19.6673 (87)
Th 2          19.9820    19.9842    19.9863    19.9964    19.9983    20.0070    20.0070    20.0087    20.0037    19.9983    19.9945    19.9905 (88)
util rest of house
               0.9990     0.9976     0.9933     0.9765     0.9135     0.7421     0.5279     0.5914     0.8714     0.9845     0.9977     0.9993 (89)
MIT 2         18.2212    18.4275    18.7687    19.2375    19.6657    19.9354    19.9976    19.9919    19.8267    19.2874    18.6762    18.1940 (90)
Living area fraction                                                                                        fLA = Living area / (4) =      0.1432 (91)
MIT           18.4315    18.6283    18.9540    19.4013    19.8121    20.0741    20.1378    20.1311    19.9666    19.4486    18.8650    18.4049 (92)
Temperature adjustment                                                                                                                 0.0000
adjusted MIT  18.4315    18.6283    18.9540    19.4013    19.8121    20.0741    20.1378    20.1311    19.9666    19.4486    18.8650    18.4049 (93)
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8. Space heating requirement

```
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9984     0.9963     0.9905     0.9706     0.9069     0.7484     0.5464     0.6088     0.8691     0.9800     0.9965     0.9988 (94)
Useful gains 600.7494   695.2180   771.7247   832.9834   827.5033   670.6505   466.4589   484.3102   639.6435   643.8915   588.2067   566.8609 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1957.4920  1897.1079  1716.9836  1431.8144  1103.7492   737.5778   476.6779   501.8157   793.4474  1203.9581  1607.5438  1949.4653 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1009.4165   807.6700   703.2726   431.1583   205.5270     0.0000     0.0000     0.0000     0.0000   416.6896   733.9227  1028.6577 (98)
Space heating                                                                                                                       5336.3145 (98)
Space heating per m2                                                                                                 (98) / (4) =     43.2651 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5719.5225	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1009.4165	807.6700	703.2726	431.1583	205.5270	0.0000	0.0000	0.0000	0.0000	416.6896	733.9227	1028.6577	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1081.9041	865.6699	753.7756	462.1204	220.2862	0.0000	0.0000	0.0000	0.0000	446.6126	786.6267	1102.5270	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7387	89.6942	89.6011	89.3760	88.8188	86.7000	86.7000	86.7000	86.7000	89.3262	89.6321	89.7615	(217)
Fuel for water heating, kWh/month													
	199.4862	174.9247	181.5647	159.9228	155.3246	138.6856	129.8794	147.0972	148.2792	166.0825	179.0876	193.5462	(219)
Water heating fuel used												1973.8809	(219)
Annual totals kWh/year													
Space heating fuel - main system												5719.5225	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												7576.7520	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5719.5225	0.2160	1235.4169	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.8809	0.2160	426.3583	(264)
Space and water heating			1661.7751	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1601.2331	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.9800	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		28.4131	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4131	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6100	10.6334	0.6300	0.7000	0.7700	24.7302	(74)
South	5.7300	46.7521	0.6300	0.7000	0.7700	81.8705	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
North	0.6500	15.2954	0.6300	0.7000	1.0000	3.9460	(82)

Solar gains	119.0700	205.3639	291.5244	385.0486	457.5121	466.9329	444.7878	387.9913	323.0658	229.4467	142.9900	101.7082	(83)
Total gains	597.8791	681.6412	750.6148	816.3665	859.6076	841.2918	801.9676	752.6914	703.0273	637.4149	583.0260	566.1739	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9984	0.9958	0.9858	0.9479	0.8346	0.6696	0.7264	0.9249	0.9907	0.9985	0.9995	(86)
MIT	19.7561	19.8852	20.1033	20.4049	20.6968	20.9075	20.9786	20.9671	20.8147	20.4440	20.0483	19.7361	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9978	0.9942	0.9796	0.9230	0.7577	0.5421	0.6029	0.8784	0.9857	0.9978	0.9993	(89)
MIT 2	18.3478	18.5383	18.8584	19.3033	19.7135	19.9795	20.0408	20.0359	19.8774	19.3640	18.7848	18.3250	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5495	18.7312	19.0366	19.4610	19.8543	20.1124	20.1751	20.1692	20.0116	19.5186	18.9657	18.5270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9967	0.9918	0.9745	0.9168	0.7635	0.5600	0.6197	0.8763	0.9816	0.9967	0.9989	(94)
Useful gains	596.9674	679.3880	744.4632	795.5468	788.1081	642.3093	449.1138	466.4426	616.0305	625.7155	581.1147	565.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1883.8486	1823.8428	1648.9592	1372.5783	1057.3946	707.2921	458.7236	482.6752	761.6280	1156.5100	1545.6940	1875.1933	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating												5079.0669	(98)
Space heating per m2											(98) / (4) =	41.1794	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5437.9732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.4396	769.0736	672.9451	415.4627	200.3492	0.0000	0.0000	0.0000	0.0000	394.9111	694.4972	974.3885	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1025.0959	823.4193	720.4979	444.8208	214.5066	0.0000	0.0000	0.0000	0.0000	422.8170	743.5730	1043.2425	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3382	88.1819	87.8504	87.0781	85.3878	80.3000	80.3000	80.3000	80.3000	86.8813	87.9421	88.4063	(217)
Fuel for water heating, kWh/month													
	246.9450	218.0164	229.7639	207.7035	205.3202	192.2923	184.2307	205.3740	207.3721	215.8689	225.6197	240.7876	(219)
Water heating fuel used												2579.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.9732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8592.7259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.9732	0.2160	1174.6022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.2944	0.2160	557.1276	(264)
Space and water heating			1731.7298	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2030.3927	(272)
Emissions per m2 for space and water heating			14.0403	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0403 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 232 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 232 - EPC	**Prop Type Ref**	As
Property	7 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	12.98	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.15		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.26	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.46	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.98	$kgCO_2/m^2$	Pass
	-3.48 (-21.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.26	$kWh/m^2/yr$	
	-4.9 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 232 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 232 - EPC	**Prop Type Ref**	As
Property	7 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	12.98	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.15		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.26	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South							2.12	100
D2 w8	Window	[2] External Wall	North	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.89	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£131	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 232 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 232 - EPC	**Prop Type Ref**	As
Property	7 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	88 B	**DER**	12.98	**TER**	16.46
Environmental	89 B	**% DER<TER**	21.15		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.26	**TFEE**	52.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	12.98	$kgCO_2/yr/m^2$	
TER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.98	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.15	%	
CfSH ENE1 credits achieved	3.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	47.26	$kWh/m^2/yr$
CfSH ENE2 credits achieved	6.5	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.83	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.26	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.26	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.92	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.35	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.35	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 233 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 233 - EPC	**Prop Type Ref**	Opp
Property	5 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.40	**TER**	16.42
Environmental	91 B	**% DER<TER**	30.57		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.83	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.40	$kgCO_2/m^2$	Pass
	-5.02 (-30.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.83	$kWh/m^2/yr$	
	-4.4 (-8.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.54 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	7.61 m², No overhang
Windows facing South East	1.42 m², No overhang
Windows facing South West	5.73 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.54 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 233 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 233 - EPC	**Prop Type Ref**	Opp
Property	5 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.40	**TER**	16.42
Environmental	91 B	**% DER<TER**	30.57		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.83	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.40 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.54 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.61 m², No overhang
Windows facing South East: 1.42 m², No overhang
Windows facing South West: 5.73 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.5400	
Infiltration rate			0.4005	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3405	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4341	0.4256	0.4171	0.3745	0.3660	0.3234	0.3234	0.3149	0.3405	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5800	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.4895	63.0986	62.7155	60.9158	60.5791	59.0116	59.0116	58.7213	59.6154	60.5791	61.2602	61.9724	(38)
Heat transfer coeff	140.0870	139.6961	139.3130	137.5133	137.1766	135.6091	135.6091	135.3188	136.2129	137.1766	137.8577	138.5699	(39)
Average = Sum(39)m / 12 =												137.5117	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1358	1.1326	1.1295	1.1149	1.1122	1.0995	1.0995	1.0971	1.1044	1.1122	1.1177	1.1235	(40)
HLP (average)												1.1149	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8285	10.6738	11.7943	11.3835	11.7328	11.3182	11.6730	11.7118	11.3533	11.7643	11.4203	11.8175 (61)

Total heat required for water heating calculated for each month

	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300 (64)

Total per year (kWh/year) = Sum(64)m = 1751.0299 (64)

Heat gains from water heating, kWh/month

	58.5471	51.2878	53.1194	46.5860	44.9029	39.0462	36.4783	41.4386	41.8089	48.3575	52.4307	56.7903 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139 (71)

Water heating gains (Table 5)

	78.6923	76.3211	71.3970	64.7028	60.3533	54.2308	49.0300	55.6970	58.0679	64.9967	72.8204	76.3310 (72)

Total internal gains

	465.6605	463.1249	445.9303	418.1472	389.5413	362.4942	345.3075	352.1389	366.7803	394.7980	426.8781	451.3133 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.7200	0.7000	0.7700	29.9896	(75)
Southeast	1.4200	36.7938	0.7200	0.7000	0.7700	18.2485	(77)
Southwest	5.7300	36.7938	0.7200	0.7000	0.7700	73.6365	(79)
Northeast	0.6500	16.3666	0.7200	0.7000	1.0000	4.8255	(82)

Solar gains	126.7002	227.4905	342.4508	476.8867	582.3547	599.4033	569.0371	487.0650	388.4679	259.8171	153.8790	107.0586	(83)
Total gains	592.3607	690.6154	788.3810	895.0338	971.8960	961.8975	914.3446	839.2038	755.2483	654.6150	580.7571	558.3719	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1426	61.3136	61.4823	62.2869	62.4398	63.1615	63.1615	63.2970	62.8816	62.4398	62.1313	61.8120	
alpha	5.0762	5.0876	5.0988	5.1525	5.1627	5.2108	5.2108	5.2198	5.1921	5.1627	5.1421	5.1208	
util living area	0.9993	0.9983	0.9950	0.9806	0.9281	0.7930	0.6262	0.6940	0.9149	0.9902	0.9985	0.9995	(86)
MIT	19.6659	19.8086	20.0556	20.3975	20.7134	20.9192	20.9815	20.9692	20.8089	20.4032	19.9764	19.6458	(87)
Th 2	19.9717	19.9743	19.9768	19.9887	19.9909	20.0013	20.0013	20.0032	19.9973	19.9909	19.9864	19.9817	(88)
util rest of house	0.9991	0.9977	0.9930	0.9724	0.8959	0.7077	0.4973	0.5662	0.8632	0.9848	0.9979	0.9993	(89)
MIT 2	18.1787	18.3892	18.7515	19.2541	19.6915	19.9430	19.9939	19.9892	19.8271	19.2682	18.6436	18.1563	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.3916	18.5924	18.9382	19.4178	19.8378	20.0828	20.1353	20.1295	19.9676	19.4307	18.8344	18.3696	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3916	18.5924	18.9382	19.4178	19.8378	20.0828	20.1353	20.1295	19.9676	19.4307	18.8344	18.3696	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9964	0.9901	0.9661	0.8898	0.7155	0.5155	0.5838	0.8613	0.9804	0.9967	0.9989	(94)
Useful gains	591.4397	688.1341	780.5671	864.6728	864.7990	688.2278	471.3837	489.8985	650.4764	641.7817	578.8343	557.7331	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1974.0528	1912.7794	1732.8024	1446.3357	1116.3151	743.5140	479.4168	504.6732	799.2485	1211.3705	1617.6808	1963.4746	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1028.6642	822.9617	708.4631	418.7973	187.1280	0.0000	0.0000	0.0000	0.0000	423.7740	747.9695	1045.8716	(98)
Space heating												5383.6294	(98)
Space heating per m2											(98) / (4) =	43.6487	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5770.2352	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1028.6642	822.9617	708.4631	418.7973	187.1280	0.0000	0.0000	0.0000	0.0000	423.7740	747.9695	1045.8716	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1102.5340	882.0597	759.3388	448.8717	200.5659	0.0000	0.0000	0.0000	0.0000	454.2058	801.6822	1120.9771	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7476	89.7036	89.6052	89.3559	88.7364	86.7000	86.7000	86.7000	86.7000	89.3381	89.6423	89.7690	(217)
Fuel for water heating, kWh/month													
	199.4665	174.9064	181.5564	159.9588	155.4689	138.6856	129.8794	147.0972	148.2792	166.0603	179.0671	193.5299	(219)
Water heating fuel used												1973.9557	(219)
Annual totals kWh/year													
Space heating fuel - main system												5770.2352	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	(233)
Total delivered energy for all uses												7230.6846	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5770.2352	0.2160	1246.3708	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.9557	0.2160	426.3744	(264)
Space and water heating			1672.7452	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1406.2354	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.4000	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.8331	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.8331	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southeast	1.4200	36.7938	0.6300	0.7000	0.7700	15.9674	(77)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	110.8627	199.0542	299.6444	417.2758	509.5604	524.4779	497.9075	426.1818	339.9094	227.3400	134.6441	93.6763	(83)
Total gains	589.6718	675.3315	758.7348	848.5937	911.6558	898.8368	855.0872	790.8819	719.8709	635.3081	574.6802	558.1419	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9985	0.9956	0.9832	0.9354	0.8044	0.6352	0.7001	0.9186	0.9909	0.9986	0.9995	(86)
MIT	19.7498	19.8804	20.1094	20.4278	20.7261	20.9237	20.9833	20.9725	20.8232	20.4424	20.0419	19.7299	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9979	0.9939	0.9760	0.9062	0.7232	0.5107	0.5771	0.8696	0.9859	0.9980	0.9994	(89)
MIT 2	18.3386	18.5313	18.8672	19.3356	19.7507	19.9938	20.0431	20.0388	19.8870	19.3618	18.7754	18.3159	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9968	0.9914	0.9704	0.9005	0.7306	0.5283	0.5940	0.8679	0.9819	0.9969	0.9989	(94)
Useful gains	588.8285	673.1906	752.2252	823.5068	820.9833	656.6634	451.7589	469.7955	624.7993	623.8013	572.9157	557.5499	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1882.6830	1822.9545	1650.0764	1376.6060	1062.0731	709.1654	459.0559	483.0963	762.8438	1156.2358	1544.5305	1874.0602	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating												5056.0502	(98)
Space heating per m2											(98) / (4) =	40.9928	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5413.3300	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1030.6506	827.2391	715.2048	426.3720	192.0458	0.0000	0.0000	0.0000	0.0000	424.1234	748.9964	1048.6977	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3470	88.1899	87.8363	86.9830	85.1087	80.3000	80.3000	80.3000	80.3000	86.8884	87.9556	88.4146	(217)
Fuel for water heating, kWh/month													
	246.9203	217.9966	229.8007	207.9306	205.9935	192.2923	184.2307	205.3740	207.3721	215.8514	225.5851	240.7649	(219)
Water heating fuel used												2580.1123	(219)
Annual totals kWh/year													
Space heating fuel - main system												5413.3300	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8568.9006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5413.3300	0.2160	1169.2793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2580.1123	0.2160	557.3042	(264)
Space and water heating			1726.5835	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2025.2464	(272)
Emissions per m2 for space and water heating			13.9986	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9986 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 233 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 233 - EPC	**Prop Type Ref**	Opp
Property	5 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.40	**TER**	16.42
Environmental	91 B	**% DER<TER**	30.57		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.83	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.40	$kgCO_2/m^2$	Pass
	-5.02 (-30.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.83	$kWh/m^2/yr$	
	-4.4 (-8.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.54 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.54 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 233 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 233 - EPC	**Prop Type Ref**	Opp
Property	5 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.40	**TER**	16.42
Environmental	91 B	**% DER<TER**	30.57		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.83	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	5.54	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	North East	45°	None Or Little	Yes
0.81	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£110	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 233 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 233 - EPC	**Prop Type Ref**	Opp
Property	5 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.40	**TER**	16.42
Environmental	91 B	**% DER<TER**	30.57		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.83	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	11.40	$kgCO_2/yr/m^2$	
TER	16.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.40	$kgCO_2/yr/m^2$	
Reduction DER/TER	30.57	%	
CfSH ENE1 credits achieved	3.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	47.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.94	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.37	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.37	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	13.36	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.79	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.79	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 234 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 234 - EPC	**Prop Type Ref**	As
Property	3 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.27	**TER**	16.54
Environmental	91 B	**% DER<TER**	31.88		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.18	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.27	$kgCO_2/m^2$	Pass
	-5.27 (-31.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.18	$kWh/m^2/yr$	
	-5.6 (-10.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	7.61 m², No overhang
Windows facing South West	5.73 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 234 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 234 - EPC	**Prop Type Ref**	As
Property	3 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.27	**TER**	16.54
Environmental	91 B	**% DER<TER**	31.88		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.18	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.27 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.16 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.61 m², No overhang
Windows facing South West: 5.73 m², No overhang
Windows facing North West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			4.1600	
Infiltration rate			0.3315	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2818	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3593	0.3523	0.3452	0.3100	0.3029	0.2677	0.2677	0.2607	0.2818	0.3029	0.3170	0.3311	(22b)
Effective ac	0.5646	0.5620	0.5596	0.5480	0.5459	0.5358	0.5358	0.5340	0.5397	0.5459	0.5503	0.5548	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3200	60.0521	59.7896	58.5566	58.3259	57.2520	57.2520	57.0531	57.6656	58.3259	58.7926	59.2805	(38)
Heat transfer coeff	136.9175	136.6497	136.3871	135.1541	134.9234	133.8495	133.8495	133.6506	134.2631	134.9234	135.3901	135.8780	(39)
Average = Sum(39)m / 12 =												135.1530	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1101	1.1079	1.1058	1.0958	1.0939	1.0852	1.0852	1.0836	1.0886	1.0939	1.0977	1.1017	(40)
HLP (average)												1.0958	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)
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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2             Table 6a      Specific data    Specific data        factor                W
                                                             W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                7.6100           11.2829           0.7200           0.7000           0.7700           29.9896 (75)
Southwest                                5.7300           36.7938           0.7200           0.7000           0.7700           73.6365 (79)
Northwest                                1.4200           11.2829           0.7200           0.7000           0.7700            5.5960 (81)
Northeast                                0.6500           16.3666           0.7200           0.7000           1.0000            4.8255 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    114.0476   207.7973   320.4428   457.8932   568.6339   589.1042   557.7250   471.3113   367.4235   239.3831   139.0627    96.0117 (83)
Total gains    579.7081   670.9222   766.3731   876.0404   958.1752   951.5985   903.0325   823.4502   734.2038   634.1810   565.9408   547.3249 (84)
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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                        21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           62.5580    62.6806    62.8012    63.3742    63.4825    63.9919    63.9919    64.0871    63.7947    63.4825    63.2637    63.0365
alpha          5.1705     5.1787     5.1867     5.2249     5.2322     5.2661     5.2661     5.2725     5.2530     5.2322     5.2176     5.2024
util living area
               0.9994     0.9985     0.9955     0.9818     0.9292     0.7932     0.6265     0.6984     0.9202     0.9913     0.9987     0.9995 (86)

MIT           19.6906    19.8259    20.0676    20.4038    20.7196    20.9215    20.9822    20.9694    20.8069    20.4042    19.9877    19.6666 (87)
Th 2          19.9926    19.9944    19.9961    20.0043    20.0058    20.0129    20.0129    20.0143    20.0102    20.0058    20.0027    19.9995 (88)
util rest of house
               0.9992     0.9980     0.9938     0.9741     0.8975     0.7086     0.4989     0.5715     0.8708     0.9866     0.9981     0.9994 (89)
MIT 2         18.2296    18.4288    18.7829    19.2750    19.7121    19.9562    20.0058    20.0002    19.8363    19.2808    18.6718    18.1995 (90)
Living area fraction                                                                                                    0.1432 (91)
MIT           18.4388    18.6288    18.9668    19.4366    19.8563    20.0944    20.1456    20.1390    19.9753    19.4417    18.8602    18.4095 (92)
Temperature adjustment                                                                                                  0.0000
adjusted MIT  18.4388    18.6288    18.9668    19.4366    19.8563    20.0944    20.1456    20.1390    19.9753    19.4417    18.8602    18.4095 (93)
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8. Space heating requirement

```
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9986     0.9969     0.9911     0.9681     0.8916     0.7164     0.5170     0.5889     0.8686     0.9825     0.9971     0.9990 (94)
Useful gains 578.9114   668.8206   759.5764   848.0555   854.3185   681.7413   466.8317   484.9616   637.7503   623.0735   564.2857   546.7685 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1935.8427  1876.0374  1700.3160  1424.0711  1100.4802   735.4286   474.5753   499.7174   788.8349  1192.9497  1592.2159  1930.7631 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1009.5569   811.2497   699.9103   414.7313   183.1443     0.0000     0.0000     0.0000     0.0000   423.9879   740.1098  1029.6920 (98)
Space heating                                                                                                          5312.3821 (98)
Space heating per m2                                                                                    (98) / (4) =    43.0710 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5693.8715	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1009.5569	811.2497	699.9103	414.7313	183.1443	0.0000	0.0000	0.0000	0.0000	423.9879	740.1098	1029.6920	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1082.0545	869.5066	750.1718	444.5137	196.2962	0.0000	0.0000	0.0000	0.0000	454.4351	793.2581	1103.6356	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7388	89.6964	89.5983	89.3491	88.7173	86.7000	86.7000	86.7000	86.7000	89.3385	89.6366	89.7619	(217)
Fuel for water heating, kWh/month													
	199.4861	174.9204	181.5702	159.9710	155.5023	138.6856	129.8794	147.0972	148.2792	166.0596	179.0785	193.5452	(219)
Water heating fuel used												1974.0747	(219)
Annual totals kWh/year													
Space heating fuel - main system												5693.8715	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	(233)
Total delivered energy for all uses												7154.4399	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5693.8715	0.2160	1229.8763	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.0747	0.2160	426.4001	(264)
Space and water heating			1656.2764	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1389.7666	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.2700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.2700	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.7031	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7031	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northwest	1.4200	11.2829	0.6300	0.7000	0.7700	4.8965	(81)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	99.7917	181.8227	280.3875	400.6566	497.5547	515.4662	488.0094	412.3974	321.4955	209.4602	121.6798	84.0102	(83)
Total gains	578.6008	658.1000	739.4779	831.9744	899.6501	889.8251	845.1891	777.0975	701.4570	617.4284	561.7159	548.4758	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9994	0.9987	0.9961	0.9845	0.9384	0.8091	0.6414	0.7095	0.9255	0.9920	0.9987	0.9996	(86)
MIT	19.7413	19.8672	20.0949	20.4160	20.7195	20.9214	20.9826	20.9707	20.8139	20.4292	20.0319	19.7225	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9992	0.9982	0.9946	0.9779	0.9102	0.7285	0.5163	0.5862	0.8792	0.9876	0.9982	0.9994	(89)
MIT 2	18.3261	18.5120	18.8461	19.3190	19.7424	19.9918	20.0427	20.0378	19.8765	19.3430	18.7609	18.3050	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9972	0.9923	0.9726	0.9044	0.7357	0.5340	0.6031	0.8770	0.9839	0.9972	0.9990	(94)
Useful gains	577.8433	656.2436	733.7926	809.1585	813.6417	654.6138	451.3259	468.6689	615.1932	607.4636	560.1618	547.9403	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1881.1100	1820.5264	1647.4242	1374.5385	1061.0308	708.8994	459.0015	482.9549	761.5117	1153.8975	1542.7213	1872.6961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating												5122.5094	(98)
Space heating per m2											(98) / (4) =	41.5316	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5484.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1038.1482	837.6852	727.7751	435.8390	197.0637	0.0000	0.0000	0.0000	0.0000	435.2750	757.4334	1055.2659	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3589	88.2115	87.8695	87.0325	85.1737	80.3000	80.3000	80.3000	80.3000	86.9476	87.9763	88.4246	(217)
Fuel for water heating, kWh/month													
	246.8872	217.9432	229.7139	207.8124	205.8363	192.2923	184.2307	205.3740	207.3721	215.7044	225.5320	240.7379	(219)
Water heating fuel used												2579.4365	(219)
Annual totals kWh/year													
Space heating fuel - main system												5484.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8639.3803	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5484.4855	0.2160	1184.6489	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.4365	0.2160	557.1583	(264)
Space and water heating			1741.8071	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2040.4700	(272)
Emissions per m2 for space and water heating			14.1220	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1220 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.5400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 234 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 234 - EPC	**Prop Type Ref**	As
Property	3 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.27	**TER**	16.54
Environmental	91 B	**% DER<TER**	31.88		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.18	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.27	$kgCO_2/m^2$	Pass
	-5.27 (-31.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.18	$kWh/m^2/yr$	
	-5.6 (-10.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West Windows facing North West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 234 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 234 - EPC	**Prop Type Ref**	As
Property	3 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.27	**TER**	16.54
Environmental	91 B	**% DER<TER**	31.88		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.18	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.16	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£110	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 234 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 234 - EPC	**Prop Type Ref**	As
Property	3 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.27	**TER**	16.54
Environmental	91 B	**% DER<TER**	31.88		
CO_2 Emissions (t/year)	0.96	**DFEE**	47.18	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	11.27	$kgCO_2/yr/m^2$	
TER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.27	$kgCO_2/yr/m^2$	
Reduction DER/TER	31.88	%	
CfSH ENE1 credits achieved	3.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	47.18	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.21	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.21	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	13.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.63	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.63	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 235 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 235 - EPC	**Prop Type Ref**	As
Property	1 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	89 B	**DER**	12.95	**TER**	17.58
Environmental	89 B	**% DER<TER**	26.35		
CO_2 Emissions (t/year)	1.13	**DFEE**	54.44	**TFEE**	59.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.58	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.95	$kgCO_2/m^2$	Pass
	-4.63 (-26.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.44	$kWh/m^2/yr$	
	-4.8 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.67 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.04 m², No overhang
Windows facing North East	8.18 m², No overhang
Windows facing South West	7.10 m², No overhang
Windows facing West	1.04 m², No overhang
Windows facing North West	6.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.67 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 235 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 235 - EPC	**Prop Type Ref**	As
Property	1 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	89 B	**DER**	12.95	**TER**	17.58
Environmental	89 B	**% DER<TER**	26.35		
CO_2 Emissions (t/year)	1.13	**DFEE**	54.44	**TFEE**	59.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.58 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.95 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.67 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 8.18 m², No overhang
Windows facing South West: 7.10 m², No overhang
Windows facing West: 1.04 m², No overhang
Windows facing North West: 6.50 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.6700	
Infiltration rate		0.4164	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3540	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4513	0.4425	0.4336	0.3894	0.3805	0.3363	0.3363	0.3274	0.3540	0.3805	0.3982	0.4159	(22b)
Effective ac	0.6018	0.5979	0.5940	0.5758	0.5724	0.5565	0.5565	0.5536	0.5626	0.5724	0.5793	0.5865	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6621	(36)
Total fabric heat loss					(33) + (36) =		97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.7624	59.3697	58.9848	57.1769	56.8386	55.2640	55.2640	54.9724	55.8705	56.8386	57.5229	58.2383	(38)
Heat transfer coeff	157.1847	156.7920	156.4071	154.5992	154.2610	152.6863	152.6863	152.3947	153.2929	154.2610	154.9452	155.6606	(39)
Average = Sum(39)m / 12 =												154.5976	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3105	1.3073	1.3040	1.2890	1.2862	1.2730	1.2730	1.2706	1.2781	1.2862	1.2919	1.2978	(40)
HLP (average)												1.2890	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631	(42)
Average daily hot water use (litres/day)	102.1982	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165 (61)
Total heat required for water heating calculated for each month												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349 (64)
Heat gains from water heating, kWh/month												
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
Northeast	8.1800	11.2829	0.7200	0.7000	0.7700	32.2359	(75)
Southwest	7.1000	36.7938	0.7200	0.7000	0.7700	91.2425	(79)
West	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(80)
Northwest	6.5000	11.2829	0.7200	0.7000	0.7700	25.6153	(81)

Solar gains	160.0904	294.5149	460.3404	665.5843	831.7061	863.4201	816.7420	687.1629	530.5913	341.0278	195.7396	134.4155	(83)
Total gains	618.2649	750.4199	899.6308	1077.8316	1216.0426	1221.1887	1157.4555	1034.4296	891.9268	729.6402	615.7271	578.3664	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9897	53.1224	53.2531	53.8759	53.9940	54.5508	54.5508	54.6552	54.3350	53.9940	53.7556	53.5085	
alpha	4.5326	4.5415	4.5502	4.5917	4.5996	4.6367	4.6367	4.6437	4.6223	4.5996	4.5837	4.5672	
util living area													
	0.9989	0.9972	0.9910	0.9647	0.8820	0.7207	0.5599	0.6373	0.8844	0.9853	0.9977	0.9992	(86)
MIT	19.4728	19.6480	19.9517	20.3655	20.7234	20.9256	20.9818	20.9680	20.7942	20.3235	19.8250	19.4467	(87)
Th 2	19.8326	19.8352	19.8377	19.8495	19.8517	19.8620	19.8620	19.8639	19.8580	19.8517	19.8472	19.8425	(88)
util rest of house													
	0.9985	0.9961	0.9875	0.9503	0.8349	0.6222	0.4254	0.4991	0.8178	0.9771	0.9967	0.9989	(89)
MIT 2	17.8000	18.0577	18.5015	19.1017	19.5806	19.8132	19.8556	19.8509	19.6863	19.0524	18.3252	17.7685	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.0405	18.2863	18.7100	19.2834	19.7449	19.9731	20.0175	20.0115	19.8456	19.2351	18.5408	18.0097	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0405	18.2863	18.7100	19.2834	19.7449	19.9731	20.0175	20.0115	19.8456	19.2351	18.5408	18.0097	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9940	0.9825	0.9409	0.8297	0.6328	0.4446	0.5184	0.8169	0.9706	0.9949	0.9982	(94)
Useful gains	616.7414	745.8908	883.9029	1014.0980	1008.9024	772.7635	514.5936	536.2174	728.6304	708.1981	612.5632	577.3136	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2159.7891	2098.8695	1909.7276	1605.2609	1241.0117	820.3944	521.8017	550.3681	880.7546	1332.0609	1772.6916	2149.6241	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1148.0275	909.2017	763.2136	425.6373	172.6893	0.0000	0.0000	0.0000	0.0000	464.1539	835.2924	1169.7990	(98)
Space heating												5888.0147	(98)
Space heating per m2											(98) / (4) =	49.0913	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6310.8411	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1148.0275	909.2017	763.2136	425.6373	172.6893	0.0000	0.0000	0.0000	0.0000	464.1539	835.2924	1169.7990	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1230.4689	974.4927	818.0210	456.2029	185.0904	0.0000	0.0000	0.0000	0.0000	497.4855	895.2759	1253.8038	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7982	89.7528	89.6474	89.3690	88.6673	86.7000	86.7000	86.7000	86.7000	89.4027	89.7009	89.8189	(217)
Fuel for water heating, kWh/month													
	198.8239	174.3466	180.9915	159.5162	155.1837	138.3272	129.5472	146.7160	147.8942	165.5053	178.4767	192.9092	(219)
Water heating fuel used												1968.2376	(219)
Annual totals kWh/year													
Space heating fuel - main system												6310.8411	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1004 * 1.00) =										-979.9003		-979.9003	(233)
Total delivered energy for all uses												7826.5223	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6310.8411	0.2160	1363.1417	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.2376	0.2160	425.1393	(264)
Space and water heating			1788.2810	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-979.9003	0.5190	-508.5683	(269)
Total CO2, kg/year			1553.4042	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.9500	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.6025	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6025	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	8.1800	11.2829	0.6300	0.7000	0.7700	28.2064	(75)
Southwest	7.1000	36.7938	0.6300	0.7000	0.7700	79.8372	(79)
West	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(80)
Northwest	6.5000	11.2829	0.6300	0.7000	0.7700	22.4134	(81)

Solar gains	140.0791	257.7005	402.7979	582.3862	727.7428	755.4925	714.6492	601.2676	464.2674	298.3993	171.2722	117.6136	(83)
Total gains	611.4025	726.7582	855.2487	1007.8046	1124.5871	1125.0814	1067.1905	961.0490	838.7843	700.1822	604.4178	574.7171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9990	0.9975	0.9923	0.9697	0.8944	0.7370	0.5729	0.6482	0.8916	0.9867	0.9979	0.9993	(86)
MIT	19.5692	19.7291	20.0097	20.3944	20.7337	20.9293	20.9835	20.9710	20.8078	20.3661	19.8994	19.5435	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9987	0.9967	0.9894	0.9573	0.8515	0.6428	0.4425	0.5149	0.8294	0.9794	0.9970	0.9990	(89)
MIT 2	17.9840	18.2193	18.6296	19.1886	19.6463	19.8732	19.9148	19.9103	19.7541	19.1568	18.4759	17.9524	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.2118	18.4363	18.8280	19.3619	19.8026	20.0250	20.0684	20.0628	19.9055	19.3307	18.6805	18.1811	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2118	18.4363	18.8280	19.3619	19.8026	20.0250	20.0684	20.0628	19.9055	19.3307	18.6805	18.1811	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9948	0.9852	0.9489	0.8463	0.6528	0.4611	0.5335	0.8285	0.9736	0.9954	0.9984	(94)
Useful gains	610.0607	722.9980	842.5814	956.3507	951.7384	734.4251	492.0845	512.7671	694.9341	681.7024	601.6330	573.7783	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2053.3646	1993.4391	1811.4863	1521.2913	1175.8980	780.0880	498.7414	525.7815	837.7812	1267.0449	1687.3363	2045.5653	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1073.8181	853.7364	720.8653	406.7572	166.7747	0.0000	0.0000	0.0000	0.0000	435.4948	781.7064	1095.0095	(98)
Space heating												5534.1625	(98)
Space heating per m2											(98) / (4) =	46.1411	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5925.2276	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1073.8181	853.7364	720.8653	406.7572	166.7747	0.0000	0.0000	0.0000	0.0000	435.4948	781.7064	1095.0095	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1149.6982	914.0647	771.8043	435.5003	178.5597	0.0000	0.0000	0.0000	0.0000	466.2685	836.9448	1172.3871	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5234	88.3609	87.9832	87.0354	84.9328	80.3000	80.3000	80.3000	80.3000	87.1067	88.1591	88.5897	(217)
Fuel for water heating, kWh/month													
	245.8916	217.1044	228.9297	207.3759	205.8335	191.7458	183.7071	204.7903	206.9573	214.8646	224.5837	239.7697	(219)
Water heating fuel used												2571.5536	(219)
Annual totals kWh/year													
Space heating fuel - main system												5925.2276	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												9024.1251	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5925.2276	0.2160	1279.8492	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.5536	0.2160	555.4556	(264)
Space and water heating			1835.3047	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2108.9962	(272)
Emissions per m2 for space and water heating			15.3019	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3019 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.5800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 235 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 235 - EPC	**Prop Type Ref**	As
Property	1 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	89 B	**DER**	12.95	**TER**	17.58
Environmental	89 B	**% DER<TER**	26.35		
CO_2 Emissions (t/year)	1.13	**DFEE**	54.44	**TFEE**	59.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.58	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.95	$kgCO_2/m^2$	Pass
	-4.63 (-26.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.44	$kWh/m^2/yr$	
	-4.8 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.67 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.04 m², No overhang
Windows facing North East	8.18 m², No overhang
Windows facing South West	7.10 m², No overhang
Windows facing West	1.04 m², No overhang
Windows facing North West	6.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.67 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 235 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 235 - EPC	**Prop Type Ref**	As
Property	1 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	89 B	**DER**	12.95	**TER**	17.58
Environmental	89 B	**% DER<TER**	26.35		
CO_2 Emissions (t/year)	1.13	**DFEE**	54.44	**TFEE**	59.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West	
Property Tenure	Unknown	
Transaction Type	New dwelling	
Terrain Type	Urban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South West							2.12	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	5.67	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder	None

32.0 Photovoltaic Unit — One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£123	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 235 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 235 - EPC	**Prop Type Ref**	As
Property	1 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	89 B	**DER**	12.95	**TER**	17.58
Environmental	89 B	**% DER<TER**	26.35		
CO_2 Emissions (t/year)	1.13	**DFEE**	54.44	**TFEE**	59.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	12.95	$kgCO_2/yr/m^2$	
TER	17.58	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.95	$kgCO_2/yr/m^2$	
Reduction DER/TER	26.35	%	
CfSH ENE1 credits achieved	3.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.44	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	19.40	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.05	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.05	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 236 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 236 - EPC	**Prop Type Ref**	Opp
Property	7 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.61	**TER**	17.08
Environmental	88 B	**% DER<TER**	20.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.78	**TFEE**	56.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.08	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.61	$kgCO_2/m^2$	Pass
	-3.47 (-20.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.54	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.78	$kWh/m^2/yr$	
	-4.7 (-8.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.61 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.10 m², No overhang
Windows facing South	8.18 m², No overhang
Windows facing South West	1.04 m², No overhang
Windows facing West	6.50 m², No overhang
Windows facing North West	1.04 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.61 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.81	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 236 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 236 - EPC	**Prop Type Ref**	Opp
Property	7 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.61	**TER**	17.08
Environmental	88 B	**% DER<TER**	20.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.78	**TFEE**	56.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.08 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.61 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.61 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.10 m², No overhang
Windows facing South: 8.18 m², No overhang
Windows facing South West: 1.04 m², No overhang
Windows facing West: 6.50 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.6100	
Infiltration rate		0.4134	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3514	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4481	0.4393	0.4305	0.3866	0.3778	0.3338	0.3338	0.3251	0.3514	0.3778	0.3953	0.4129	(22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5528	0.5617	0.5714	0.5781	0.5852	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.6172	59.2301	58.8508	57.0688	56.7354	55.1834	55.1834	54.8960	55.7812	56.7354	57.4099	58.1150	(38)
Heat transfer coeff	157.0395	156.6525	156.2731	154.4911	154.1577	152.6057	152.6057	152.3183	153.2035	154.1577	154.8322	155.5373	(39)
Average = Sum(39)m / 12 =												154.4895	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3093	1.3061	1.3029	1.2881	1.2853	1.2724	1.2724	1.2700	1.2773	1.2853	1.2909	1.2968	(40)
HLP (average)												1.2881	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165 (61)
Total heat required for water heating calculated for each month												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688 (64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349 (64)
Heat gains from water heating, kWh/month												
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1000	10.6334	0.7200	0.7000	0.7700	26.3690	(74)
South	8.1800	46.7521	0.7200	0.7000	0.7700	133.5728	(78)
Southwest	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(79)
West	6.5000	19.6403	0.7200	0.7000	0.7700	44.5887	(80)
Northwest	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(81)

Solar gains	221.9940	387.4834	554.1143	725.2674	846.6355	855.3118	818.4738	725.8492	613.1560	434.7923	267.6209	188.8540	(83)
Total gains	680.1685	843.3884	993.4047	1137.5147	1230.9720	1213.0804	1159.1873	1073.1158	974.4916	823.4047	687.6083	632.8048	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0387	53.1697	53.2988	53.9136	54.0302	54.5796	54.5796	54.6826	54.3667	54.0302	53.7948	53.5509	
alpha	4.5359	4.5446	4.5533	4.5942	4.6020	4.6386	4.6386	4.6455	4.6244	4.6020	4.5863	4.5701	
util living area													
	0.9984	0.9954	0.9867	0.9574	0.8779	0.7237	0.5590	0.6185	0.8539	0.9768	0.9964	0.9988	(86)
MIT	19.5211	19.7189	20.0205	20.4040	20.7303	20.9244	20.9820	20.9717	20.8279	20.3894	19.8800	19.4893	(87)
Th 2	19.8335	19.8361	19.8385	19.8502	19.8524	19.8626	19.8626	19.8644	19.8586	19.8524	19.8480	19.8433	(88)
util rest of house													
	0.9978	0.9938	0.9818	0.9407	0.8299	0.6254	0.4246	0.4823	0.7790	0.9646	0.9948	0.9984	(89)
MIT 2	17.8712	18.1615	18.6010	19.1547	19.5892	19.8127	19.8562	19.8531	19.7207	19.1450	18.4058	17.8313	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.1084	18.3854	18.8050	19.3343	19.7532	19.9725	20.0180	20.0139	19.8798	19.3238	18.6177	18.0696	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1084	18.3854	18.8050	19.3343	19.7532	19.9725	20.0180	20.0139	19.8798	19.3238	18.6177	18.0696	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9907	0.9755	0.9308	0.8250	0.6359	0.4438	0.5015	0.7807	0.9567	0.9922	0.9974	(94)
Useful gains	677.7370	835.5337	969.0489	1058.8395	1015.5019	771.3749	514.4643	538.1140	760.7926	787.7279	682.2415	631.1574	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2168.4586	2112.5187	1922.9440	1612.0013	1241.4595	819.8785	521.6065	550.4626	885.4892	1344.8472	1783.3126	2157.2418	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1109.0969	858.1339	709.6980	398.2765	168.1124	0.0000	0.0000	0.0000	0.0000	414.4967	792.7711	1135.4068	(98)
Space heating												5585.9923	(98)
Space heating per m2											(98) / (4) =	46.5732	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5987.1300	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1109.0969	858.1339	709.6980	398.2765	168.1124	0.0000	0.0000	0.0000	0.0000	414.4967	792.7711	1135.4068	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1188.7427	919.7577	760.6623	426.8772	180.1848	0.0000	0.0000	0.0000	0.0000	444.2623	849.7011	1216.9419	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7831	89.7254	89.6076	89.3224	88.6434	86.7000	86.7000	86.7000	86.7000	89.3243	89.6744	89.8063	(217)
Fuel for water heating, kWh/month													
	198.8573	174.3998	181.0718	159.5994	155.2257	138.3272	129.5472	146.7160	147.8942	165.6505	178.5295	192.9362	(219)
Water heating fuel used												1968.7548	(219)
Annual totals kWh/year													
Space heating fuel - main system												5987.1300	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												7791.1190	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5987.1300	0.2160	1293.2201	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.7548	0.2160	425.2510	(264)
Space and water heating			1718.4711	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1632.9577	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6100	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		29.2625	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.2625	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1000	10.6334	0.6300	0.7000	0.7700	23.0729	(74)
South	8.1800	46.7521	0.6300	0.7000	0.7700	116.8762	(78)
Southwest	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(79)
West	6.5000	19.6403	0.6300	0.7000	0.7700	39.0151	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	194.2447	339.0480	484.8501	634.6089	740.8061	748.3978	716.1646	635.1180	536.5115	380.4433	234.1683	165.2472	(83)
Total gains	665.5682	808.1057	937.3009	1060.0273	1137.6503	1117.9866	1068.7058	994.8994	911.0285	782.2262	667.3139	622.3508	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9986	0.9961	0.9888	0.9635	0.8908	0.7401	0.5722	0.6304	0.8636	0.9794	0.9968	0.9990	(86)
MIT	19.6107	19.7909	20.0701	20.4285	20.7395	20.9279	20.9836	20.9742	20.8380	20.4243	19.9474	19.5802	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9981	0.9947	0.9847	0.9490	0.8470	0.6460	0.4419	0.4988	0.7934	0.9686	0.9954	0.9986	(89)
MIT 2	18.0447	18.3092	18.7165	19.2354	19.6532	19.8722	19.9149	19.9119	19.7850	19.2384	18.5458	18.0060	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.2698	18.5222	18.9111	19.4069	19.8093	20.0239	20.0685	20.0646	19.9363	19.4089	18.7473	18.2322	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2698	18.5222	18.9111	19.4069	19.8093	20.0239	20.0685	20.0646	19.9363	19.4089	18.7473	18.2322	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9922	0.9794	0.9403	0.8421	0.6559	0.4605	0.5173	0.7949	0.9615	0.9932	0.9977	(94)
Useful gains	663.4981	801.7663	917.9601	996.7244	958.0051	733.3263	492.1284	514.6269	724.1741	752.1467	662.7528	620.9319	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2061.9156	2006.0877	1823.6905	1527.8298	1176.8752	779.9322	498.7475	526.0397	842.2234	1278.3998	1697.0594	2053.0509	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1040.4227	809.3040	673.8634	382.3959	162.8394	0.0000	0.0000	0.0000	0.0000	391.5324	744.7008	1065.4965	(98)
Space heating												5270.5550	(98)
Space heating per m2											(98) / (4) =	43.9433	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5642.9925	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1040.4227	809.3040	673.8634	382.3959	162.8394	0.0000	0.0000	0.0000	0.0000	391.5324	744.7008	1065.4965	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1113.9429	866.4925	721.4811	409.4175	174.3462	0.0000	0.0000	0.0000	0.0000	419.1995	797.3242	1140.7886	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4746	88.2725	87.8571	86.8954	84.8730	80.3000	80.3000	80.3000	80.3000	86.8663	88.0734	88.5487	(217)
Fuel for water heating, kWh/month													
	246.0271	217.3217	229.2584	207.7099	205.9785	191.7458	183.7071	204.7903	206.9573	215.4592	224.8022	239.8806	(219)
Water heating fuel used												2573.6383	(219)
Annual totals kWh/year													
Space heating fuel - main system												5642.9925	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8743.9747	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5642.9925	0.2160	1218.8864	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2573.6383	0.2160	555.9059	(264)
Space and water heating			1774.7923	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2048.4837	(272)
Emissions per m2 for space and water heating			14.7973	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7973 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.0800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 236 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 236 - EPC	**Prop Type Ref**	Opp
Property	7 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.61	**TER**	17.08
Environmental	88 B	**% DER<TER**	20.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.78	**TFEE**	56.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.08	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.61	$kgCO_2/m^2$	Pass
	-3.47 (-20.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.54	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.78	$kWh/m^2/yr$	
	-4.7 (-8.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.61 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	7.10 m², No overhang		
Windows facing South	8.18 m², No overhang		
Windows facing South West	1.04 m², No overhang		
Windows facing West	6.50 m², No overhang		
Windows facing North West	1.04 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.61 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 236 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 236 - EPC	**Prop Type Ref**	Opp
Property	7 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.61	**TER**	17.08
Environmental	88 B	**% DER<TER**	20.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.78	**TFEE**	56.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	5.61	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£133	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 236 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 236 - EPC	**Prop Type Ref**	Opp
Property	7 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.61	**TER**	17.08
Environmental	88 B	**% DER<TER**	20.31		
CO_2 Emissions (t/year)	1.23	**DFEE**	51.78	**TFEE**	56.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	13.61	$kgCO_2/yr/m^2$	
TER	17.08	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.61	$kgCO_2/yr/m^2$	
Reduction DER/TER	20.31	%	
CfSH ENE1 credits achieved	3.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.78	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	18.77	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.43	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 237 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 237 - EPC	**Prop Type Ref**	Opp
Property	5 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	14.05	**TER**	18.02
Environmental	89 B	**% DER<TER**	22.04		
CO_2 Emissions (t/year)	0.99	**DFEE**	51.23	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.02	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.05	$kgCO_2/m^2$	Pass
	-3.97 (-22.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.23	$kWh/m^2/yr$	
	-2.9 (-5.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	5.05 m², No overhang		
Windows facing East	0.71 m², No overhang		
Windows facing South	7.61 m², No overhang		
Windows facing West	0.71 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	0.81	kW	

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 237 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 237 - EPC	**Prop Type Ref**	Opp
Property	5 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	14.05	**TER**	18.02
Environmental	89 B	**% DER<TER**	22.04		
CO_2 Emissions (t/year)	0.99	**DFEE**	51.23	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.02 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.00 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 5.05 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 7.61 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3543	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4163	(22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5725	0.5567	0.5567	0.5537	0.5628	0.5725	0.5795	0.5867	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.6262	47.3127	47.0054	45.5622	45.2921	44.0351	44.0351	43.8023	44.5193	45.2921	45.8384	46.4095	(38)
Heat transfer coeff	124.2306	123.9172	123.6099	122.1666	121.8966	120.6396	120.6396	120.4068	121.1238	121.8966	122.4429	123.0140	(39)
Average = Sum(39)m / 12 =												122.1653	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3007	1.2974	1.2942	1.2791	1.2763	1.2631	1.2631	1.2607	1.2682	1.2763	1.2820	1.2880	(40)
HLP (average)												1.2791	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0500	10.6334	0.7200	0.7000	0.7700	18.7554	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	152.7615	258.4121	351.5277	436.5960	493.1982	492.3300	473.4722	430.2616	380.5336	284.7858	182.5795	131.0224	(83)
Total gains	567.1121	670.4417	748.4285	809.0964	840.7944	816.1268	781.9611	745.1861	708.1412	637.0181	563.0443	532.7849	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.3897	53.5248	53.6578	54.2917	54.4120	54.9790	54.9790	55.0852	54.7592	54.4120	54.1693	53.9178	
alpha	4.5593	4.5683	4.5772	4.6194	4.6275	4.6653	4.6653	4.6723	4.6506	4.6275	4.6113	4.5945	
util living area													
	0.9980	0.9954	0.9892	0.9711	0.9204	0.7999	0.6386	0.6847	0.8838	0.9790	0.9959	0.9985	(86)
MIT	19.5562	19.7286	19.9920	20.3347	20.6542	20.8851	20.9697	20.9579	20.7979	20.3809	19.9042	19.5280	(87)
Th 2	19.8403	19.8429	19.8454	19.8572	19.8595	19.8698	19.8698	19.8718	19.8658	19.8595	19.8550	19.8503	(88)
util rest of house													
	0.9973	0.9938	0.9852	0.9589	0.8838	0.7081	0.4940	0.5438	0.8173	0.9678	0.9942	0.9980	(89)
MIT 2	17.9270	18.1803	18.5651	19.0654	19.5053	19.7882	19.8583	19.8537	19.6972	19.1384	18.4458	17.8926	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1753	18.4163	18.7826	19.2589	19.6805	19.9554	20.0277	20.0220	19.8650	19.3278	18.6681	18.1419	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1753	18.4163	18.7826	19.2589	19.6805	19.9554	20.0277	20.0220	19.8650	19.3278	18.6681	18.1419	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9908	0.9797	0.9503	0.8766	0.7161	0.5157	0.5644	0.8172	0.9604	0.9914	0.9968	(94)
Useful gains	564.7130	664.2692	733.2371	768.8835	737.0144	584.4006	403.2655	420.5703	578.6971	611.7989	558.1979	531.0754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1723.7406	1674.9068	1518.2542	1265.5101	972.7926	646.0717	413.5162	436.1167	698.2756	1063.8939	1416.4330	1715.0474	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	862.3165	679.1485	584.0527	357.5711	175.4190	0.0000	0.0000	0.0000	0.0000	336.3587	617.9293	880.8751	(98)
Space heating												4493.6710	(98)
Space heating per m2											(98) / (4) =	47.0492	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4816.3676	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	862.3165	679.1485	584.0527	357.5711	175.4190	0.0000	0.0000	0.0000	0.0000	336.3587	617.9293	880.8751	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	924.2406	727.9191	625.9944	383.2488	188.0161	0.0000	0.0000	0.0000	0.0000	360.5130	662.3037	944.1320	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6808	89.6241	89.5152	89.2711	88.7140	86.7000	86.7000	86.7000	86.7000	89.1973	89.5572	89.7066	(217)
Fuel for water heating, kWh/month													
	191.7595	168.1869	174.6361	153.8902	149.5015	133.3829	124.9657	141.4577	142.5727	159.8698	172.2221	186.0592	(219)
Water heating fuel used												1898.5044	(219)
Annual totals kWh/year													
Space heating fuel - main system												4816.3676	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6506.0387	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4816.3676	0.2160	1040.3354	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.5044	0.2160	410.0769	(264)
Space and water heating			1450.4124	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1342.0279	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.0500	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		31.4129	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.4129	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0500	10.6334	0.6300	0.7000	0.7700	16.4110	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	7.6100	46.7521	0.6300	0.7000	0.7700	108.7320	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	133.6663	226.1106	307.5867	382.0215	431.5485	430.7887	414.2882	376.4789	332.9669	249.1876	159.7571	114.6446	(83)
Total gains	561.1705	651.2974	717.6522	767.0523	791.0121	765.7921	733.9906	703.2775	673.1144	614.5941	553.3844	529.5643	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9982	0.9959	0.9902	0.9729	0.9225	0.7977	0.6302	0.6748	0.8810	0.9794	0.9961	0.9986	(86)
MIT	19.7011	19.8573	20.0976	20.4094	20.7010	20.9070	20.9779	20.9689	20.8328	20.4557	20.0189	19.6731	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9976	0.9944	0.9865	0.9618	0.8879	0.7104	0.4959	0.5433	0.8167	0.9688	0.9945	0.9982	(89)
MIT 2	18.2023	18.4317	18.7827	19.2378	19.6391	19.8900	19.9482	19.9448	19.8129	19.3097	18.6755	18.1672	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4307	18.6490	18.9831	19.4164	19.8009	20.0450	20.1052	20.1009	19.9684	19.4844	18.8803	18.3968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4307	18.6490	18.9831	19.4164	19.8009	20.0450	20.1052	20.1009	19.9684	19.4844	18.8803	18.3968	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9918	0.9818	0.9543	0.8819	0.7188	0.5162	0.5628	0.8178	0.9622	0.9921	0.9971	(94)
Useful gains	559.0299	645.9803	704.6157	732.0064	697.6154	550.4228	378.8794	395.7828	550.4840	591.3657	548.9866	528.0298	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1598.7574	1552.0783	1406.0686	1172.2478	901.2307	600.2151	386.3812	407.2650	649.1844	988.3878	1315.7682	1592.2429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	773.5573	608.8979	521.8809	316.9738	151.4898	0.0000	0.0000	0.0000	0.0000	295.3844	552.0827	791.7746	(98)
Space heating												4012.0413	(98)
Space heating per m2											(98) / (4) =	42.0065	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4295.5475	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.5573	608.8979	521.8809	316.9738	151.4898	0.0000	0.0000	0.0000	0.0000	295.3844	552.0827	791.7746	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	828.2198	651.9249	558.7590	339.3724	162.1946	0.0000	0.0000	0.0000	0.0000	316.2574	591.0950	847.7244	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0262	87.8144	87.4040	86.5496	84.7927	80.3000	80.3000	80.3000	80.3000	86.2661	87.5567	88.1114	(217)
Fuel for water heating, kWh/month													
	239.8340	211.9269	223.6783	200.4247	198.0672	184.2067	176.4840	196.7383	198.9111	210.7506	219.4523	233.8668	(219)
Water heating fuel used												2494.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4295.5475	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7280.5870	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4295.5475	0.2160	927.8383	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2494.3409	0.2160	538.7776	(264)
Space and water heating			1466.6159	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1721.2885	(272)
Emissions per m2 for space and water heating			15.3556	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3556 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.0200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 237 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 237 - EPC	**Prop Type Ref**	Opp
Property	5 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	14.05	**TER**	18.02
Environmental	89 B	**% DER<TER**	22.04		
CO_2 Emissions (t/year)	0.99	**DFEE**	51.23	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.02	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.05	$kgCO_2/m^2$	Pass
	-3.97 (-22.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.23	$kWh/m^2/yr$	
	-2.9 (-5.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	5.05 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	7.61 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 237 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 237 - EPC	**Prop Type Ref**	Opp
Property	5 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	14.05	**TER**	18.02
Environmental	89 B	**% DER<TER**	22.04		
CO_2 Emissions (t/year)	0.99	**DFEE**	51.23	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
D2 (W9)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	5.00	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£113	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 237 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 237 - EPC	**Prop Type Ref**	Opp
Property	5 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	14.05	**TER**	18.02
Environmental	89 B	**% DER<TER**	22.04		
CO_2 Emissions (t/year)	0.99	**DFEE**	51.23	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	14.05	$kgCO_2/yr/m^2$	
TER	18.02	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.04	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.23	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.27	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	16.46	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.82	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.82	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 238 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 238 - EPC	**Prop Type Ref**	Opp
Property	3 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.86	**TER**	18.02
Environmental	89 B	**% DER<TER**	23.09		
CO_2 Emissions (t/year)	0.98	**DFEE**	50.43	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.02	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.86	$kgCO_2/m^2$	Pass
	-4.16 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.43	$kWh/m^2/yr$	
	-3.7 (-6.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	5.05 m², No overhang		
Windows facing East	0.71 m², No overhang		
Windows facing South	7.61 m², No overhang		
Windows facing West	0.71 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	0.81	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 238 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 238 - EPC	**Prop Type Ref**	Opp
Property	3 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.86	**TER**	18.02
Environmental	89 B	**% DER<TER**	23.09		
CO_2 Emissions (t/year)	0.98	**DFEE**	50.43	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.02 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.86 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.01 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 5.05 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 7.61 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3674	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3123	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3981	0.3903	0.3825	0.3435	0.3357	0.2966	0.2966	0.2888	0.3123	0.3357	0.3513	0.3669	(22b)
Effective ac	0.5793	0.5762	0.5732	0.5590	0.5563	0.5440	0.5440	0.5417	0.5488	0.5563	0.5617	0.5673	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.8228	45.5793	45.3407	44.2199	44.0102	43.0339	43.0339	42.8532	43.4100	44.0102	44.4344	44.8779	(38)
Heat transfer coeff	122.4273	122.1838	121.9452	120.8243	120.6146	119.6384	119.6384	119.4576	120.0144	120.6146	121.0389	121.4824	(39)
Average = Sum(39)m / 12 =												120.8233	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2818	1.2793	1.2768	1.2650	1.2628	1.2526	1.2526	1.2507	1.2566	1.2628	1.2673	1.2719	(40)
HLP (average)												1.2650	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0500	10.6334	0.7200	0.7000	0.7700	18.7554	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	152.7615	258.4121	351.5277	436.5960	493.1982	492.3300	473.4722	430.2616	380.5336	284.7858	182.5795	131.0224	(83)
Total gains	567.1121	670.4417	748.4285	809.0964	840.7944	816.1268	781.9611	745.1861	708.1412	637.0181	563.0443	532.7849	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1762	54.2841	54.3903	54.8949	54.9903	55.4390	55.4390	55.5229	55.2653	54.9903	54.7976	54.5975	
alpha	4.6117	4.6189	4.6260	4.6597	4.6660	4.6959	4.6959	4.7015	4.6844	4.6660	4.6532	4.6398	
util living area													
	0.9980	0.9954	0.9891	0.9706	0.9189	0.7971	0.6349	0.6813	0.8819	0.9787	0.9959	0.9985	(86)
MIT	19.5802	19.7513	20.0120	20.3483	20.6636	20.8889	20.9711	20.9596	20.8036	20.3921	19.9201	19.5485	(87)
Th 2	19.8551	19.8571	19.8591	19.8683	19.8701	19.8781	19.8781	19.8796	19.8750	19.8701	19.8665	19.8629	(88)
util rest of house													
	0.9974	0.9938	0.9850	0.9584	0.8820	0.7054	0.4916	0.5414	0.8151	0.9675	0.9942	0.9980	(89)
MIT 2	17.9722	18.2232	18.6036	19.0927	19.5260	19.7993	19.8671	19.8623	19.7113	19.1619	18.4769	17.9312	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.2174	18.4561	18.8183	19.2841	19.6994	19.9654	20.0354	20.0296	19.8778	19.3495	18.6969	18.1778	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2174	18.4561	18.8183	19.2841	19.6994	19.9654	20.0354	20.0296	19.8778	19.3495	18.6969	18.1778	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9908	0.9796	0.9498	0.8751	0.7136	0.5131	0.5619	0.8153	0.9601	0.9914	0.9968	(94)
Useful gains	564.7381	664.2831	733.1640	768.5014	735.7508	582.3742	401.2431	418.6902	577.3574	611.6123	558.2100	531.0946	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1703.8649	1656.3401	1502.1580	1254.6540	964.8437	641.9059	411.0044	433.5806	693.4224	1055.3119	1403.6810	1698.0538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	847.5103	666.6623	572.1315	350.0299	170.4451	0.0000	0.0000	0.0000	0.0000	330.1125	608.7391	868.2176	(98)
Space heating												4413.8484	(98)
Space heating per m2											(98) / (4) =	46.2135	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4730.8128 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	847.5103	666.6623	572.1315	350.0299	170.4451	0.0000	0.0000	0.0000	0.0000	330.1125	608.7391	868.2176	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	908.3712	714.5362	613.2170	375.1660	182.6850	0.0000	0.0000	0.0000	0.0000	353.8183	652.4535	930.5655	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6719	89.6138	89.5025	89.2554	88.6885	86.7000	86.7000	86.7000	86.7000	89.1829	89.5483	89.6994	(217)
Fuel for water heating, kWh/month													
	191.7786	168.2061	174.6610	153.9174	149.5446	133.3829	124.9657	141.4577	142.5727	159.8956	172.2391	186.0741	(219)
Water heating fuel used												1898.6956	(219)
Annual totals kWh/year													
Space heating fuel - main system												4730.8128	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6420.6751	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4730.8128	0.2160	1021.8556	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.6956	0.2160	410.1182	(264)
Space and water heating			1431.9738	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1323.5893	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.8600	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		31.2229	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.2229	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0500	10.6334	0.6300	0.7000	0.7700	16.4110	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	7.6100	46.7521	0.6300	0.7000	0.7700	108.7320	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	133.6663	226.1106	307.5867	382.0215	431.5485	430.7887	414.2882	376.4789	332.9669	249.1876	159.7571	114.6446	(83)
Total gains	561.1705	651.2974	717.6522	767.0523	791.0121	765.7921	733.9906	703.2775	673.1144	614.5941	553.3844	529.5643	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9982	0.9959	0.9902	0.9729	0.9225	0.7977	0.6302	0.6748	0.8810	0.9794	0.9961	0.9986	(86)
MIT	19.7011	19.8573	20.0976	20.4094	20.7010	20.9070	20.9779	20.9689	20.8328	20.4557	20.0189	19.6731	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9976	0.9944	0.9865	0.9618	0.8879	0.7104	0.4959	0.5433	0.8167	0.9688	0.9945	0.9982	(89)
MIT 2	18.2023	18.4317	18.7827	19.2378	19.6391	19.8900	19.9482	19.9448	19.8129	19.3097	18.6755	18.1672	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4307	18.6490	18.9831	19.4164	19.8009	20.0450	20.1052	20.1009	19.9684	19.4844	18.8803	18.3968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4307	18.6490	18.9831	19.4164	19.8009	20.0450	20.1052	20.1009	19.9684	19.4844	18.8803	18.3968	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9918	0.9818	0.9543	0.8819	0.7188	0.5162	0.5628	0.8178	0.9622	0.9921	0.9971	(94)
Useful gains	559.0299	645.9803	704.6157	732.0064	697.6154	550.4228	378.8794	395.7828	550.4840	591.3657	548.9866	528.0298	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1598.7574	1552.0783	1406.0686	1172.2478	901.2307	600.2151	386.3812	407.2650	649.1844	988.3878	1315.7682	1592.2429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	773.5573	608.8979	521.8809	316.9738	151.4898	0.0000	0.0000	0.0000	0.0000	295.3844	552.0827	791.7746	(98)
Space heating												4012.0413	(98)
Space heating per m2											(98) / (4) =	42.0065	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4295.5475	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.5573	608.8979	521.8809	316.9738	151.4898	0.0000	0.0000	0.0000	0.0000	295.3844	552.0827	791.7746	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	828.2198	651.9249	558.7590	339.3724	162.1946	0.0000	0.0000	0.0000	0.0000	316.2574	591.0950	847.7244	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0262	87.8144	87.4040	86.5496	84.7927	80.3000	80.3000	80.3000	80.3000	86.2661	87.5567	88.1114	(217)
Fuel for water heating, kWh/month													
	239.8340	211.9269	223.6783	200.4247	198.0672	184.2067	176.4840	196.7383	198.9111	210.7506	219.4523	233.8668	(219)
Water heating fuel used												2494.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4295.5475	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7280.5870	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4295.5475	0.2160	927.8383	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2494.3409	0.2160	538.7776	(264)
Space and water heating			1466.6159	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1721.2885	(272)
Emissions per m2 for space and water heating			15.3556	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3556 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.0200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 238 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 238 - EPC	**Prop Type Ref**	Opp
Property	3 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.86	**TER**	18.02
Environmental	89 B	**% DER<TER**	23.09		
CO_2 Emissions (t/year)	0.98	**DFEE**	50.43	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.02	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.86	$kgCO_2/m^2$	Pass
	-4.16 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.43	$kWh/m^2/yr$	
	-3.7 (-6.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	5.05 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	7.61 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 238 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 238 - EPC	**Prop Type Ref**	Opp
Property	3 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.86	**TER**	18.02
Environmental	89 B	**% DER<TER**	23.09		
CO_2 Emissions (t/year)	0.98	**DFEE**	50.43	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	North							2.12	100
D2 (W9)	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.01	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£112	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 238 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 238 - EPC	**Prop Type Ref**	Opp
Property	3 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	88 B	**DER**	13.86	**TER**	18.02
Environmental	89 B	**% DER<TER**	23.09		
CO_2 Emissions (t/year)	0.98	**DFEE**	50.43	**TFEE**	54.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	13.86	$kgCO_2/yr/m^2$	
TER	18.02	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.86	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.09	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	50.43	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.05	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.41	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	16.25	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.61	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.61	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 239 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 239 - EPC	**Prop Type Ref**	As
Property	12 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.71
Environmental	88 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.06	**TFEE**	59.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.71	$kgCO_2/m^2$	Pass
	-4.00 (-21.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.47	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.06	$kWh/m^2/yr$	
	-5.4 (-9.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.94 m², No overhang
Windows facing South East	1.31 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	5.25 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	6.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 239 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 239 - EPC	**Prop Type Ref**	As
Property	12 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.71
Environmental	88 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.06	**TFEE**	59.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.28 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.94 m², No overhang
Windows facing South East: 1.31 m², No overhang
Windows facing South: 1.02 m², No overhang
Windows facing South West: 5.25 m², No overhang
Windows facing West: 1.02 m², No overhang
Windows facing North West: 6.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.4191	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3248	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4141	0.4060	0.3979	0.3573	0.3491	0.3085	0.3085	0.3004	0.3248	0.3491	0.3654	0.3816	(22b)
Effective ac	0.5857	0.5824	0.5791	0.5638	0.5610	0.5476	0.5476	0.5451	0.5527	0.5610	0.5668	0.5728	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2500	1.2357	26.2595			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1900	9.3632			(28a)
External Wall	142.9500	25.4900	117.4600	0.2700	31.7142			(29a)
Main Roof	47.9200		47.9200	0.1600	7.6672			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5625			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1602	(36)
Total fabric heat loss (33) + (36) =	86.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1269	46.8590	46.5964	45.3631	45.1324	44.0582	44.0582	43.8593	44.4720	45.1324	45.5992	46.0872	(38)
Heat transfer coeff	133.8496	133.5817	133.3191	132.0859	131.8551	130.7810	130.7810	130.5821	131.1947	131.8551	132.3219	132.8099	(39)
Average = Sum(39)m / 12 =												132.0848	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3771	1.3743	1.3716	1.3589	1.3565	1.3455	1.3455	1.3434	1.3497	1.3565	1.3613	1.3664	(40)
HLP (average)												1.3589	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8152	10.6622	11.7823	11.3641	11.7138	11.3025	11.6584	11.6944	11.3361	11.7534	11.4085	11.8046	(61)
Total heat required for water heating calculated for each month													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
								Total per year (kWh/year) = Sum(64)m =				1689.8333	(64)
Heat gains from water heating, kWh/month													
	56.4402	49.4451	51.2179	44.9260	43.3100	37.6718	35.2047	39.9769	40.3299	46.6362	50.5517	54.7498	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4536	19.9431	16.2188	12.2787	9.1785	7.7489	8.3729	10.8834	14.6077	18.5478	21.6481	23.0777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	75.8605	73.5790	68.8412	62.3972	58.2123	52.3219	47.3182	53.7325	56.0138	62.6831	70.2107	73.5885	(72)
Total internal gains													
	416.7149	414.5350	399.4906	375.0934	350.1195	326.1744	310.6881	317.0009	329.5888	354.2112	382.5280	403.9605	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9400	11.2829	0.7200	0.7000	0.7700	23.4084	(75)
Southeast	1.3100	36.7938	0.7200	0.7000	0.7700	16.8349	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	5.2500	36.7938	0.7200	0.7000	0.7700	67.4680	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	6.7100	11.2829	0.7200	0.7000	0.7700	26.4429	(81)

Solar gains	157.8070	286.0383	436.5907	615.8424	757.4872	781.6090	741.2495	631.1674	498.0322	328.3798	192.1685	133.0029	(83)
Total gains	574.5219	700.5733	836.0813	990.9358	1107.6067	1107.7834	1051.9376	948.1682	827.6210	682.5910	574.6965	536.9634	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.4297	50.5309	50.6304	51.1031	51.1926	51.6130	51.6130	51.6916	51.4502	51.1926	51.0120	50.8245	
alpha	4.3620	4.3687	4.3754	4.4069	4.4128	4.4409	4.4409	4.4461	4.4300	4.4128	4.4008	4.3883	
util living area													
	0.9980	0.9950	0.9853	0.9500	0.8542	0.6876	0.5294	0.6002	0.8504	0.9763	0.9959	0.9985	(86)
MIT	19.4580	19.6506	19.9698	20.3886	20.7391	20.9297	20.9827	20.9706	20.8122	20.3437	19.8212	19.4243	(87)
Th 2	19.7810	19.7831	19.7852	19.7950	19.7968	19.8054	19.8054	19.8070	19.8021	19.7968	19.7931	19.7892	(88)
util rest of house													
	0.9973	0.9932	0.9799	0.9306	0.8000	0.5852	0.3944	0.4605	0.7724	0.9638	0.9941	0.9980	(89)
MIT 2	17.7437	18.0260	18.4903	19.0903	19.5492	19.7610	19.7995	19.7956	19.6535	19.0402	18.2829	17.7000	(90)
Living area fraction									fLA = Living area / (4) =			0.2037	(91)
MIT	18.0929	18.3570	18.7917	19.3548	19.7916	19.9991	20.0406	20.0350	19.8895	19.3057	18.5962	18.0512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0929	18.3570	18.7917	19.3548	19.7916	19.9991	20.0406	20.0350	19.8895	19.3057	18.5962	18.0512	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9900	0.9735	0.9215	0.7997	0.6032	0.4221	0.4888	0.7792	0.9565	0.9914	0.9968	(94)
Useful gains	572.0849	693.5606	813.9318	913.1778	885.7310	668.1732	443.9717	463.4681	644.8957	652.8943	569.7396	535.2500	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1846.1745	1797.6054	1638.7169	1380.9283	1066.9157	706.0938	449.9585	474.6600	759.5555	1147.8899	1521.2039	1839.5812	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	947.9227	741.9181	613.6400	336.7803	134.8015	0.0000	0.0000	0.0000	0.0000	368.2768	685.0543	970.4225	(98)
Space heating												4798.8161	(98)
Space heating per m2											(98) / (4) =	49.3705	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5143.4257	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	947.9227	741.9181	613.6400	336.7803	134.8015	0.0000	0.0000	0.0000	0.0000	368.2768	685.0543	970.4225	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1015.9943	795.1962	657.7064	360.9650	144.4817	0.0000	0.0000	0.0000	0.0000	394.7232	734.2489	1040.1098	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7259	89.6691	89.5427	89.2235	88.4744	86.7000	86.7000	86.7000	86.7000	89.2624	89.6139	89.7512	(217)
Fuel for water heating, kWh/month													
	192.4489	168.7899	175.2931	154.5952	150.5091	133.9135	125.4573	142.0220	143.1438	160.3984	172.8146	186.7275	(219)
Water heating fuel used												1906.1133	(219)
Annual totals kWh/year													
Space heating fuel - main system												5143.4257	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.5383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												6870.4877	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5143.4257	0.2160	1110.9799	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1906.1133	0.2160	411.7205	(264)
Space and water heating			1522.7004	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.5383	0.5190	205.8034	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total CO2, kg/year			1429.7728	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7100	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		31.9500	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9500	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1230	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3730	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.3200	118.6300	0.1800	21.3534			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8598			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.1035	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7982	123.5859	123.3778	122.4006	122.2178	121.3666	121.3666	121.2090	121.6945	122.2178	122.5876	122.9743	(39)
Average = Sum(39)m / 12 =												122.3997	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2736	1.2715	1.2693	1.2593	1.2574	1.2486	1.2486	1.2470	1.2520	1.2574	1.2612	1.2652	(40)
HLP (average)												1.2593	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5307	20.0116	16.2745	12.3209	9.2100	7.7755	8.4017	10.9208	14.6579	18.6115	21.7224	23.1569	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9451	427.7602	412.7105	387.7375	362.0872	337.4735	321.9963	328.9811	342.2506	367.4488	395.7644	417.1964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6100	11.2829	0.6300	0.7000	0.7700	19.3445	(75)
Southeast	1.2400	36.7938	0.6300	0.7000	0.7700	13.9434	(77)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
Southwest	4.9600	36.7938	0.6300	0.7000	0.7700	55.7736	(79)
West	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(80)
Northwest	6.3500	11.2829	0.6300	0.7000	0.7700	21.8962	(81)

Solar gains	130.4364	236.4366	360.9079	509.1287	626.2652	646.2232	612.8485	521.8118	411.7125	271.4425	158.8398	109.9333 (83)
Total gains	560.3815	664.1967	773.6184	896.8662	988.3524	983.6967	934.8448	850.7928	753.9631	638.8914	554.6042	527.1297 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5242	54.6179	54.7100	55.1468	55.2293	55.6166	55.6166	55.6889	55.4668	55.2293	55.0626	54.8895	
alpha	4.6349	4.6412	4.6473	4.6765	4.6820	4.7078	4.7078	4.7126	4.6978	4.6820	4.6708	4.6593	
util living area													
	0.9983	0.9959	0.9884	0.9599	0.8763	0.7158	0.5529	0.6215	0.8658	0.9797	0.9964	0.9987	(86)
MIT	19.5750	19.7444	20.0313	20.4125	20.7436	20.9311	20.9838	20.9727	20.8227	20.3886	19.9096	19.5431	(87)
Th 2	19.8615	19.8633	19.8649	19.8729	19.8744	19.8813	19.8813	19.8826	19.8786	19.8744	19.8714	19.8682	(88)
util rest of house													
	0.9977	0.9945	0.9840	0.9441	0.8284	0.6185	0.4216	0.4868	0.7946	0.9690	0.9949	0.9983	(89)
MIT 2	17.9691	18.2174	18.6355	19.1841	19.6241	19.8360	19.8755	19.8715	19.7340	19.1604	18.4651	17.9269	(90)
Living area fraction									fLA = Living area / (4) =			0.2037	(91)
MIT	18.2962	18.5285	18.9198	19.4344	19.8522	20.0591	20.1013	20.0958	19.9557	19.4106	18.7594	18.2561	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2962	18.5285	18.9198	19.4344	19.8522	20.0591	20.1013	20.0958	19.9557	19.4106	18.7594	18.2561	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9919	0.9789	0.9361	0.8273	0.6353	0.4484	0.5141	0.8005	0.9628	0.9926	0.9972	(94)
Useful gains	558.3523	658.8114	757.2857	839.5758	817.6677	624.9619	419.2118	437.3733	603.5183	615.1125	550.5080	525.6797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1732.7032	1684.2861	1532.3269	1289.4120	996.3396	662.5533	424.9388	447.9654	712.6102	1076.8093	1429.2944	1728.5422	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	873.7171	689.1190	576.6306	323.8820	132.9319	0.0000	0.0000	0.0000	0.0000	343.5024	632.7262	894.9297	(98)
Space heating												4467.4390	(98)
Space heating per m2											(98) / (4) =	45.9613	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4783.1252	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	873.7171	689.1190	576.6306	323.8820	132.9319	0.0000	0.0000	0.0000	0.0000	343.5024	632.7262	894.9297	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	935.4573	737.8148	617.3776	346.7688	142.3253	0.0000	0.0000	0.0000	0.0000	367.7756	677.4370	958.1689	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2345	88.0393	87.6033	86.5905	84.4588	80.3000	80.3000	80.3000	80.3000	86.6215	87.8205	88.3154	(217)
Fuel for water heating, kWh/month													
	240.0651	212.0845	223.8941	201.2101	199.7236	185.0158	177.2592	197.6025	199.7848	210.5494	219.5074	234.0979	(219)
Water heating fuel used												2500.7943	(219)
Annual totals kWh/year													
Space heating fuel - main system												4783.1252	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9000	(232)
Total delivered energy for all uses												7756.8196	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4783.1252	0.2160	1033.1551	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2500.7943	0.2160	540.1716	(264)
Space and water heating			1573.3266	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9000	0.5190	206.5101	(268)
Total CO2, kg/m2/year			1818.7617	(272)
Emissions per m2 for space and water heating			16.1865	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1246	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1865 * 1.00) + 2.1246 + 0.4005, rounded to 2 d.p.			18.7100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 239 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 239 - EPC	**Prop Type Ref**	As
Property	12 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.71
Environmental	88 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.06	**TFEE**	59.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.71	$kgCO_2/m^2$	Pass
	-4.00 (-21.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.47	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.06	$kWh/m^2/yr$	
	-5.4 (-9.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.94 m², No overhang
Windows facing South East	1.31 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	5.25 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	6.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 239 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 239 - EPC	**Prop Type Ref**	As
Property	12 Grouse Road, Boorley Green, Southampton, SO32 2XB		

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Environmental	88 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.06	**TFEE**	59.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	49.28 m²	2.39 m
1st Storey:	1.00 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	142.95	117.46

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.92	47.92
Bay Roof	External Slope Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	49.28

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3a	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.02	10
W3b	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	10
W3c	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.31	10
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.31	10
D1	Half Glazed Door	[1] External Wall	North West				2.12	10
D2*	Half Glazed Door	[1] External Wall	South East				2.12	10
D3 (W14)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		3.32	10

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.060	No
Independently assessed	E3 Sill	14.79	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.84	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value 0.021 W/m²K

18.0 Pressure Testing Yes

Designed AP_{50} 4.50 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP_{50} 4.28 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather: Windows fully open

Cross ventilation possible: Yes

Night Ventilation: No

Air change rate: 8.00

Mechanical Ventilation

Mechanical Ventilation System Present: No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£55	B 88	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 239 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 239 - EPC	**Prop Type Ref**	As
Property	12 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.71
Environmental	88 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	1.08	**DFEE**	54.06	**TFEE**	59.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	14.71	$kgCO_2/yr/m^2$	
TER	18.71	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.71	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.39	%	
CfSH ENE1 credits achieved	3.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	20.65	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 240 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 240 - EPC	**Prop Type Ref**	As
Property	10 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.12	**TER**	16.54
Environmental	91 B	**% DER<TER**	32.78		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.50	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.12	$kgCO_2/m^2$	Pass
	-5.42 (-32.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.50	$kWh/m^2/yr$	
	-6.3 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.28 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

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Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	7.61 m², No overhang
Windows facing South West	5.73 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.28 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.3	m³/m²h
Photovoltaic array	1.62	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 240 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 240 - EPC	**Prop Type Ref**	As
Property	10 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.12	**TER**	16.54
Environmental	91 B	**% DER<TER**	32.78		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.50	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.12 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.5 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.28 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.61 m², No overhang
Windows facing South West: 5.73 m², No overhang
Windows facing North West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.3 m³/m²h
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			3.2800	
Infiltration rate			0.2875	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2444	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3116	0.3055	0.2994	0.2689	0.2627	0.2322	0.2322	0.2261	0.2444	0.2627	0.2750	0.2872	(22b)
Effective ac	0.5486	0.5467	0.5448	0.5361	0.5345	0.5270	0.5270	0.5256	0.5299	0.5345	0.5378	0.5412	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.6108	58.4093	58.2119	57.2844	57.1109	56.3031	56.3031	56.1535	56.6142	57.1109	57.4619	57.8289	(38)
Heat transfer coeff	135.2083	135.0068	134.8094	133.8819	133.7084	132.9006	132.9006	132.7510	133.2117	133.7084	134.0594	134.4264	(39)
Average = Sum(39)m / 12 =												133.8811	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0962	1.0946	1.0930	1.0855	1.0841	1.0775	1.0775	1.0763	1.0800	1.0841	1.0869	1.0899	(40)
HLP (average)												1.0855	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)
```

5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)
```

6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data        factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                7.6100            11.2829            0.7200           0.7000           0.7700           29.9896 (75)
Southwest                                5.7300            36.7938            0.7200           0.7000           0.7700           73.6365 (79)
Northwest                                1.4200            11.2829            0.7200           0.7000           0.7700            5.5960 (81)
Northeast                                0.6500            16.3666            0.7200           0.7000           1.0000            4.8255 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    114.0476   207.7973   320.4428   457.8932   568.6339   589.1042   557.7250   471.3113   367.4235   239.3831   139.0627    96.0117 (83)
Total gains    579.7081   670.9222   766.3731   876.0404   958.1752   951.5985   903.0325   823.4502   734.2038   634.1810   565.9408   547.3249 (84)
```

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          63.3488    63.4433    63.5362    63.9764    64.0594    64.4488    64.4488    64.5214    64.2982    64.0594    63.8917    63.7172
alpha         5.2233     5.2296     5.2357     5.2651     5.2706     5.2966     5.2966     5.3014     5.2865     5.2706     5.2594     5.2478
util living area
              0.9994     0.9985     0.9955     0.9816     0.9278     0.7905     0.6231     0.6953     0.9189     0.9913     0.9987     0.9996 (86)

MIT          19.7092    19.8434    20.0830    20.4144    20.7268    20.9241    20.9830    20.9706    20.8114    20.4128    20.0000    19.6825 (87)
Th 2          20.0039    20.0053    20.0066    20.0127    20.0139    20.0192    20.0192    20.0202    20.0172    20.0139    20.0115    20.0091 (88)
util rest of house
              0.9992     0.9980     0.9937     0.9738     0.8959     0.7060     0.4965     0.5692     0.8692     0.9864     0.9981     0.9994 (89)
MIT 2         18.2649    18.4621    18.8129    19.2964    19.7280    19.9645    20.0124    20.0068    19.8477    19.2992    18.6960    18.2296 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1432 (91)
MIT           18.4717    18.6599    18.9947    19.4565    19.8711    20.1019    20.1514    20.1448    19.9857    19.4586    18.8827    18.4376 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT  18.4717    18.6599    18.9947    19.4565    19.8711    20.1019    20.1514    20.1448    19.9857    19.4586    18.8827    18.4376 (93)
```

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9986     0.9969     0.9911     0.9677     0.8902     0.7139     0.5145     0.5865     0.8672     0.9824     0.9971     0.9990 (94)
Useful gains  578.9229   668.8339   759.5591   847.7854   852.9621   679.3879   464.6095   482.9630   636.7015   623.0118   564.2953   546.7766 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1916.1277  1857.6761  1684.4048  1413.3216  1092.5381   731.2074   471.9828   497.1203   784.0381  1184.4737  1579.5836  1913.9123 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             994.8804   798.9020   688.0852   407.1861   178.2446     0.0000     0.0000     0.0000     0.0000   417.7276   731.0076  1017.1489 (98)
Space heating                                                                                                                    5233.1825 (98)
Space heating per m2                                                                                                 (98) / (4) =    42.4289 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5608.9844	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	994.8804	798.9020	688.0852	407.1861	178.2446	0.0000	0.0000	0.0000	0.0000	417.7276	731.0076	1017.1489	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1066.3241	856.2722	737.4976	436.4267	191.0446	0.0000	0.0000	0.0000	0.0000	447.7252	783.5023	1090.1918	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7318	89.6887	89.5887	89.3362	88.6932	86.7000	86.7000	86.7000	86.7000	89.3279	89.6299	89.7563	(217)
Fuel for water heating, kWh/month													
	199.5016	174.9355	181.5898	159.9941	155.5445	138.6856	129.8794	147.0972	148.2792	166.0792	179.0919	193.5574	(219)
Water heating fuel used												1974.2354	(219)
Annual totals kWh/year													
Space heating fuel - main system												5608.9844	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	(233)
Total delivered energy for all uses												7069.7135	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5608.9844	0.2160	1211.5406	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.2354	0.2160	426.4349	(264)
Space and water heating			1637.9755	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1371.4657	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.1200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.1200	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.5531	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5531	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northwest	1.4200	11.2829	0.6300	0.7000	0.7700	4.8965	(81)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	99.7917	181.8227	280.3875	400.6566	497.5547	515.4662	488.0094	412.3974	321.4955	209.4602	121.6798	84.0102	(83)
Total gains	578.6008	658.1000	739.4779	831.9744	899.6501	889.8251	845.1891	777.0975	701.4570	617.4284	561.7159	548.4758	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9994	0.9987	0.9961	0.9845	0.9384	0.8091	0.6414	0.7095	0.9255	0.9920	0.9987	0.9996	(86)
MIT	19.7413	19.8672	20.0949	20.4160	20.7195	20.9214	20.9826	20.9707	20.8139	20.4292	20.0319	19.7225	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9992	0.9982	0.9946	0.9779	0.9102	0.7285	0.5163	0.5862	0.8792	0.9876	0.9982	0.9994	(89)
MIT 2	18.3261	18.5120	18.8461	19.3190	19.7424	19.9918	20.0427	20.0378	19.8765	19.3430	18.7609	18.3050	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9972	0.9923	0.9726	0.9044	0.7357	0.5340	0.6031	0.8770	0.9839	0.9972	0.9990	(94)
Useful gains	577.8433	656.2436	733.7926	809.1585	813.6417	654.6138	451.3259	468.6689	615.1932	607.4636	560.1618	547.9403	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1881.1100	1820.5264	1647.4242	1374.5385	1061.0308	708.8994	459.0015	482.9549	761.5117	1153.8975	1542.7213	1872.6961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating												5122.5094	(98)
Space heating per m2											(98) / (4) =	41.5316	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5484.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1038.1482	837.6852	727.7751	435.8390	197.0637	0.0000	0.0000	0.0000	0.0000	435.2750	757.4334	1055.2659	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3589	88.2115	87.8695	87.0325	85.1737	80.3000	80.3000	80.3000	80.3000	86.9476	87.9763	88.4246	(217)
Fuel for water heating, kWh/month													
	246.8872	217.9432	229.7139	207.8124	205.8363	192.2923	184.2307	205.3740	207.3721	215.7044	225.5320	240.7379	(219)
Water heating fuel used												2579.4365	(219)
Annual totals kWh/year													
Space heating fuel - main system												5484.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8639.3803	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5484.4855	0.2160	1184.6489	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.4365	0.2160	557.1583	(264)
Space and water heating			1741.8071	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2040.4700	(272)
Emissions per m2 for space and water heating			14.1220	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1220 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.5400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 240 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 240 - EPC	**Prop Type Ref**	As
Property	10 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.12	**TER**	16.54
Environmental	91 B	**% DER<TER**	32.78		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.50	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.12	$kgCO_2/m^2$	Pass
	-5.42 (-32.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.50	$kWh/m^2/yr$	
	-6.3 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.28 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West Windows facing North West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.28 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.3	m³/m²h
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 240 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 240 - EPC	**Prop Type Ref**	As
Property	10 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.12	**TER**	16.54
Environmental	91 B	**% DER<TER**	32.78		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.50	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.28	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£53	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 240 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 240 - EPC	**Prop Type Ref**	As
Property	10 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.12	**TER**	16.54
Environmental	91 B	**% DER<TER**	32.78		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.50	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.90		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	11.12	$kgCO_2/yr/m^2$	
TER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.12	$kgCO_2/yr/m^2$	
Reduction DER/TER	32.78	%	
CfSH ENE1 credits achieved	4.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	46.50	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.62	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.05	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.05	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	13.04	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.47	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.47	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 241- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 241 - EPC	**Prop Type Ref**	Opp
Property	8 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	10.94	**TER**	16.42
Environmental	91 B	**% DER<TER**	33.37		
CO_2 Emissions (t/year)	0.93	**DFEE**	45.73	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.94	$kgCO_2/m^2$	Pass
	-5.48 (-33.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.73	$kWh/m^2/yr$	
	-6.5 (-12.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.05 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.05 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.1	m³/m²h
Photovoltaic array	1.62	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 241- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 241 - EPC	**Prop Type Ref**	Opp
Property	8 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	10.94	**TER**	16.42
Environmental	91 B	**% DER<TER**	33.37		
CO_2 Emissions (t/year)	0.93	**DFEE**	45.73	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.94 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.26 (max. 0.30)        0.27 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           0.18 (max. 0.25)        0.18 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.32 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         3.05 (measured in this dwelling)
Maximum                                 10.0                                    OK
-------------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
-------------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
-------------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing North East:              7.61 m², No overhang
Windows facing South East:              1.42 m², No overhang
Windows facing South West:              5.73 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Thermal bridging y-value                0.027 W/m²K
Air permeability                        3.1 m³/m²h
Photovoltaic array                      1.62 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			3.0500	
Infiltration rate			0.2760	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2346	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2992	0.2933	0.2874	0.2581	0.2522	0.2229	0.2229	0.2170	0.2346	0.2522	0.2640	0.2757	(22b)
Effective ac	0.5447	0.5430	0.5413	0.5333	0.5318	0.5248	0.5248	0.5236	0.5275	0.5318	0.5348	0.5380	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2041	58.0185	57.8365	56.9817	56.8218	56.0773	56.0773	55.9394	56.3641	56.8218	57.1453	57.4835	(38)
Heat transfer coeff	134.8016	134.6160	134.4340	133.5792	133.4193	132.6748	132.6748	132.5369	132.9616	133.4193	133.7428	134.0810	(39)
Average = Sum(39)m / 12 =												133.5784	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0929	1.0914	1.0899	1.0830	1.0817	1.0757	1.0757	1.0746	1.0780	1.0817	1.0843	1.0871	(40)
HLP (average)												1.0830	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m													
	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8285	10.6738	11.7943	11.3835	11.7328	11.3182	11.6730	11.7118	11.3533	11.7643	11.4203	11.8175	(61)
Total heat required for water heating calculated for each month													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
								Total per year (kWh/year) = Sum(64)m =				1751.0299	(64)
Heat gains from water heating, kWh/month													
	58.5471	51.2878	53.1194	46.5860	44.9029	39.0462	36.4783	41.4386	41.8089	48.3575	52.4307	56.7903	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	78.6923	76.3211	71.3970	64.7028	60.3533	54.2308	49.0300	55.6970	58.0679	64.9967	72.8204	76.3310	(72)
Total internal gains													
	465.6605	463.1249	445.9303	418.1472	389.5413	362.4942	345.3075	352.1389	366.7803	394.7980	426.8781	451.3133	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.7200	0.7000	0.7700	29.9896	(75)
Southeast	1.4200	36.7938	0.7200	0.7000	0.7700	18.2485	(77)
Southwest	5.7300	36.7938	0.7200	0.7000	0.7700	73.6365	(79)
Northeast	0.6500	16.3666	0.7200	0.7000	1.0000	4.8255	(82)

Solar gains	126.7002	227.4905	342.4508	476.8867	582.3547	599.4033	569.0371	487.0650	388.4679	259.8171	153.8790	107.0586	(83)
Total gains	592.3607	690.6154	788.3810	895.0338	971.8960	961.8975	914.3446	839.2038	755.2483	654.6150	580.7571	558.3719	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5399	63.6275	63.7136	64.1213	64.1982	64.5584	64.5584	64.6256	64.4192	64.1982	64.0429	63.8813	
alpha	5.2360	5.2418	5.2476	5.2748	5.2799	5.3039	5.3039	5.3084	5.2946	5.2799	5.2695	5.2588	
util living area													
	0.9993	0.9983	0.9948	0.9798	0.9239	0.7846	0.6157	0.6844	0.9106	0.9899	0.9985	0.9995	(86)
MIT	19.7233	19.8626	20.1031	20.4300	20.7357	20.9271	20.9840	20.9728	20.8228	20.4298	20.0142	19.6948	(87)
Th 2	20.0066	20.0078	20.0091	20.0147	20.0158	20.0207	20.0207	20.0217	20.0188	20.0158	20.0136	20.0114	(88)
util rest of house													
	0.9991	0.9977	0.9929	0.9713	0.8908	0.6996	0.4902	0.5590	0.8579	0.9844	0.9979	0.9993	(89)
MIT 2	18.2875	18.4920	18.8439	19.3200	19.7406	19.9685	20.0144	20.0093	19.8617	19.3248	18.7183	18.2492	(90)
Living area fraction										fLA = Living area / (4) =		0.1432	(91)
MIT	18.4931	18.6882	19.0242	19.4789	19.8831	20.1058	20.1532	20.1473	19.9993	19.4831	18.9039	18.4562	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4931	18.6882	19.0242	19.4789	19.8831	20.1058	20.1532	20.1473	19.9993	19.4831	18.9039	18.4562	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9900	0.9650	0.8854	0.7079	0.5080	0.5763	0.8566	0.9800	0.9967	0.9989	(94)
Useful gains	591.4778	688.1755	780.4914	863.7493	860.4805	680.9041	464.5112	483.6574	646.9548	641.5419	578.8645	557.7602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1913.2496	1856.1139	1683.6786	1413.1229	1091.7781	730.4762	471.4201	496.6517	784.3831	1185.1709	1578.6822	1911.4828	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	983.3982	784.8546	671.9713	395.5490	172.0854	0.0000	0.0000	0.0000	0.0000	404.4600	719.8687	1007.1697	(98)
Space heating												5139.3568	(98)
Space heating per m2											(98) / (4) =	41.6682	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5508.4210	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	983.3982	784.8546	671.9713	395.5490	172.0854	0.0000	0.0000	0.0000	0.0000	404.4600	719.8687	1007.1697	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1054.0174	841.2161	720.2264	423.9539	184.4431	0.0000	0.0000	0.0000	0.0000	433.5048	771.5635	1079.4959	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7262	89.6796	89.5751	89.3156	88.6619	86.7000	86.7000	86.7000	86.7000	89.3049	89.6215	89.7517	(217)
Fuel for water heating, kWh/month													
	199.5140	174.9532	181.6175	160.0310	155.5995	138.6856	129.8794	147.0972	148.2792	166.1221	179.1087	193.5672	(219)
Water heating fuel used												1974.4546	(219)
Annual totals kWh/year													
Space heating fuel - main system												5508.4210	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	(233)
Total delivered energy for all uses												6969.3693	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5508.4210	0.2160	1189.8189	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.4546	0.2160	426.4822	(264)
Space and water heating			1616.3011	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1349.7913	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.9400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		10.9400	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.3731	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.3731	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southeast	1.4200	36.7938	0.6300	0.7000	0.7700	15.9674	(77)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	110.8627	199.0542	299.6444	417.2758	509.5604	524.4779	497.9075	426.1818	339.9094	227.3400	134.6441	93.6763	(83)
Total gains	589.6718	675.3315	758.7348	848.5937	911.6558	898.8368	855.0872	790.8819	719.8709	635.3081	574.6802	558.1419	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9985	0.9956	0.9832	0.9354	0.8044	0.6352	0.7001	0.9186	0.9909	0.9986	0.9995	(86)
MIT	19.7498	19.8804	20.1094	20.4278	20.7261	20.9237	20.9833	20.9725	20.8232	20.4424	20.0419	19.7299	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9979	0.9939	0.9760	0.9062	0.7232	0.5107	0.5771	0.8696	0.9859	0.9980	0.9994	(89)
MIT 2	18.3386	18.5313	18.8672	19.3356	19.7507	19.9938	20.0431	20.0388	19.8870	19.3618	18.7754	18.3159	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9968	0.9914	0.9704	0.9005	0.7306	0.5283	0.5940	0.8679	0.9819	0.9969	0.9989	(94)
Useful gains	588.8285	673.1906	752.2252	823.5068	820.9833	656.6634	451.7589	469.7955	624.7993	623.8013	572.9157	557.5499	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1882.6830	1822.9545	1650.0764	1376.6060	1062.0731	709.1654	459.0559	483.0963	762.8438	1156.2358	1544.5305	1874.0602	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating												5056.0502	(98)
Space heating per m2											(98) / (4) =	40.9928	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5413.3300	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1030.6506	827.2391	715.2048	426.3720	192.0458	0.0000	0.0000	0.0000	0.0000	424.1234	748.9964	1048.6977	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3470	88.1899	87.8363	86.9830	85.1087	80.3000	80.3000	80.3000	80.3000	86.8884	87.9556	88.4146	(217)
Fuel for water heating, kWh/month													
	246.9203	217.9966	229.8007	207.9306	205.9935	192.2923	184.2307	205.3740	207.3721	215.8514	225.5851	240.7649	(219)
Water heating fuel used												2580.1123	(219)
Annual totals kWh/year													
Space heating fuel - main system												5413.3300	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	500.4584	(232)
Total delivered energy for all uses	8568.9006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5413.3300	0.2160	1169.2793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2580.1123	0.2160	557.3042	(264)
Space and water heating			1726.5835	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2025.2464	(272)
Emissions per m2 for space and water heating			13.9986	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9986 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 241- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 241 - EPC	**Prop Type Ref**	Opp
Property	8 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	10.94	**TER**	16.42
Environmental	91 B	**% DER<TER**	33.37		
CO_2 Emissions (t/year)	0.93	**DFEE**	45.73	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.94	$kgCO_2/m^2$	Pass
	-5.48 (-33.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.73	$kWh/m^2/yr$	
	-6.5 (-12.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.05 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.05 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.1	m³/m²h
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 241- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 241 - EPC	**Prop Type Ref**	Opp
Property	8 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	10.94	**TER**	16.42
Environmental	91 B	**% DER<TER**	33.37		
CO_2 Emissions (t/year)	0.93	**DFEE**	45.73	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.05	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£53	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 241- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 241 - EPC	**Prop Type Ref**	Opp
Property	8 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	10.94	**TER**	16.42
Environmental	91 B	**% DER<TER**	33.37		
CO_2 Emissions (t/year)	0.93	**DFEE**	45.73	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	10.94	$kgCO_2/yr/m^2$	
TER	16.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	10.94	$kgCO_2/yr/m^2$	
Reduction DER/TER	33.37	%	
CfSH ENE1 credits achieved	4.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	45.73	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.86	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.86	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.85	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.28	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.28	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 242- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 242 - EPC	**Prop Type Ref**	As
Property	6 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.08	**TER**	16.54
Environmental	91 B	**% DER<TER**	33.02		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.30	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.08	$kgCO_2/m^2$	Pass
	-5.46 (-33.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.30	$kWh/m^2/yr$	
	-6.5 (-12.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West Windows facing North West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.0	m³/m²h
Photovoltaic array	1.62	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 242- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 242 - EPC	**Prop Type Ref**	As
Property	6 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.08	**TER**	16.54
Environmental	91 B	**% DER<TER**	33.02		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.30	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.08 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.00 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.61 m², No overhang
Windows facing South West: 5.73 m², No overhang
Windows facing North West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.0 m³/m²h
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			3.0000	
Infiltration rate			0.2735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2325	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2965	0.2906	0.2848	0.2558	0.2499	0.2209	0.2209	0.2151	0.2325	0.2499	0.2616	0.2732	(22b)
Effective ac	0.5439	0.5422	0.5406	0.5327	0.5312	0.5244	0.5244	0.5231	0.5270	0.5312	0.5342	0.5373	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.1179	57.9356	57.7569	56.9175	56.7605	56.0294	56.0294	55.8941	56.3110	56.7605	57.0782	57.4103	(38)
Heat transfer coeff	134.7154	134.5331	134.3544	133.5150	133.3580	132.6269	132.6269	132.4916	132.9085	133.3580	133.6757	134.0078	(39)
Average = Sum(39)m / 12 =												133.5143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0922	1.0907	1.0893	1.0825	1.0812	1.0753	1.0753	1.0742	1.0776	1.0812	1.0838	1.0865	(40)
HLP (average)												1.0825	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m        143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                7.6100           11.2829           0.7200           0.7000           0.7700           29.9896 (75)
Southwest                                5.7300           36.7938           0.7200           0.7000           0.7700           73.6365 (79)
Northwest                                1.4200           11.2829           0.7200           0.7000           0.7700            5.5960 (81)
Northeast                                0.6500           16.3666           0.7200           0.7000           1.0000            4.8255 (82)
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Solar gains    114.0476   207.7973   320.4428   457.8932   568.6339   589.1042   557.7250   471.3113   367.4235   239.3831   139.0627    96.0117 (83)
Total gains    579.7081   670.9222   766.3731   876.0404   958.1752   951.5985   903.0325   823.4502   734.2038   634.1810   565.9408   547.3249 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          63.5805    63.6667    63.7514    64.1522    64.2277    64.5817    64.5817    64.6477    64.4449    64.2277    64.0751    63.9163
alpha         5.2387     5.2444     5.2501     5.2768     5.2818     5.3054     5.3054     5.3098     5.2963     5.2818     5.2717     5.2611
util living area
               0.9994     0.9985     0.9955     0.9815     0.9274     0.7897     0.6221     0.6944     0.9185     0.9912     0.9987     0.9996 (86)

MIT           19.7146    19.8484    20.0874    20.4174    20.7289    20.9249    20.9832    20.9709    20.8127    20.4153    20.0035    19.6871 (87)
Th 2          20.0072    20.0084    20.0096    20.0152    20.0162    20.0211    20.0211    20.0220    20.0192    20.0162    20.0141    20.0119 (88)
util rest of house
               0.9992     0.9980     0.9937     0.9737     0.8954     0.7052     0.4959     0.5685     0.8687     0.9864     0.9981     0.9994 (89)
MIT 2         18.2751    18.4717    18.8215    19.3026    19.7327    19.9669    20.0143    20.0086    19.8509    19.3045    18.7030    18.2383 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1432 (91)
MIT           18.4812    18.6689    19.0028    19.4622    19.8753    20.1041    20.1531    20.1464    19.9886    19.4635    18.8892    18.4457 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.4812    18.6689    19.0028    19.4622    19.8753    20.1041    20.1531    20.1464    19.9886    19.4635    18.8892    18.4457 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9987     0.9969     0.9911     0.9677     0.8898     0.7132     0.5138     0.5858     0.8668     0.9824     0.9971     0.9990 (94)
Useful gains 578.9262   668.8376   759.5535   847.7049   852.5613   678.7009   463.9645   482.3821   636.3928   622.9933   564.2980   546.7789 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1910.4261  1852.3663  1679.8036  1410.2140  1090.2412   729.9869   471.2330   496.3693   782.6507  1182.0233  1575.9321  1909.0410 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             990.6359   795.3313   684.6661   405.0066   176.8339     0.0000     0.0000     0.0000     0.0000   415.9183   728.3766  1013.5230 (98)
Space heating                                                                                                                 5210.2917 (98)
Space heating per m2                                                                                          (98) / (4) =     42.2433 (99)


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```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5584.4498	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	990.6359	795.3313	684.6661	405.0066	176.8339	0.0000	0.0000	0.0000	0.0000	415.9183	728.3766	1013.5230	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1061.7748	852.4452	733.8329	434.0907	189.5325	0.0000	0.0000	0.0000	0.0000	445.7860	780.6823	1086.3055	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7298	89.6864	89.5858	89.3324	88.6862	86.7000	86.7000	86.7000	86.7000	89.3249	89.6279	89.7547	(217)
Fuel for water heating, kWh/month													
	199.5061	174.9400	181.5956	160.0009	155.5569	138.6856	129.8794	147.0972	148.2792	166.0849	179.0958	193.5609	(219)
Water heating fuel used												1974.2826	(219)
Annual totals kWh/year													
Space heating fuel - main system												5584.4498	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	(233)
Total delivered energy for all uses												7045.2261	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5584.4498	0.2160	1206.2412	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.2826	0.2160	426.4450	(264)
Space and water heating			1632.6862	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1366.1764	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.0800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.0800	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.5131	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5131	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northwest	1.4200	11.2829	0.6300	0.7000	0.7700	4.8965	(81)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	99.7917	181.8227	280.3875	400.6566	497.5547	515.4662	488.0094	412.3974	321.4955	209.4602	121.6798	84.0102	(83)
Total gains	578.6008	658.1000	739.4779	831.9744	899.6501	889.8251	845.1891	777.0975	701.4570	617.4284	561.7159	548.4758	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9994	0.9987	0.9961	0.9845	0.9384	0.8091	0.6414	0.7095	0.9255	0.9920	0.9987	0.9996	(86)
MIT	19.7413	19.8672	20.0949	20.4160	20.7195	20.9214	20.9826	20.9707	20.8139	20.4292	20.0319	19.7225	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9992	0.9982	0.9946	0.9779	0.9102	0.7285	0.5163	0.5862	0.8792	0.9876	0.9982	0.9994	(89)
MIT 2	18.3261	18.5120	18.8461	19.3190	19.7424	19.9918	20.0427	20.0378	19.8765	19.3430	18.7609	18.3050	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5288	18.7060	19.0249	19.4761	19.8823	20.1249	20.1773	20.1714	20.0107	19.4985	18.9429	18.5079	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9972	0.9923	0.9726	0.9044	0.7357	0.5340	0.6031	0.8770	0.9839	0.9972	0.9990	(94)
Useful gains	577.8433	656.2436	733.7926	809.1585	813.6417	654.6138	451.3259	468.6689	615.1932	607.4636	560.1618	547.9403	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1881.1100	1820.5264	1647.4242	1374.5385	1061.0308	708.8994	459.0015	482.9549	761.5117	1153.8975	1542.7213	1872.6961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating												5122.5094	(98)
Space heating per m2											(98) / (4) =	41.5316	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5484.4855	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	969.6304	782.3980	679.7419	407.0736	184.0575	0.0000	0.0000	0.0000	0.0000	406.5468	707.4428	985.6184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1038.1482	837.6852	727.7751	435.8390	197.0637	0.0000	0.0000	0.0000	0.0000	435.2750	757.4334	1055.2659	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3589	88.2115	87.8695	87.0325	85.1737	80.3000	80.3000	80.3000	80.3000	86.9476	87.9763	88.4246	(217)
Fuel for water heating, kWh/month													
	246.8872	217.9432	229.7139	207.8124	205.8363	192.2923	184.2307	205.3740	207.3721	215.7044	225.5320	240.7379	(219)
Water heating fuel used												2579.4365	(219)
Annual totals kWh/year													
Space heating fuel - main system												5484.4855	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8639.3803	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5484.4855	0.2160	1184.6489	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.4365	0.2160	557.1583	(264)
Space and water heating			1741.8071	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2040.4700	(272)
Emissions per m2 for space and water heating			14.1220	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1220 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.5400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 242- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 242 - EPC	**Prop Type Ref**	As
Property	6 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.08	**TER**	16.54
Environmental	91 B	**% DER<TER**	33.02		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.30	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.08	$kgCO_2/m^2$	Pass
	-5.46 (-33.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.78	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.30	$kWh/m^2/yr$	
	-6.5 (-12.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South West Windows facing North West	7.61 m², No overhang 5.73 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.00 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.0	m³/m²h
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 242- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 242 - EPC	**Prop Type Ref**	As
Property	6 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.08	**TER**	16.54
Environmental	91 B	**% DER<TER**	33.02		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.30	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No
17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.00	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£53	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 242- BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 242 - EPC	**Prop Type Ref**	As
Property	6 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.08	**TER**	16.54
Environmental	91 B	**% DER<TER**	33.02		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.30	**TFEE**	52.78
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	11.08	$kgCO_2/yr/m^2$	
TER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.08	$kgCO_2/yr/m^2$	
Reduction DER/TER	33.02	%	
CfSH ENE1 credits achieved	4.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	46.30	$kWh/m^2/yr$
CfSH ENE2 credits achieved	6.9	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.00	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.00	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.99	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 243 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 243 - EPC	**Prop Type Ref**	Opp
Property	4 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.15	**TER**	16.42
Environmental	91 B	**% DER<TER**	32.10		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.70	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.15	$kgCO_2/m^2$	Pass
	-5.27 (-32.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.70	$kWh/m^2/yr$	
	-5.5 (-10.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

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Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 243 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 243 - EPC	**Prop Type Ref**	Opp
Property	4 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.15	**TER**	16.42
Environmental	91 B	**% DER<TER**	32.10		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.70	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 123 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.15 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.31 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.61 m², No overhang
Windows facing South East: 1.42 m², No overhang
Windows facing South West: 5.73 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3390	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2882	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3674	0.3602	0.3530	0.3170	0.3098	0.2738	0.2738	0.2666	0.2882	0.3098	0.3242	0.3386	(22b)
Effective ac	0.5675	0.5649	0.5623	0.5502	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5573	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			14.7600	1.2357	18.2395			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1900	0.6555			(29a)
External Wall	102.1000	14.7200	87.3800	0.2700	23.5926			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.2300	6.0467			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1600	9.3872			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.1808			(33)
Party Wall			71.3800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4167	(36)
Total fabric heat loss (33) + (36) =	76.5975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.6355	60.3555	60.0809	58.7915	58.5502	57.4272	57.4272	57.2192	57.8597	58.5502	59.0383	59.5485	(38)
Heat transfer coeff	137.2331	136.9530	136.6784	135.3890	135.1477	134.0247	134.0247	133.8167	134.4573	135.1477	135.6358	136.1460	(39)
Average = Sum(39)m / 12 =												135.3878	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1126	1.1104	1.1081	1.0977	1.0957	1.0866	1.0866	1.0849	1.0901	1.0957	1.0997	1.1038	(40)
HLP (average)												1.0977	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8753 (42)
Average daily hot water use (litres/day)	102.4895 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              25.0782    21.9335    22.6334    19.7324    18.9337    16.3383    15.1399    17.3732    17.5807    20.4886    22.3649    24.2869 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8285    10.6738    11.7943    11.3835    11.7328    11.3182    11.6730    11.7118    11.3533    11.7643    11.4203    11.8175 (61)
Total heat required for water heating calculated for each month
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             179.0164   156.8973   162.6839   142.9327   137.9574   120.2404   112.6054   127.5332   128.5581   148.3551   160.5199   173.7300 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1751.0299 (64)
Heat gains from water heating, kWh/month
              58.5471    51.2878    53.1194    46.5860    44.9029    39.0462    36.4783    41.4386    41.8089    48.3575    52.4307    56.7903 (65)
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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673   143.7673 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.3380    25.1696    20.4693    15.4966    11.5839     9.7796    10.5672    13.7356    18.4359    23.4086    27.3213    29.1256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             289.4999   292.5040   284.9338   268.8176   248.4739   229.3536   216.5801   213.5760   221.1463   237.2624   257.6062   276.7264 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767    37.3767 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139  -115.0139 (71)
Water heating gains (Table 5)
              78.6923    76.3211    71.3970    64.7028    60.3533    54.2308    49.0300    55.6970    58.0679    64.9967    72.8204    76.3310 (72)
Total internal gains
             465.6605   463.1249   445.9303   418.1472   389.5413   362.4942   345.3075   352.1389   366.7803   394.7980   426.8781   451.3133 (73)
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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
Northeast                                7.6100           11.2829           0.7200           0.7000           0.7700           29.9896 (75)
Southeast                                1.4200           36.7938           0.7200           0.7000           0.7700           18.2485 (77)
Southwest                                5.7300           36.7938           0.7200           0.7000           0.7700           73.6365 (79)
Northeast                                0.6500           16.3666           0.7200           0.7000           1.0000            4.8255 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains    126.7002   227.4905   342.4508   476.8867   582.3547   599.4033   569.0371   487.0650   388.4679   259.8171   153.8790   107.0586 (83)
Total gains    592.3607   690.6154   788.3810   895.0338   971.8960   961.8975   914.3446   839.2038   755.2483   654.6150   580.7571   558.3719 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                        21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           62.4141    62.5417    62.6674    63.2642    63.3771    63.9082    63.9082    64.0075    63.7026    63.3771    63.1491    62.9124
alpha          5.1609     5.1694     5.1778     5.2176     5.2251     5.2605     5.2605     5.2672     5.2468     5.2251     5.2099     5.1942
util living area
               0.9993     0.9983     0.9949     0.9802     0.9259     0.7885     0.6206     0.6889     0.9127     0.9901     0.9985     0.9995 (86)

MIT           19.6968    19.8376    20.0812    20.4150    20.7254    20.9235    20.9828    20.9712    20.8164    20.4175    19.9968    19.6722 (87)
Th 2          19.9905    19.9924    19.9942    20.0027    20.0043    20.0118    20.0118    20.0132    20.0089    20.0043    20.0011    19.9977 (88)
util rest of house
               0.9991     0.9977     0.9929     0.9718     0.8932     0.7034     0.4935     0.5623     0.8604     0.9846     0.9979     0.9993 (89)
MIT 2         18.2372    18.4445    18.8012    19.2896    19.7180    19.9568    20.0049    20.0001    19.8458    19.2987    18.6838    18.2063 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1432 (91)
MIT           18.4462    18.6440    18.9845    19.4507    19.8622    20.0952    20.1450    20.1391    19.9848    19.4589    18.8718    18.4162 (92)
Temperature adjustment                                                                                                             0.0000
adjusted MIT  18.4462    18.6440    18.9845    19.4507    19.8622    20.0952    20.1450    20.1391    19.9848    19.4589    18.8718    18.4162 (93)
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8. Space heating requirement

```
                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9985     0.9964     0.9900     0.9655     0.8875     0.7114     0.5115     0.5798     0.8588     0.9802     0.9967     0.9989 (94)
Useful gains 591.4606   688.1575   780.5306   864.1919   862.5293   684.3261   467.6992   486.5575   648.6167   641.6578   578.8511   557.7479 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1941.3250  1882.2763  1706.3589  1428.4510  1103.1083   736.4941   475.1123   500.3550   791.2477  1197.2623  1596.6782  1935.4762 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1004.2991   802.4479   688.8163   406.2666   178.9908     0.0000     0.0000     0.0000     0.0000   413.3697   732.8355  1025.0298 (98)
Space heating                                                                                                                     5252.0556 (98)
Space heating per m2                                                                                                 (98) / (4) =    42.5819 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5629.2129	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1004.2991	802.4479	688.8163	406.2666	178.9908	0.0000	0.0000	0.0000	0.0000	413.3697	732.8355	1025.0298	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1076.4192	860.0727	738.2811	435.4411	191.8443	0.0000	0.0000	0.0000	0.0000	443.0544	785.4614	1098.6386	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.0164	156.8973	162.6839	142.9327	137.9574	120.2404	112.6054	127.5332	128.5581	148.3551	160.5199	173.7300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7363	89.6909	89.5893	89.3346	88.6969	86.7000	86.7000	86.7000	86.7000	89.3205	89.6313	89.7599	(217)
Fuel for water heating, kWh/month													
	199.4916	174.9311	181.5886	159.9970	155.5380	138.6856	129.8794	147.0972	148.2792	166.0931	179.0892	193.5497	(219)
Water heating fuel used												1974.2197	(219)
Annual totals kWh/year													
Space heating fuel - main system												5629.2129	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-1088.9647	
PV Unit 1 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-1088.9647	(233)
Total delivered energy for all uses												7089.9262	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5629.2129	0.2160	1215.9100	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.2197	0.2160	426.4314	(264)
Space and water heating			1642.3414	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Energy saving/generation technologies				
PV Unit	-1088.9647	0.5190	-565.1727	(269)
Total CO2, kg/year			1375.8316	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.1500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.1500	ZC1
Total Floor Area	TFA	123.3400	
Assumed number of occupants	N	2.8753	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9088	ZC2
CO2 emissions from cooking, equation (L16)		1.5243	ZC3
Total CO2 emissions		26.5831	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5831	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	44.0400 (1c)	x	2.6400 (2c)	=	116.2656	(1c) - (3c)
Second floor	35.2600 (1d)	x	2.9000 (2d)	=	102.2540	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.7752	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1235	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3735	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3175	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4048	0.3969	0.3890	0.3493	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3572	0.3731	(22b)
Effective ac	0.5819	0.5788	0.5756	0.5610	0.5583	0.5455	0.5455	0.5431	0.5504	0.5583	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7600	1.3258	19.5682			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9000	1.4500	3.4500	0.1800	0.6210			(29a)
External Wall	102.1000	14.7200	87.3800	0.1800	15.7284			(29a)
Smart Gable	27.0000	0.7100	26.2900	0.1800	4.7322			(29a)
Sloping roof	59.3200	0.6500	58.6700	0.1300	7.6271			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Total net area of external elements Aum(A, m2)			239.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8641			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1625	(36)
Total fabric heat loss					(33) + (36) =		70.0266	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1781	61.8381	61.5049	59.9397	59.6468	58.2835	58.2835	58.0311	58.8086	59.6468	60.2392	60.8586	(38)
Heat transfer coeff	132.2047	131.8648	131.5315	129.9663	129.6734	128.3102	128.3102	128.0577	128.8353	129.6734	130.2659	130.8852	(39)
Average = Sum(39)m / 12 =												129.9649	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0719	1.0691	1.0664	1.0537	1.0513	1.0403	1.0403	1.0382	1.0446	1.0513	1.0562	1.0612	(40)
HLP (average)												1.0537	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8753	(42)
Average daily hot water use (litres/day)												102.4895	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7384	108.6389	104.5393	100.4397	96.3401	92.2405	92.2405	96.3401	100.4397	104.5393	108.6389	112.7384	(44)
Energy conte	167.1878	146.2236	150.8896	131.5492	126.2246	108.9222	100.9325	115.8215	117.2048	136.5908	149.0996	161.9125	(45)
Energy content (annual)										Total = Sum(45)m =		1612.5588	(45)
Distribution loss (46)m = 0.15 x (45)m													

	25.0782	21.9335	22.6334	19.7324	18.9337	16.3383	15.1399	17.3732	17.5807	20.4886	22.3649	24.2869	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.0939	45.4885	47.0048	49.0939	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
								Total per year (kWh/year) = Sum(64)m =				2201.0480	(64)
Heat gains from water heating, kWh/month													
	68.3297	60.1262	62.9105	56.0689	54.2432	47.5888	45.3112	50.7841	51.2994	58.1562	61.9044	66.5756	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	143.7673	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3380	25.1696	20.4693	15.4966	11.5839	9.7796	10.5672	13.7356	18.4359	23.4086	27.3213	29.1256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	289.4999	292.5040	284.9338	268.8176	248.4739	229.3536	216.5801	213.5760	221.1463	237.2624	257.6062	276.7264	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	37.3767	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	-115.0139	(71)
Water heating gains (Table 5)													
	91.8410	89.4735	84.5572	77.8735	72.9075	66.0955	60.9022	68.2582	71.2491	78.1669	85.9783	89.4834	(72)
Total internal gains													
	478.8091	476.2773	459.0904	431.3179	402.0954	374.3589	357.1797	364.7001	379.9615	407.9682	440.0360	464.4656	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6100	11.2829	0.6300	0.7000	0.7700	26.2409	(75)
Southeast	1.4200	36.7938	0.6300	0.7000	0.7700	15.9674	(77)
Southwest	5.7300	36.7938	0.6300	0.7000	0.7700	64.4320	(79)
Northeast	0.6500	16.3666	0.6300	0.7000	1.0000	4.2223	(82)

Solar gains	110.8627	199.0542	299.6444	417.2758	509.5604	524.4779	497.9075	426.1818	339.9094	227.3400	134.6441	93.6763	(83)
Total gains	589.6718	675.3315	758.7348	848.5937	911.6558	898.8368	855.0872	790.8819	719.8709	635.3081	574.6802	558.1419	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.7880	64.9550	65.1196	65.9038	66.0527	66.7545	66.7545	66.8861	66.4824	66.0527	65.7523	65.4411	
alpha	5.3192	5.3303	5.3413	5.3936	5.4035	5.4503	5.4503	5.4591	5.4322	5.4035	5.3835	5.3627	
util living area													
	0.9993	0.9985	0.9956	0.9832	0.9354	0.8044	0.6352	0.7001	0.9186	0.9909	0.9986	0.9995	(86)
MIT	19.7498	19.8804	20.1094	20.4278	20.7261	20.9237	20.9833	20.9725	20.8232	20.4424	20.0419	19.7299	(87)
Th 2	20.0239	20.0261	20.0284	20.0388	20.0408	20.0499	20.0499	20.0516	20.0464	20.0408	20.0368	20.0327	(88)
util rest of house													
	0.9991	0.9979	0.9939	0.9760	0.9062	0.7232	0.5107	0.5771	0.8696	0.9859	0.9980	0.9994	(89)
MIT 2	18.3386	18.5313	18.8672	19.3356	19.7507	19.9938	20.0431	20.0388	19.8870	19.3618	18.7754	18.3159	(90)
Living area fraction									fLA = Living area / (4) =			0.1432	(91)
MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5407	18.7244	19.0451	19.4920	19.8904	20.1270	20.1777	20.1725	20.0211	19.5165	18.9568	18.5183	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9968	0.9914	0.9704	0.9005	0.7306	0.5283	0.5940	0.8679	0.9819	0.9969	0.9989	(94)
Useful gains	588.8285	673.1906	752.2252	823.5068	820.9833	656.6634	451.7589	469.7955	624.7993	623.8013	572.9157	557.5499	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1882.6830	1822.9545	1650.0764	1376.6060	1062.0731	709.1654	459.0559	483.0963	762.8438	1156.2358	1544.5305	1874.0602	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating												5056.0502	(98)
Space heating per m2											(98) / (4) =	40.9928	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5413.3300	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	962.6277	772.6413	668.0013	398.2314	179.3708	0.0000	0.0000	0.0000	0.0000	396.1313	699.5627	979.4837	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1030.6506	827.2391	715.2048	426.3720	192.0458	0.0000	0.0000	0.0000	0.0000	424.1234	748.9964	1048.6977	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.1468	192.2510	201.8485	180.8643	175.3185	154.4107	147.9372	164.9154	166.5198	187.5498	198.4147	212.8714	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3470	88.1899	87.8363	86.9830	85.1087	80.3000	80.3000	80.3000	80.3000	86.8884	87.9556	88.4146	(217)
Fuel for water heating, kWh/month													
	246.9203	217.9966	229.8007	207.9306	205.9935	192.2923	184.2307	205.3740	207.3721	215.8514	225.5851	240.7649	(219)
Water heating fuel used												2580.1123	(219)
Annual totals kWh/year													
Space heating fuel - main system												5413.3300	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												500.4584	(232)
Total delivered energy for all uses												8568.9006	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5413.3300	0.2160	1169.2793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2580.1123	0.2160	557.3042	(264)
Space and water heating			1726.5835	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	500.4584	0.5190	259.7379	(268)
Total CO2, kg/m2/year			2025.2464	(272)
Emissions per m2 for space and water heating			13.9986	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1059	(272b)
Emissions per m2 for pumps and fans			0.3156	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9986 * 1.00) + 2.1059 + 0.3156, rounded to 2 d.p.			16.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 243 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 243 - EPC	**Prop Type Ref**	Opp
Property	4 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.15	**TER**	16.42
Environmental	91 B	**% DER<TER**	32.10		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.70	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.15	$kgCO_2/m^2$	Pass
	-5.27 (-32.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.16	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.70	$kWh/m^2/yr$	
	-5.5 (-10.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.61 m², No overhang 1.42 m², No overhang 5.73 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 243 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 243 - EPC	**Prop Type Ref**	Opp
Property	4 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.15	**TER**	16.42
Environmental	91 B	**% DER<TER**	32.10		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.70	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.77 m	44.04 m²	2.39 m
1st Storey:	19.67 m	44.04 m²	2.64 m
2nd Storey:	15.78 m	35.26 m²	2.90 m

7.0 Living Area	17.66	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Dormer Wall	Cavity Wall	0.19	4.90	3.45
External Wall	Cavity Wall	0.27	102.10	87.38
Smart Gable	Cavity Wall	0.23	27.00	26.29

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	71.38

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping roof	External Slope Roof	0.16	59.32	58.67
Dormer roof	External Flat Roof	0.16	2.18	2.18

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.18	44.04

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Window	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Rooflight	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W5	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W6	Window	[1] Dormer Wall	South West	Dark-coloured curtain or roller blind	0.00					1.45	100
W7	Window	[3] Smart Gable	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W1	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.30	100
W2	Window	[2] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W3	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
W4	Window	[2] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
RL1	Roof Window	[1] Sloping roof	North East	Dark-coloured curtain or roller blind						0.65	100
D1	Half Glazed Door	[2] External Wall	South West							2.12	100
D2 w8	Window	[2] External Wall	North East	Dark-coloured curtain or roller blind	0.00					5.44	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%

16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.75	0.060	No
Independently assessed	E3 Sill	8.13	0.009	No
Independently assessed	E4 Jamb	24.30	0.011	No
Independently assessed	E5 Ground floor (normal)	18.77	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	39.34	-0.001	No
Independently assessed	E11 Eaves (insulation at rafter level)	9.47	0.030	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	13.18	0.040	No
Table K1 - Default	E14 Flat roof	4.62	0.080	No
Independently assessed	E16 Corner (normal)	15.85	0.033	No
Independently assessed	E18 Party wall between dwellings	15.85	0.023	No
Independently assessed	P1 Party wall - Ground floor	9.31	0.053	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.81	0.000	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	16.81	0.080	No
Table K1 - Default	R1 Head of roof window	0.66	0.080	No
Table K1 - Default	R2 Sill of roof window	0.66	0.060	No
Independently assessed	R3 Jamb of roof window	1.96	0.060	No
Independently assessed	R4 Ridge (vaulted ceiling)	4.73	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.32	0.040	No

Y-value	0.027	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.31	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£53	B 91	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 243 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 243 - EPC	**Prop Type Ref**	Opp
Property	4 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	90 B	**DER**	11.15	**TER**	16.42
Environmental	91 B	**% DER<TER**	32.10		
CO_2 Emissions (t/year)	0.94	**DFEE**	46.70	**TFEE**	52.16
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	123.34	m^2	
DER	11.15	$kgCO_2/yr/m^2$	
TER	16.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.15	$kgCO_2/yr/m^2$	
Reduction DER/TER	32.10	%	
CfSH ENE1 credits achieved	4.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	46.70	$kWh/m^2/yr$
CfSH ENE2 credits achieved	6.7	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	123.34	m^2	
DER	17.67	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.10	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.10	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	13.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.91	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.52	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.51	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.51	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	14	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 244 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 244 - EPC	**Prop Type Ref**	Opp
Property	2 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.12	**TER**	18.21
Environmental	89 B	**% DER<TER**	22.44		
CO_2 Emissions (t/year)	1.03	**DFEE**	51.53	**TFEE**	56.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.21	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.12	$kgCO_2/m^2$	Pass
	-4.09 (-22.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.53	$kWh/m^2/yr$	
	-5.4 (-9.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.94 m², No overhang
Windows facing South East	6.71 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	5.25 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.31 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 244 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 244 - EPC	**Prop Type Ref**	Opp
Property	2 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.12	**TER**	18.21
Environmental	89 B	**% DER<TER**	22.44		
CO_2 Emissions (t/year)	1.03	**DFEE**	51.53	**TFEE**	56.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.21 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.12 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.30 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.94 m², No overhang
Windows facing South East: 6.71 m², No overhang
Windows facing South: 1.02 m², No overhang
Windows facing South West: 5.25 m², No overhang
Windows facing West: 1.02 m², No overhang
Windows facing North West: 1.31 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2051	(8)
Pressure test			Yes	
Measured/design AP50			4.3000	
Infiltration rate			0.4201	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3256	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4151	0.4070	0.3988	0.3581	0.3500	0.3093	0.3093	0.3011	0.3256	0.3500	0.3663	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5671	0.5732	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			21.2500	1.2357	26.2595			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1900	9.3632			(28a)
External Wall	142.9500	25.4900	117.4600	0.2700	31.7142			(29a)
Main Roof	47.9200		47.9200	0.1600	7.6672			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.5625			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1602	(36)
Total fabric heat loss (33) + (36) =	86.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1598	46.8907	46.6268	45.3877	45.1558	44.0765	44.0765	43.8767	44.4923	45.1558	45.6248	46.1152	(38)
Heat transfer coeff	133.8825	133.6134	133.3496	132.1104	131.8785	130.7993	130.7993	130.5994	131.2150	131.8785	132.3476	132.8379	(39)
Average = Sum(39)m / 12 =												132.1093	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3774	1.3746	1.3719	1.3592	1.3568	1.3457	1.3457	1.3436	1.3499	1.3568	1.3616	1.3666	(40)
HLP (average)												1.3591	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8152	10.6622	11.7823	11.3641	11.7138	11.3025	11.6584	11.6944	11.3361	11.7534	11.4085	11.8046	(61)
Total heat required for water heating calculated for each month													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
Total per year (kWh/year) = Sum(64)m =												1689.8333	(64)
Heat gains from water heating, kWh/month													
	56.4402	49.4451	51.2179	44.9260	43.3100	37.6718	35.2047	39.9769	40.3299	46.6362	50.5517	54.7498	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4536	19.9431	16.2188	12.2787	9.1785	7.7489	8.3729	10.8834	14.6077	18.5478	21.6481	23.0777	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	75.8605	73.5790	68.8412	62.3972	58.2123	52.3219	47.3182	53.7325	56.0138	62.6831	70.2107	73.5885	(72)
Total internal gains													
	416.7149	414.5350	399.4906	375.0934	350.1195	326.1744	310.6881	317.0009	329.5888	354.2112	382.5280	403.9605	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.9400	11.2829	0.7200	0.7000	0.7700	23.4084	(75)
Southeast	6.7100	36.7938	0.7200	0.7000	0.7700	86.2306	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	5.2500	36.7938	0.7200	0.7000	0.7700	67.4680	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	1.3100	11.2829	0.7200	0.7000	0.7700	5.1625	(81)

Solar gains	205.9223	360.9280	520.2828	688.0709	809.6648	820.7743	784.2671	691.0756	578.0605	406.0866	248.5123	175.0125	(83)
Total gains	622.6372	775.4630	919.7734	1063.1644	1159.7843	1146.9488	1094.9553	1008.0765	907.6493	760.2978	631.0403	578.9730	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.4173	50.5189	50.6188	51.0936	51.1835	51.6058	51.6058	51.6848	51.4423	51.1835	51.0021	50.8138	
alpha	4.3612	4.3679	4.3746	4.4062	4.4122	4.4404	4.4404	4.4457	4.4295	4.4122	4.4001	4.3876	
util living area													
	0.9973	0.9925	0.9793	0.9376	0.8373	0.6704	0.5108	0.5703	0.8148	0.9656	0.9941	0.9980	(86)
MIT	19.5017	19.7176	20.0408	20.4399	20.7622	20.9364	20.9849	20.9759	20.8454	20.4065	19.8721	19.4627	(87)
Th 2	19.7807	19.7828	19.7849	19.7948	19.7966	19.8052	19.8052	19.8068	19.8019	19.7966	19.7929	19.7890	(88)
util rest of house													
	0.9963	0.9900	0.9718	0.9146	0.7800	0.5683	0.3795	0.4348	0.7296	0.9483	0.9916	0.9973	(89)
MIT 2	17.8073	18.1230	18.5911	19.1582	19.5742	19.7656	19.8002	19.7978	19.6845	19.1259	18.3564	17.7558	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.1524	18.4479	18.8864	19.4193	19.8162	20.0041	20.0415	20.0378	19.9210	19.3868	18.6652	18.1035	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1524	18.4479	18.8864	19.4193	19.8162	20.0041	20.0415	20.0378	19.9210	19.3868	18.6652	18.1035	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9858	0.9642	0.9056	0.7811	0.5866	0.4064	0.4623	0.7394	0.9403	0.9880	0.9958	(94)
Useful gains	619.0843	764.4176	886.8851	962.8360	905.9251	672.7901	444.9914	466.0765	671.1141	714.9356	623.4607	576.5198	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1854.5978	1810.1745	1651.7274	1389.7122	1070.3533	706.8522	450.1520	475.0880	763.8031	1158.7845	1530.6245	1846.9150	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	919.2220	702.7486	569.0427	307.3508	122.3346	0.0000	0.0000	0.0000	0.0000	330.2236	653.1580	945.1740	(98)
Space heating												4549.2544	(98)
Space heating per m2											(98) / (4) =	46.8030	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4875.9425	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	919.2220	702.7486	569.0427	307.3508	122.3346	0.0000	0.0000	0.0000	0.0000	330.2236	653.1580	945.1740	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	985.2326	753.2139	609.9064	329.4221	131.1196	0.0000	0.0000	0.0000	0.0000	353.9374	700.0621	1013.0483	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6765	151.3525	156.9621	137.9353	133.1620	116.1030	108.7715	123.1330	124.1057	143.1755	154.8660	167.5901	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7109	89.6404	89.4966	89.1533	88.3872	86.7000	86.7000	86.7000	86.7000	89.1801	89.5870	89.7388	(217)
Fuel for water heating, kWh/month													
	192.4811	168.8440	175.3834	154.7170	150.6575	133.9135	125.4573	142.0220	143.1438	160.5466	172.8665	186.7533	(219)
Water heating fuel used												1906.7859	(219)
Annual totals kWh/year													
Space heating fuel - main system												4875.9425	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.5383	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												6603.6771	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4875.9425	0.2160	1053.2036	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1906.7859	0.2160	411.8658	(264)
Space and water heating			1465.0693	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.5383	0.5190	205.8034	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total CO2, kg/year			1372.1417	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.1200	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		31.3600	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.3600	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800	(1b)	x 2.3900	(2b) =	117.7792	(1b) - (3b)
First floor	47.9200	(1c)	x 2.6300	(2c) =	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1230	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3730	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.3200	118.6300	0.1800	21.3534			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8598			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.1035	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7982	123.5859	123.3778	122.4006	122.2178	121.3666	121.3666	121.2090	121.6945	122.2178	122.5876	122.9743	(39)
Average = Sum(39)m / 12 =												122.3997	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2736	1.2715	1.2693	1.2593	1.2574	1.2486	1.2486	1.2470	1.2520	1.2574	1.2612	1.2652	(40)
HLP (average)												1.2593	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5307	20.0116	16.2745	12.3209	9.2100	7.7755	8.4017	10.9208	14.6579	18.6115	21.7224	23.1569	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9451	427.7602	412.7105	387.7375	362.0872	337.4735	321.9963	328.9811	342.2506	367.4488	395.7644	417.1964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.6100	11.2829	0.6300	0.7000	0.7700	19.3445	(75)
Southeast	6.3500	36.7938	0.6300	0.7000	0.7700	71.4037	(77)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
Southwest	4.9600	36.7938	0.6300	0.7000	0.7700	55.7736	(79)
West	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622	(80)
Northwest	1.2400	11.2829	0.6300	0.7000	0.7700	4.2758	(81)

Solar gains	170.2763	298.4459	430.2058	568.9346	669.4687	678.6525	648.4675	571.4163	477.9767	335.7845	205.4930	144.7176 (83)
Total gains	600.2214	726.2061	842.9163	956.6721	1031.5559	1016.1260	970.4638	900.3974	820.2273	703.2333	601.2574	561.9140 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5242	54.6179	54.7100	55.1468	55.2293	55.6166	55.6166	55.6889	55.4668	55.2293	55.0626	54.8895	
alpha	4.6349	4.6412	4.6473	4.6765	4.6820	4.7078	4.7078	4.7126	4.6978	4.6820	4.6708	4.6593	
util living area													
	0.9977	0.9941	0.9838	0.9500	0.8615	0.6996	0.5349	0.5929	0.8340	0.9710	0.9950	0.9983	(86)
MIT	19.6123	19.8015	20.0924	20.4579	20.7650	20.9375	20.9858	20.9775	20.8524	20.4426	19.9528	19.5757	(87)
Th 2	19.8615	19.8633	19.8649	19.8729	19.8744	19.8813	19.8813	19.8826	19.8786	19.8744	19.8714	19.8682	(88)
util rest of house													
	0.9969	0.9920	0.9779	0.9311	0.8106	0.6021	0.4067	0.4617	0.7557	0.9565	0.9929	0.9977	(89)
MIT 2	18.0234	18.3004	18.7227	19.2452	19.6482	19.8408	19.8763	19.8737	19.7628	19.2347	18.5278	17.9746	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.3471	18.6061	19.0017	19.4922	19.8757	20.0642	20.1023	20.0985	19.9848	19.4808	18.8181	18.3008	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3471	18.6061	19.0017	19.4922	19.8757	20.0642	20.1023	20.0985	19.9848	19.4808	18.8181	18.3008	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9887	0.9717	0.9230	0.8106	0.6193	0.4329	0.4884	0.7643	0.9496	0.9900	0.9964	(94)
Useful gains	597.3754	717.9944	819.0730	883.0352	836.2112	629.3062	420.1217	439.7204	626.9288	667.7667	595.2322	559.9182	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1739.0018	1693.8864	1542.4375	1296.4974	999.2190	663.1692	425.0679	448.2952	716.1420	1085.3856	1436.4954	1734.0321	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	849.3701	655.7995	538.1832	297.6928	121.2778	0.0000	0.0000	0.0000	0.0000	310.7085	605.7095	873.5407	(98)
Space heating												4252.2820	(98)
Space heating per m2											(98) / (4) =	43.7478	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4552.7645	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	849.3701	655.7995	538.1832	297.6928	121.2778	0.0000	0.0000	0.0000	0.0000	310.7085	605.7095	873.5407	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	909.3898	702.1408	576.2133	318.7289	129.8477	0.0000	0.0000	0.0000	0.0000	332.6643	648.5112	935.2684	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1860	87.9485	87.4617	86.3885	84.2363	80.3000	80.3000	80.3000	80.3000	86.3814	87.7358	88.2751	(217)
Fuel for water heating, kWh/month													
	240.1971	212.3036	224.2567	201.6807	200.2511	185.0158	177.2592	197.6025	199.7848	211.1347	219.7193	234.2047	(219)
Water heating fuel used												2503.4102	(219)
Annual totals kWh/year													
Space heating fuel - main system												4552.7645	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9000	(232)
Total delivered energy for all uses												7529.0747	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4552.7645	0.2160	983.3971	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2503.4102	0.2160	540.7366	(264)
Space and water heating			1524.1337	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9000	0.5190	206.5101	(268)
Total CO2, kg/m2/year			1769.5688	(272)
Emissions per m2 for space and water heating			15.6804	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1246	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6804 * 1.00) + 2.1246 + 0.4005, rounded to 2 d.p.			18.2100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 244 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 244 - EPC	**Prop Type Ref**	Opp
Property	2 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.12	**TER**	18.21
Environmental	89 B	**% DER<TER**	22.44		
CO_2 Emissions (t/year)	1.03	**DFEE**	51.53	**TFEE**	56.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.21	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.12	$kgCO_2/m^2$	Pass
	-4.09 (-22.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.53	$kWh/m^2/yr$	
	-5.4 (-9.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.94 m², No overhang
Windows facing South East	6.71 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	5.25 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.31 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

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General Requirements Compliance	Pass	**% DFEE<TFEE**	9.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	49.28 m²	2.39 m
1st Storey:	1.00 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	142.95	117.46

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.92	47.92
Bay Roof	External Slope Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	49.28

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	10
W3a	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.02	10
W3b	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	10
W3c	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	10
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	1.31	10
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	1.31	10
D1	Half Glazed Door	[1] External Wall	South East			2.12	10
D2*	Half Glazed Door	[1] External Wall	North West			2.12	10
D3 (W14)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00	3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.060	No
Independently assessed	E3 Sill	14.79	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.84	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value: 0.021 W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.30	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£54	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 244 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 244 - EPC	**Prop Type Ref**	Opp
Property	2 Grouse Road, Boorley Green, Southampton, SO32 2XB		

SAP Rating	87 B	**DER**	14.12	**TER**	18.21
Environmental	89 B	**% DER<TER**	22.44		
CO_2 Emissions (t/year)	1.03	**DFEE**	51.53	**TFEE**	56.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	14.12	$kgCO_2/yr/m^2$	
TER	18.21	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.12	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.44	%	
CfSH ENE1 credits achieved	3.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.53	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	20.02	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.26	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.26	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	16.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.78	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.78	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 245 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 245 - EPC	**Prop Type Ref**	As
Property	9 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.24	**TER**	19.45
Environmental	89 B	**% DER<TER**	26.78		
CO_2 Emissions (t/year)	0.83	**DFEE**	53.02	**TFEE**	58.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.45	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.24	$kgCO_2/m^2$	Pass
	-5.21 (-26.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.50	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.02	$kWh/m^2/yr$	
	-5.5 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West	7.42 m², No overhang 2.49 m², No overhang 10.49 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K	
Photovoltaic array	0.81	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 245 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 245 - EPC	**Prop Type Ref**	As
Property	9 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.24	**TER**	19.45
Environmental	89 B	**% DER<TER**	26.78		
CO_2 Emissions (t/year)	0.83	**DFEE**	53.02	**TFEE**	58.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.45 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.24 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.40 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.42 m², No overhang
Windows facing South East: 2.49 m², No overhang
Windows facing South West: 10.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800 (1b)	x	2.3900 (2b)	=	94.3572	(1b) - (3b)
First floor	39.4800 (1c)	x	2.6300 (2c)	=	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2018	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.4218	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3586	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4572	0.4482	0.4392	0.3944	0.3854	0.3406	0.3406	0.3317	0.3586	0.3854	0.4034	0.4213	(22b)
Effective ac	0.6045	0.6004	0.5965	0.5778	0.5743	0.5580	0.5580	0.5550	0.5643	0.5743	0.5814	0.5887	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4000	1.2357	25.2091			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.2000	7.8960			(28a)
External Wall	131.3700	22.5200	108.8500	0.2700	29.3895			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			210.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.9914			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4907	(36)
Total fabric heat loss					(33) + (36) =		76.4821	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5355	39.2702	39.0100	37.7882	37.5596	36.4955	36.4955	36.2984	36.9054	37.5596	38.0221	38.5055	(38)
Heat transfer coeff	116.0177	115.7523	115.4922	114.2704	114.0418	112.9776	112.9776	112.7805	113.3875	114.0418	114.5042	114.9877	(39)
Average = Sum(39)m / 12 =												114.2693	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4693	1.4660	1.4627	1.4472	1.4443	1.4308	1.4308	1.4283	1.4360	1.4443	1.4502	1.4563	(40)
HLP (average)												1.4472	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4428	(42)
Average daily hot water use (litres/day)												92.2173	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7933	10.6368	11.7456	11.3318	11.6842	11.2780	11.6357	11.6671	11.3073	11.7202	11.3826	11.7834	(61)
Total heat required for water heating calculated for each month													
	162.2244	142.2048	147.5120	129.6962	125.2577	109.2833	102.4520	115.8802	116.7650	134.6209	145.5383	157.4678	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.2244	142.2048	147.5120	129.6962	125.2577	109.2833	102.4520	115.8802	116.7650	134.6209	145.5383	157.4678	(64)
								Total per year (kWh/year) = Sum(64)m =				1588.9027	(64)
Heat gains from water heating, kWh/month													
	52.9667	46.4056	48.0787	42.1891	40.6842	35.4063	33.1053	37.5676	37.8915	43.7945	47.4524	51.3859	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3683	17.2027	13.9902	10.5915	7.9173	6.6841	7.2224	9.3879	12.6005	15.9992	18.6734	19.9066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.1918	69.0559	64.6219	58.5960	54.6831	49.1754	44.4964	50.4941	52.6271	58.8636	65.9062	69.0671	(72)
Total internal gains													
	370.4557	368.4087	355.0812	333.5623	311.7083	290.6188	276.8924	282.8012	293.8277	315.5572	340.5408	359.2836	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.4200	11.2829	0.7200	0.7000	0.7700	29.2409	(75)
Southeast	2.4900	36.7938	0.7200	0.7000	0.7700	31.9991	(77)
Southwest	10.4900	36.7938	0.7200	0.7000	0.7700	134.8076	(79)

Solar gains	196.0476	343.6541	496.0011	657.8116	776.2732	788.0209	752.5113	661.4793	551.6192	386.7670	236.5885	166.6313	(83)
Total gains	566.5033	712.0628	851.0823	991.3739	1087.9816	1078.6397	1029.4037	944.2805	845.4470	702.3242	577.1294	525.9149	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.2629	47.3713	47.4780	47.9856	48.0818	48.5347	48.5347	48.6195	48.3592	48.0818	47.8876	47.6863	
alpha	4.1509	4.1581	4.1652	4.1990	4.2055	4.2356	4.2356	4.2413	4.2239	4.2055	4.1925	4.1791	
util living area													
	0.9957	0.9886	0.9697	0.9149	0.7975	0.6240	0.4712	0.5290	0.7760	0.9518	0.9909	0.9968	(86)
MIT	19.4562	19.6957	20.0443	20.4633	20.7822	20.9435	20.9864	20.9782	20.8572	20.4157	19.8500	19.4143	(87)
Th 2	19.7106	19.7131	19.7156	19.7273	19.7295	19.7398	19.7398	19.7417	19.7358	19.7295	19.7251	19.7205	(88)
util rest of house													
	0.9942	0.9847	0.9592	0.8854	0.7327	0.5196	0.3421	0.3942	0.6822	0.9287	0.9871	0.9957	(89)
MIT 2	17.6944	18.0436	18.5454	19.1332	19.5335	19.7062	19.7355	19.7340	19.6327	19.0865	18.2782	17.6398	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	17.9978	18.3282	18.8036	19.3623	19.7486	19.9193	19.9510	19.9483	19.8436	19.3154	18.5490	17.9454	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9978	18.3282	18.8036	19.3623	19.7486	19.9193	19.9510	19.9483	19.8436	19.3154	18.5490	17.9454	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9911	0.9785	0.9490	0.8750	0.7338	0.5354	0.3644	0.4173	0.6913	0.9185	0.9818	0.9933	(94)
Useful gains	561.4399	696.7685	807.6464	867.4406	798.3365	577.5257	375.1083	394.0639	584.4996	645.1054	566.6193	522.3708	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1589.1899	1554.3450	1420.9687	1195.5346	917.8733	600.9646	378.5860	400.1779	651.2578	993.9219	1310.9538	1580.5541	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	764.6460	576.2914	456.3118	236.2277	88.9354	0.0000	0.0000	0.0000	0.0000	259.5194	535.9208	787.2884	(98)
Space heating												3705.1410	(98)
Space heating per m2											(98) / (4) =	46.9243	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3971.2122	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	764.6460	576.2914	456.3118	236.2277	88.9354	0.0000	0.0000	0.0000	0.0000	259.5194	535.9208	787.2884	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	819.5562	617.6757	489.0802	253.1915	95.3220	0.0000	0.0000	0.0000	0.0000	278.1559	574.4060	843.8246	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2244	142.2048	147.5120	129.6962	125.2577	109.2833	102.4520	115.8802	116.7650	134.6209	145.5383	157.4678	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6485	89.5640	89.3932	88.9903	88.1593	86.7000	86.7000	86.7000	86.7000	89.0373	89.5063	89.6793	(217)
Fuel for water heating, kWh/month													
	180.9561	158.7746	165.0148	145.7420	142.0810	126.0476	118.1684	133.6565	134.6770	151.1962	162.6013	175.5899	(219)
Water heating fuel used												1794.5053	(219)
Annual totals kWh/year													
Space heating fuel - main system												3971.2122	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												5532.1779	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3971.2122	0.2160	857.7818	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1794.5053	0.2160	387.6131	(264)
Space and water heating			1245.3950	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0499	0.5190	177.5239	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total CO2, kg/year			1124.1879	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2400	ZC1
Total Floor Area	TFA	78.9600	
Assumed number of occupants	N	2.4428	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3044	ZC2
CO2 emissions from cooking, equation (L16)		2.2496	ZC3
Total CO2 emissions		32.7940	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.7940	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800 (1b)	x	2.3900 (2b)	=	94.3572	(1b) - (3b)
First floor	39.4800 (1c)	x	2.6300 (2c)	=	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1514	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4014	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3412	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4350	0.4265	0.4179	0.3753	0.3668	0.3241	0.3241	0.3156	0.3412	0.3668	0.3838	0.4009	(22b)
Effective ac	0.5946	0.5909	0.5873	0.5704	0.5673	0.5525	0.5525	0.5498	0.5582	0.5673	0.5737	0.5803	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			17.6500	1.3258	23.3996			(27)
Ground floor			39.4800	0.1300	5.1324			(28a)
External Wall	131.3700	19.7700	111.6000	0.1800	20.0880			(29a)
Main Roof	39.4800		39.4800	0.1300	5.1324			(30)
Total net area of external elements Aum(A, m2)			210.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2964			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9575	(36)
Total fabric heat loss					(33) + (36) =		67.2539	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.8888	38.6485	38.4130	37.3068	37.0998	36.1364	36.1364	35.9580	36.5075	37.0998	37.5185	37.9562	(38)
Heat transfer coeff	106.1427	105.9024	105.6669	104.5607	104.3538	103.3903	103.3903	103.2119	103.7614	104.3538	104.7724	105.2102	(39)
Average = Sum(39)m / 12 =												104.5597	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3443	1.3412	1.3382	1.3242	1.3216	1.3094	1.3094	1.3071	1.3141	1.3216	1.3269	1.3324	(40)
HLP (average)												1.3242	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428	(42)
Average daily hot water use (litres/day)	92.2173	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.9919	47.9328	44.5675	44.1733	40.9293	42.2936	44.1733	44.5675	47.9328	48.2056	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(64)
								Total per year (kWh/year) = Sum(64)m =				2002.6219	(64)
Heat gains from water heating, kWh/month													
	62.7581	54.9943	57.1255	50.4980	48.8065	42.8191	40.7698	45.6942	46.2065	52.8477	56.6582	61.1798	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3674	17.2019	13.9895	10.5910	7.9169	6.6838	7.2220	9.3875	12.5999	15.9984	18.6725	19.9056	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	84.3522	81.8368	76.7816	70.1362	65.6001	59.4709	54.7981	61.4169	64.1757	71.0318	78.6919	82.2309	(72)
Total internal gains													
	383.6153	381.1888	367.2402	345.1019	322.6250	300.9140	287.1937	293.7235	305.3758	327.7247	353.3257	372.4465	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	6.4200	11.2829	0.6300	0.7000	0.7700	22.1375	(75)
Southeast	2.1600	36.7938	0.6300	0.7000	0.7700	24.2885	(77)
Southwest	9.0700	36.7938	0.6300	0.7000	0.7700	101.9892	(79)

Solar gains	148.4152	260.1592	375.4926	497.9911	587.6729	596.5670	569.6844	500.7683	417.5983	292.7975	179.1063	126.1460	(83)
Total gains	532.0305	641.3480	742.7328	843.0931	910.2979	897.4810	856.8781	794.4918	722.9741	620.5222	532.4320	498.5925	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6600	51.7772	51.8926	52.4416	52.5456	53.0353	53.0353	53.1270	52.8456	52.5456	52.3356	52.1179	
alpha	4.4440	4.4518	4.4595	4.4961	4.5030	4.5357	4.5357	4.5418	4.5230	4.5030	4.4890	4.4745	
util living area													
	0.9967	0.9919	0.9792	0.9397	0.8435	0.6776	0.5164	0.5730	0.8149	0.9638	0.9930	0.9975	(86)
MIT	19.5729	19.7715	20.0744	20.4548	20.7662	20.9381	20.9856	20.9774	20.8536	20.4380	19.9311	19.5378	(87)
Th 2	19.8063	19.8087	19.8110	19.8219	19.8240	19.8335	19.8335	19.8352	19.8298	19.8240	19.8198	19.8155	(88)
util rest of house													
	0.9955	0.9892	0.9718	0.9176	0.7880	0.5772	0.3868	0.4399	0.7310	0.9460	0.9902	0.9966	(89)
MIT 2	17.9282	18.2187	18.6576	19.1999	19.6036	19.7945	19.8286	19.8266	19.7181	19.1895	18.4604	17.8833	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	18.2115	18.4862	18.9017	19.4160	19.8039	19.9914	20.0279	20.0248	19.9137	19.4046	18.7137	18.1683	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2115	18.4862	18.9017	19.4160	19.8039	19.9914	20.0279	20.0248	19.9137	19.4046	18.7137	18.1683	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9846	0.9639	0.9079	0.7869	0.5919	0.4092	0.4626	0.7380	0.9373	0.9861	0.9947	(94)
Useful gains	528.3708	631.4863	715.9466	765.4859	716.3331	531.1914	350.5925	367.5522	533.5554	581.6370	525.0249	495.9722	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1476.6024	1438.8086	1310.4449	1099.5612	845.6677	557.4227	354.4115	374.1257	603.2379	918.7899	1216.7978	1469.6054	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	705.4843	542.5206	442.3068	240.5343	96.2250	0.0000	0.0000	0.0000	0.0000	250.8418	498.0765	724.3831	(98)
Space heating												3500.3724	(98)
Space heating per m2											(98) / (4) =	44.3310	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3747.7220	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	705.4843	542.5206	442.3068	240.5343	96.2250	0.0000	0.0000	0.0000	0.0000	250.8418	498.0765	724.3831	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	755.3365	580.8572	473.5618	257.5313	103.0246	0.0000	0.0000	0.0000	0.0000	268.5672	533.2725	775.5708	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9436	87.6918	87.1822	86.0303	83.8494	80.3000	80.3000	80.3000	80.3000	86.0169	87.4520	88.0359	(217)
Fuel for water heating, kWh/month													
	228.9990	201.3414	210.7072	189.3890	188.1311	173.0194	165.7658	184.7900	186.8308	198.6046	208.5273	223.3673	(219)
Water heating fuel used												2359.4729	(219)
Annual totals kWh/year													
Space heating fuel - main system												3747.7220	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0336	(232)
Total delivered energy for all uses												6524.2285	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3747.7220	0.2160	809.5080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2359.4729	0.2160	509.6462	(264)
Space and water heating			1319.1541	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0336	0.5190	177.5154	(268)
Total CO2, kg/m2/year			1535.5945	(272)
Emissions per m2 for space and water heating			16.7066	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2482	(272b)
Emissions per m2 for pumps and fans			0.4930	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7066 * 1.00) + 2.2482 + 0.4930, rounded to 2 d.p.			19.4500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 245 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 245 - EPC	**Prop Type Ref**	As
Property	9 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.24	**TER**	19.45
Environmental	89 B	**% DER<TER**	26.78		
CO_2 Emissions (t/year)	0.83	**DFEE**	53.02	**TFEE**	58.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.45	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.24	$kgCO_2/m^2$	Pass
	-5.21 (-26.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.50	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.02	$kWh/m^2/yr$	
	-5.5 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	7.42 m², No overhang
Windows facing South East	2.49 m², No overhang
Windows facing South West	10.49 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 245 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 245 - EPC	**Prop Type Ref**	As
Property	9 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.24	**TER**	19.45
Environmental	89 B	**% DER<TER**	26.78		
CO_2 Emissions (t/year)	0.83	**DFEE**	53.02	**TFEE**	58.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	39.48 m²	2.39 m
1st Storey:	1.00 m	39.48 m²	2.63 m

7.0 Living Area	13.60	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	131.37	108.85

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	39.48	39.48

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	39.48

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.83	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.83	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
D2 (W14)	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					5.46	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.49	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.49	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.83	100
W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100

W13	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		1.50	100
W12	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.46	0.060	No
Independently assessed	E3 Sill	12.85	0.009	No
Independently assessed	E4 Jamb	38.40	0.011	No
Independently assessed	E5 Ground floor (normal)	26.22	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	26.22	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.85	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.37	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.021	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.40	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£50	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 245 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 245 - EPC	**Prop Type Ref**	As
Property	9 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.24	**TER**	19.45
Environmental	89 B	**% DER<TER**	26.78		
CO_2 Emissions (t/year)	0.83	**DFEE**	53.02	**TFEE**	58.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	78.96	m^2	
DER	14.24	$kgCO_2/yr/m^2$	
TER	19.45	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.24	$kgCO_2/yr/m^2$	
Reduction DER/TER	26.78	%	
CfSH ENE1 credits achieved	3.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	53.02	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	78.96	m^2	
DER	21.36	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	39.91	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	39.91	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	35.63	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	35.63	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 246 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 246 - EPC	**Prop Type Ref**	As
Property	11 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.21	**TER**	18.16
Environmental	89 B	**% DER<TER**	21.77		
CO_2 Emissions (t/year)	1.02	**DFEE**	51.38	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.16	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.21	$kgCO_2/m^2$	Pass
	-3.95 (-21.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.03	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.38	$kWh/m^2/yr$	
	-3.6 (-6.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.09 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.05 m², No overhang
Windows facing South East	0.71 m², No overhang
Windows facing South West	7.61 m², No overhang
Windows facing North West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.09 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K
Photovoltaic array	0.81	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 246 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 246 - EPC	**Prop Type Ref**	As
Property	11 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.21	**TER**	18.16
Environmental	89 B	**% DER<TER**	21.77		
CO_2 Emissions (t/year)	1.02	**DFEE**	51.38	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.21 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.09 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.05 m², No overhang
Windows facing South East: 0.71 m², No overhang
Windows facing South West: 7.61 m², No overhang
Windows facing North West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Measured/design AP50		4.0900	
Infiltration rate		0.3714	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3157	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4025	0.3946	0.3867	0.3472	0.3393	0.2999	0.2999	0.2920	0.3157	0.3393	0.3551	0.3709	(22b)
Effective ac	0.5810	0.5778	0.5748	0.5603	0.5576	0.5450	0.5450	0.5426	0.5498	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.9601	45.7113	45.4674	44.3220	44.1077	43.1101	43.1101	42.9254	43.4944	44.1077	44.5413	44.9945	(38)
Heat transfer coeff	122.5645	122.3157	122.0719	120.9265	120.7122	119.7146	119.7146	119.5299	120.0989	120.7122	121.1457	121.5990	(39)
Average = Sum(39)m / 12 =												120.9255	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2833	1.2807	1.2781	1.2661	1.2639	1.2534	1.2534	1.2515	1.2574	1.2639	1.2684	1.2732	(40)
HLP (average)												1.2661	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8138	10.6609	11.7810	11.3618	11.7118	11.3008	11.6569	11.6925	11.3341	11.7522	11.4071	11.8032	(61)
Total heat required for water heating calculated for each month													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.0287	(64)
Heat gains from water heating, kWh/month													
	56.2059	49.2402	51.0064	44.7414	43.1329	37.5190	35.0631	39.8144	40.1654	46.4448	50.3428	54.5230	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5456	73.2741	68.5570	62.1408	57.9743	52.1097	47.1278	53.5140	55.7853	62.4258	69.9206	73.2836	(72)
Total internal gains													
	414.3506	412.0296	396.9009	372.5004	347.5961	323.7969	308.4889	314.9246	327.6076	352.2323	380.4648	401.7625	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.7200	0.7000	0.7700	19.9011	(75)
Southeast	0.7100	36.7938	0.7200	0.7000	0.7700	9.1242	(77)
Southwest	7.6100	36.7938	0.7200	0.7000	0.7700	97.7965	(79)
Northwest	0.7100	11.2829	0.7200	0.7000	0.7700	2.7980	(81)

Solar gains	129.6199	228.3303	332.4384	445.4753	529.6089	539.2562	514.2920	449.4641	371.2592	257.7534	156.6278	110.0391	(83)
Total gains	543.9705	640.3600	729.3392	817.9758	877.2050	863.0531	822.7809	764.3887	698.8668	609.9857	537.0926	511.8016	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1155	54.2256	54.3339	54.8485	54.9459	55.4038	55.4038	55.4894	55.2265	54.9459	54.7493	54.5452	
alpha	4.6077	4.6150	4.6223	4.6566	4.6631	4.6936	4.6936	4.6993	4.6818	4.6631	4.6500	4.6363	
util living area													
	0.9984	0.9962	0.9902	0.9695	0.9081	0.7720	0.6094	0.6686	0.8862	0.9819	0.9966	0.9988	(86)
MIT	19.5564	19.7213	19.9931	20.3546	20.6859	20.9036	20.9755	20.9626	20.7981	20.3676	19.8944	19.5269	(87)
Th 2	19.8540	19.8560	19.8580	19.8675	19.8692	19.8775	19.8775	19.8790	19.8743	19.8692	19.8657	19.8619	(88)
util rest of house													
	0.9978	0.9949	0.9864	0.9568	0.8679	0.6774	0.4690	0.5294	0.8208	0.9722	0.9952	0.9983	(89)
MIT 2	17.9366	18.1788	18.5757	19.1008	19.5521	19.8109	19.8684	19.8632	19.7050	19.1273	18.4390	17.8990	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1836	18.4139	18.7917	19.2919	19.7250	19.9774	20.0372	20.0308	19.8716	19.3164	18.6608	18.1472	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1836	18.4139	18.7917	19.2919	19.7250	19.9774	20.0372	20.0308	19.8716	19.3164	18.6608	18.1472	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9923	0.9814	0.9482	0.8617	0.6869	0.4902	0.5499	0.8206	0.9653	0.9928	0.9973	(94)
Useful gains	542.0347	635.4047	715.7477	775.5721	755.8500	592.8463	403.3645	420.3249	573.4960	588.8479	533.2343	510.4173	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1701.6331	1652.9686	1500.4755	1256.6596	968.7100	643.7581	411.4785	433.9879	693.1685	1052.1724	1400.5463	1695.9615	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	862.7412	683.8029	583.8375	346.3830	158.3678	0.0000	0.0000	0.0000	0.0000	344.7134	624.4646	882.0449	(98)
Space heating												4486.3554	(98)
Space heating per m2											(98) / (4) =	46.9726	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4808.5267	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	862.7412	683.8029	583.8375	346.3830	158.3678	0.0000	0.0000	0.0000	0.0000	344.7134	624.4646	882.0449	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	924.6958	732.9078	625.7637	371.2572	169.7404	0.0000	0.0000	0.0000	0.0000	369.4677	669.3083	945.3858	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.9716	150.7359	156.3259	137.3796	132.6288	115.6430	108.3452	122.6438	123.6105	142.5996	154.2373	166.9074	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6811	89.6278	89.5150	89.2476	88.6228	86.7000	86.7000	86.7000	86.7000	89.2160	89.5634	89.7073	(217)
Fuel for water heating, kWh/month													
	191.7590	168.1799	174.6366	153.9308	149.6554	133.3829	124.9657	141.4577	142.5727	159.8364	172.2102	186.0578	(219)
Water heating fuel used												1898.6449	(219)
Annual totals kWh/year													
Space heating fuel - main system												4808.5267	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												6530.9573	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4808.5267	0.2160	1038.6418	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.6449	0.2160	410.1073	(264)
Space and water heating			1448.7491	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total CO2, kg/year			1357.2938	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2100	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		31.5729	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5729	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3751 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.6300	0.7000	0.7700	17.4135	(75)
Southeast	0.7100	36.7938	0.6300	0.7000	0.7700	7.9837	(77)
Southwest	7.6100	36.7938	0.6300	0.7000	0.7700	85.5720	(79)
Northwest	0.7100	11.2829	0.6300	0.7000	0.7700	2.4482	(81)

Solar gains	113.4174	199.7890	290.8836	389.7909	463.4078	471.8492	450.0055	393.2811	324.8518	225.5342	137.0493	96.2842	(83)
Total gains	540.9216	624.9759	700.9491	774.8217	822.8714	806.8526	769.7079	720.0797	664.9994	590.9408	530.6766	511.2039	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9985	0.9965	0.9911	0.9719	0.9121	0.7732	0.6056	0.6625	0.8851	0.9824	0.9968	0.9988	(86)
MIT	19.6815	19.8321	20.0820	20.4160	20.7214	20.9198	20.9814	20.9714	20.8284	20.4347	19.9971	19.6553	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9979	0.9953	0.9878	0.9604	0.8745	0.6834	0.4743	0.5318	0.8220	0.9731	0.9954	0.9984	(89)
MIT 2	18.1736	18.3950	18.7603	19.2469	19.6639	19.9006	19.9497	19.9460	19.8084	19.2805	18.6438	18.1412	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9931	0.9834	0.9528	0.8692	0.6929	0.4942	0.5512	0.8227	0.9670	0.9933	0.9975	(94)
Useful gains	539.1509	620.6474	689.2840	738.2293	715.2193	559.0608	380.3841	396.9269	547.1207	571.4246	527.1138	509.9286	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1595.6745	1548.1367	1403.6675	1173.2218	903.9176	601.4195	386.5847	407.4193	648.6895	985.2778	1312.3945	1589.4586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating												4070.8930	(98)
Space heating per m2											(98) / (4) =	42.6227	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4358.5579	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	841.5991	667.3157	569.0592	335.3261	150.3121	0.0000	0.0000	0.0000	0.0000	329.6647	605.3556	859.9254	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0552	87.8591	87.4424	86.5210	84.6038	80.3000	80.3000	80.3000	80.3000	86.3671	87.6052	88.1366	(217)
Fuel for water heating, kWh/month													
	239.7551	211.8193	223.5802	200.4910	198.5094	184.2067	176.4840	196.7383	198.9111	210.5042	219.3309	233.7999	(219)
Water heating fuel used												2494.1301	(219)
Annual totals kWh/year													
Space heating fuel - main system												4358.5579	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7343.3866	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4358.5579	0.2160	941.4485	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2494.1301	0.2160	538.7321	(264)
Space and water heating			1480.1806	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1734.8532	(272)
Emissions per m2 for space and water heating			15.4977	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4977 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.1600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 246 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 246 - EPC	**Prop Type Ref**	As
Property	11 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.21	**TER**	18.16
Environmental	89 B	**% DER<TER**	21.77		
CO_2 Emissions (t/year)	1.02	**DFEE**	51.38	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.16	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.21	$kgCO_2/m^2$	Pass
	-3.95 (-21.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.03	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.38	$kWh/m^2/yr$	
	-3.6 (-6.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.09 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.05 m², No overhang
Windows facing South East	0.71 m², No overhang
Windows facing South West	7.61 m², No overhang
Windows facing North West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.09 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 246 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 246 - EPC	**Prop Type Ref**	As
Property	11 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.21	**TER**	18.16
Environmental	89 B	**% DER<TER**	21.77		
CO_2 Emissions (t/year)	1.02	**DFEE**	51.38	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North East	
Property Tenure	Unknown	
Transaction Type	New dwelling	
Terrain Type	Urban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
D2 (W9)	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.09	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£54	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 246 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 246 - EPC	**Prop Type Ref**	As
Property	11 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	87 B	**DER**	14.21	**TER**	18.16
Environmental	89 B	**% DER<TER**	21.77		
CO_2 Emissions (t/year)	1.02	**DFEE**	51.38	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	14.21	$kgCO_2/yr/m^2$	
TER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.21	$kgCO_2/yr/m^2$	
Reduction DER/TER	21.77	%	
CfSH ENE1 credits achieved	3.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.38	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.24	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.60	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.60	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	16.62	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.98	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.98	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 247 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 247 - EPC	**Prop Type Ref**	As
Property	15 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.50	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.54		
CO_2 Emissions (t/year)	1.08	**DFEE**	52.72	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.50	$kgCO_2/m^2$	Pass
	-4.99 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.72	$kWh/m^2/yr$	
	-6.1 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.04 m², No overhang
Windows facing North East	6.50 m², No overhang
Windows facing East	1.04 m², No overhang
Windows facing South East	8.18 m², No overhang
Windows facing North West	7.10 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	Plot 247 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 247 - EPC	**Prop Type Ref**	As
Property	15 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.50	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.54		
CO_2 Emissions (t/year)	1.08	**DFEE**	52.72	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.17 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.50 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 8.18 m², No overhang
Windows facing North West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.3414	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2902	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3700	0.3628	0.3555	0.3192	0.3120	0.2757	0.2757	0.2685	0.2902	0.3120	0.3265	0.3410	(22b)
Effective ac	0.5685	0.5658	0.5632	0.5510	0.5487	0.5380	0.5380	0.5360	0.5421	0.5487	0.5533	0.5581	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4478	56.1838	55.9251	54.7097	54.4824	53.4238	53.4238	53.2278	53.8316	54.4824	54.9424	55.4233	(38)
Heat transfer coeff	153.8701	153.6062	153.3474	152.1321	151.9047	150.8462	150.8462	150.6502	151.2539	151.9047	152.3647	152.8456	(39)
Average = Sum(39)m / 12 =												152.1310	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2829	1.2807	1.2785	1.2684	1.2665	1.2577	1.2577	1.2560	1.2611	1.2665	1.2703	1.2744	(40)
HLP (average)												1.2684	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165	(61)
Total heat required for water heating calculated for each month													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349	(64)
Heat gains from water heating, kWh/month													
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
Northeast	6.5000	11.2829	0.7200	0.7000	0.7700	25.6153	(75)
East	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(76)
Southeast	8.1800	36.7938	0.7200	0.7000	0.7700	105.1216	(77)
Northwest	7.1000	11.2829	0.7200	0.7000	0.7700	27.9798	(81)

Solar gains	169.7134	309.4928	477.0788	680.0300	842.1416	871.2531	825.3455	699.1446	546.5969	356.5691	207.0084	142.8174	(83)
Total gains	627.8879	765.3978	916.3692	1092.2773	1226.4781	1229.0218	1166.0590	1046.4112	907.9325	745.1815	626.9958	586.7683	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1311	54.2242	54.3157	54.7496	54.8315	55.2163	55.2163	55.2881	55.0675	54.8315	54.6660	54.4940	
alpha	4.6087	4.6149	4.6210	4.6500	4.6554	4.6811	4.6811	4.6859	4.6712	4.6554	4.6444	4.6329	
util living area													
	0.9989	0.9969	0.9902	0.9621	0.8760	0.7126	0.5509	0.6264	0.8758	0.9838	0.9975	0.9992	(86)
MIT	19.5150	19.6921	19.9930	20.3945	20.7406	20.9312	20.9836	20.9712	20.8093	20.3508	19.8565	19.4828	(87)
Th 2	19.8543	19.8560	19.8577	19.8657	19.8672	19.8741	19.8741	19.8754	19.8714	19.8672	19.8641	19.8610	(88)
util rest of house													
	0.9985	0.9958	0.9864	0.9470	0.8279	0.6148	0.4191	0.4904	0.8071	0.9750	0.9965	0.9989	(89)
MIT 2	17.8763	18.1363	18.5752	19.1541	19.6142	19.8291	19.8683	19.8637	19.7139	19.1022	18.3827	17.8338	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.1118	18.3600	18.7790	19.3324	19.7761	19.9875	20.0287	20.0229	19.8713	19.2816	18.5946	18.0709	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1118	18.3600	18.7790	19.3324	19.7761	19.9875	20.0287	20.0229	19.8713	19.2816	18.5946	18.0709	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9936	0.9813	0.9376	0.8233	0.6255	0.4380	0.5095	0.8071	0.9682	0.9945	0.9981	(94)
Useful gains	626.2816	760.4651	899.1980	1024.0924	1009.7416	768.7892	510.7331	533.1115	732.7954	721.5155	623.5745	585.6632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2125.2302	2067.5342	1882.9513	1587.0964	1226.7957	812.6878	517.1998	545.7912	872.9392	1318.7804	1751.3658	2120.0990	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1115.2177	878.3504	731.9124	405.3629	161.4882	0.0000	0.0000	0.0000	0.0000	444.3651	812.0097	1141.6202	(98)
Space heating												5690.3267	(98)
Space heating per m2											(98) / (4) =	47.4431	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6098.9568	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1115.2177	878.3504	731.9124	405.3629	161.4882	0.0000	0.0000	0.0000	0.0000	444.3651	812.0097	1141.6202	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1195.3030	941.4260	784.4720	434.4725	173.0849	0.0000	0.0000	0.0000	0.0000	476.2756	870.3212	1223.6015	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7855	89.7366	89.6247	89.3349	88.6073	86.7000	86.7000	86.7000	86.7000	89.3730	89.6867	89.8086	(217)
Fuel for water heating, kWh/month													
	198.8519	174.3781	181.0373	159.5771	155.2887	138.3272	129.5472	146.7160	147.8942	165.5602	178.5050	192.9312	(219)
Water heating fuel used												1968.6142	(219)
Annual totals kWh/year													
Space heating fuel - main system												6098.9568	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1029 * 1.00) =										-996.2527		-996.2527	(233)
Total delivered energy for all uses												7598.6621	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6098.9568	0.2160	1317.3747	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.6142	0.2160	425.2207	(264)
Space and water heating			1742.5953	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-996.2527	0.5190	-517.0552	(269)
Total CO2, kg/year			1499.2316	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5000	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.1525	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.1525	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	6.5000	11.2829	0.6300	0.7000	0.7700	22.4134	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	8.1800	36.7938	0.6300	0.7000	0.7700	91.9814	(77)
Northwest	7.1000	11.2829	0.6300	0.7000	0.7700	24.4823	(81)

Solar gains	148.4992	270.8062	417.4440	595.0262	736.8739	762.3465	722.1773	611.7515	478.2723	311.9980	181.1323	124.9653	(83)
Total gains	619.8227	739.8639	869.8948	1020.4445	1133.7181	1131.9353	1074.7186	971.5329	852.7893	713.7809	614.2780	582.0688	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9990	0.9973	0.9918	0.9682	0.8919	0.7339	0.5694	0.6426	0.8864	0.9856	0.9978	0.9992	(86)
MIT	19.5757	19.7391	20.0206	20.4027	20.7378	20.9305	20.9839	20.9720	20.8140	20.3759	19.9070	19.5492	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9986	0.9964	0.9886	0.9554	0.8484	0.6397	0.4395	0.5099	0.8224	0.9778	0.9968	0.9990	(89)
MIT 2	17.9934	18.2338	18.6453	19.2001	19.6511	19.8742	19.9150	19.9108	19.7606	19.1707	18.4869	17.9606	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9944	0.9842	0.9469	0.8434	0.6497	0.4581	0.5284	0.8220	0.9718	0.9951	0.9983	(94)
Useful gains	618.3833	735.7547	856.1824	966.2679	956.1327	735.4638	492.2997	513.3732	701.0141	693.6419	611.2573	581.0657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.6956	1995.4849	1813.6849	1522.8976	1176.5834	780.2351	498.7714	525.8656	838.7107	1268.9668	1688.8656	2046.7216	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating												5486.6932	(98)
Space heating per m2											(98) / (4) =	45.7453	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5874.4038	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1144.1289	906.3583	762.7215	429.0935	175.6053	0.0000	0.0000	0.0000	0.0000	458.2887	830.7045	1167.5032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5160	88.3471	87.9614	87.0021	84.8910	80.3000	80.3000	80.3000	80.3000	87.0683	88.1460	88.5835	(217)
Fuel for water heating, kWh/month													
	245.9123	217.1383	228.9865	207.4553	205.9348	191.7458	183.7071	204.7903	206.9573	214.9594	224.6170	239.7865	(219)
Water heating fuel used												2571.9908	(219)
Annual totals kWh/year													
Space heating fuel - main system												5874.4038	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8973.7385	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5874.4038	0.2160	1268.8712	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.9908	0.2160	555.5500	(264)
Space and water heating			1824.4212	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2098.1127	(272)
Emissions per m2 for space and water heating			15.2111	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2111 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.4900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 247 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 247 - EPC	**Prop Type Ref**	As
Property	15 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.50	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.54		
CO_2 Emissions (t/year)	1.08	**DFEE**	52.72	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.50	$kgCO_2/m^2$	Pass
	-4.99 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.72	$kWh/m^2/yr$	
	-6.1 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.04 m², No overhang
Windows facing North East	6.50 m², No overhang
Windows facing East	1.04 m², No overhang
Windows facing South East	8.18 m², No overhang
Windows facing North West	7.10 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 247 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 247 - EPC	**Prop Type Ref**	As
Property	15 Jay Road, Boorley Green, Southampton, SO32 2XF		

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Environmental	89 B	**% DER<TER**	28.54		
CO_2 Emissions (t/year)	1.08	**DFEE**	52.72	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.17	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£55	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 247 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 247 - EPC	**Prop Type Ref**	As
Property	15 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.50	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.54		
CO_2 Emissions (t/year)	1.08	**DFEE**	52.72	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	12.50	$kgCO_2/yr/m^2$	
TER	17.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.50	$kgCO_2/yr/m^2$	
Reduction DER/TER	28.54	%	
CfSH ENE1 credits achieved	3.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	18.98	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.63	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.63	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.67	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.32	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.32	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 248 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 248 - EPC	**Prop Type Ref**	As
Property	17 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.65	**TER**	16.94
Environmental	89 B	**% DER<TER**	25.34		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.31	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.94	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.65	$kgCO_2/m^2$	Pass
	-4.29 (-25.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.31	$kWh/m^2/yr$	
	-4.6 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.02 m², No overhang
Windows facing North East	1.09 m², No overhang
Windows facing South East	8.11 m², No overhang
Windows facing South West	1.42 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	8.13 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 248 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 248 - EPC	**Prop Type Ref**	As
Property	17 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.65	**TER**	16.94
Environmental	89 B	**% DER<TER**	25.34		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.31	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.94 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.65 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.45 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   1.02 m², No overhang
Windows facing North East:              1.09 m², No overhang
Windows facing South East:              8.11 m², No overhang
Windows facing South West:              1.42 m², No overhang
Windows facing West:                    1.02 m², No overhang
Windows facing North West:              8.13 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.019 W/m²K
Photovoltaic array                      1.22 kW



---------------------------------------------------------------------------------------------------
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1554	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3779	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3212	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4095	0.4015	0.3935	0.3533	0.3453	0.3051	0.3051	0.2971	0.3212	0.3453	0.3614	0.3774	(22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7900	1.2357	25.6911			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	169.5200	25.0300	144.4900	0.2700	39.0123			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7259			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7408	(36)
Total fabric heat loss (33) + (36) =	99.4667	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.9991	61.6533	61.3144	59.7224	59.4246	58.0380	58.0380	57.7812	58.5721	59.4246	60.0271	60.6571	(38)
Heat transfer coeff	161.4658	161.1200	160.7811	159.1891	158.8913	157.5047	157.5047	157.2479	158.0388	158.8913	159.4938	160.1237	(39)
Average = Sum(39)m / 12 =												159.1877	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2589	1.2562	1.2536	1.2411	1.2388	1.2280	1.2280	1.2260	1.2322	1.2388	1.2435	1.2484	(40)
HLP (average)												1.2411	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8298	10.6749	11.7954	11.3844	11.7346	11.3197	11.6743	11.7134	11.3542	11.7653	11.4214	11.8186	(61)
Total heat required for water heating calculated for each month													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.6449	(64)
Heat gains from water heating, kWh/month													
	58.7405	51.4569	53.2939	46.7381	45.0491	39.1723	36.5952	41.5727	41.9445	48.5155	52.6031	56.9775	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9522	76.5728	71.6316	64.9141	60.5498	54.4060	49.1871	55.8773	58.2562	65.2090	73.0599	76.5827	(72)
Total internal gains													
	471.3429	468.9646	451.7446	423.7583	394.8343	367.4205	349.9206	356.6097	371.2674	399.4890	431.8997	456.6924	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0200	10.6334	0.7200	0.7000	0.7700	3.7882	(74)
Northeast	1.0900	11.2829	0.7200	0.7000	0.7700	4.2955	(75)
Southeast	8.1100	36.7938	0.7200	0.7000	0.7700	104.2221	(77)
Southwest	1.4200	36.7938	0.7200	0.7000	0.7700	18.2485	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	8.1300	11.2829	0.7200	0.7000	0.7700	32.0388	(81)

Solar gains	169.5901	303.4993	453.5277	625.1378	757.2031	776.6156	738.3964	636.1857	512.4400	345.8050	205.8072	143.3937	(83)
Total gains	640.9330	772.4639	905.2723	1048.8960	1152.0374	1144.0360	1088.3170	992.7954	883.7074	745.2940	637.7068	600.0862	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1630	55.2814	55.3980	55.9520	56.0569	56.5503	56.5503	56.6427	56.3592	56.0569	55.8451	55.6254	
alpha	4.6775	4.6854	4.6932	4.7301	4.7371	4.7700	4.7700	4.7762	4.7573	4.7371	4.7230	4.7084	
util living area													
	0.9991	0.9976	0.9927	0.9735	0.9109	0.7706	0.6078	0.6767	0.9006	0.9872	0.9980	0.9993	(86)
MIT	19.5237	19.6902	19.9704	20.3481	20.6914	20.9087	20.9772	20.9628	20.7875	20.3395	19.8621	19.4963	(87)
Th 2	19.8732	19.8753	19.8774	19.8872	19.8891	19.8977	19.8977	19.8992	19.8943	19.8891	19.8853	19.8815	(88)
util rest of house													
	0.9988	0.9967	0.9900	0.9623	0.8719	0.6771	0.4698	0.5390	0.8407	0.9802	0.9972	0.9991	(89)
MIT 2	17.9020	18.1468	18.5567	19.1069	19.5759	19.8344	19.8891	19.8832	19.7117	19.1023	18.4056	17.8676	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.1244	18.3585	18.7506	19.2772	19.7289	19.9818	20.0383	20.0313	19.8593	19.2720	18.6053	18.0910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1244	18.3585	18.7506	19.2772	19.7289	19.9818	20.0383	20.0313	19.8593	19.2720	18.6053	18.0910	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9949	0.9858	0.9540	0.8650	0.6851	0.4885	0.5570	0.8383	0.9743	0.9956	0.9985	(94)
Useful gains	639.5984	768.5056	892.3830	1000.6518	996.4830	783.7950	531.6311	552.9928	740.7906	726.1108	634.8738	599.1679	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2232.1757	2168.4284	1969.6666	1651.9298	1275.7210	847.6520	541.5539	571.0121	910.1883	1377.9045	1835.0284	2224.2771	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1184.8775	940.7482	801.4990	468.9202	207.7531	0.0000	0.0000	0.0000	0.0000	484.9345	864.1113	1209.0812	(98)
Space heating												6161.9250	(98)
Space heating per m2											(98) / (4) =	48.0425	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6604.4212	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1184.8775	940.7482	801.4990	468.9202	207.7531	0.0000	0.0000	0.0000	0.0000	484.9345	864.1113	1209.0812	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1269.9652	1008.3046	859.0557	502.5940	222.6721	0.0000	0.0000	0.0000	0.0000	519.7583	926.1643	1295.9070	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8092	89.7657	89.6701	89.4304	88.8254	86.7000	86.7000	86.7000	86.7000	89.4280	89.7148	89.8301	(217)
Fuel for water heating, kWh/month													
	199.9776	175.3522	182.0106	160.3375	155.8086	139.1236	130.2852	147.5630	148.7497	166.4250	179.5008	194.0258	(219)
Water heating fuel used												1979.1596	(219)
Annual totals kWh/year													
Space heating fuel - main system												6604.4212	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												8138.4230	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6604.4212	0.2160	1426.5550	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.1596	0.2160	427.4985	(264)
Space and water heating			1854.0535	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			1623.0165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6500	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		27.7763	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7763	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1243	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3743	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3977	0.3897	0.3500	0.3420	0.3023	0.3023	0.2943	0.3182	0.3420	0.3579	0.3738	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.7900	1.3258	27.5625			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	169.5200	25.0300	144.4900	0.1800	26.0082			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4937			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3325	(36)
Total fabric heat loss (33) + (36) =	88.8262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.8313	61.4921	61.1595	59.5975	59.3053	57.9449	57.9449	57.6929	58.4689	59.3053	59.8965	60.5146	(38)
Heat transfer coeff	150.6576	150.3183	149.9857	148.4238	148.1315	146.7711	146.7711	146.5192	147.2951	148.1315	148.7227	149.3408	(39)
Average = Sum(39)m / 12 =												148.4224	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1746	1.1720	1.1694	1.1572	1.1549	1.1443	1.1443	1.1424	1.1484	1.1549	1.1595	1.1644	(40)
HLP (average)												1.1572	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.4911	482.1166	464.9043	436.9286	407.4451	379.3395	361.8472	369.2276	384.4483	412.6589	445.0572	469.8444	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0200	10.6334	0.6300	0.7000	0.7700	3.3147	(74)
Northeast	1.0900	11.2829	0.6300	0.7000	0.7700	3.7586	(75)
Southeast	8.1100	36.7938	0.6300	0.7000	0.7700	91.1943	(77)
Southwest	1.4200	36.7938	0.6300	0.7000	0.7700	15.9674	(79)
West	1.0200	19.6403	0.6300	0.7000	0.7700	6.1224	(80)
Northwest	8.1300	11.2829	0.6300	0.7000	0.7700	28.0340	(81)

Solar gains	148.3913	265.5619	396.8368	546.9955	662.5527	679.5386	646.0969	556.6625	448.3850	302.5794	180.0813	125.4695 (83)
Total gains	632.8825	747.6785	861.7411	983.9242	1069.9978	1058.8781	1007.9441	925.8901	832.8332	715.2383	625.1385	595.3139 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1205	59.2539	59.3853	60.0102	60.1286	60.6860	60.6860	60.7903	60.4701	60.1286	59.8896	59.6417	
alpha	4.9414	4.9503	4.9590	5.0007	5.0086	5.0457	5.0457	5.0527	5.0313	5.0086	4.9926	4.9761	
util living area													
	0.9992	0.9979	0.9938	0.9771	0.9194	0.7809	0.6146	0.6813	0.9052	0.9884	0.9982	0.9994	(86)
MIT	19.6269	19.7791	20.0381	20.3897	20.7118	20.9176	20.9807	20.9683	20.8077	20.3901	19.9451	19.6022	(87)
Th 2	19.9404	19.9425	19.9446	19.9544	19.9562	19.9648	19.9648	19.9664	19.9615	19.9562	19.9525	19.9486	(88)
util rest of house													
	0.9989	0.9972	0.9915	0.9675	0.8840	0.6923	0.4830	0.5503	0.8488	0.9820	0.9975	0.9992	(89)
MIT 2	18.0995	18.3236	18.7027	19.2166	19.6592	19.9065	19.9573	19.9524	19.7937	19.2238	18.5737	18.0691	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.3090	18.5232	18.8858	19.3775	19.8036	20.0451	20.0977	20.0917	19.9328	19.3838	18.7617	18.2794	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3090	18.5232	18.8858	19.3775	19.8036	20.0451	20.0977	20.0917	19.9328	19.3838	18.7617	18.2794	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9957	0.9880	0.9602	0.8776	0.7000	0.5009	0.5675	0.8469	0.9769	0.9961	0.9987	(94)
Useful gains	631.7286	744.4323	851.3941	944.7832	939.0269	741.2186	504.8410	525.4300	705.3207	698.7023	622.6823	594.5133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2110.5610	2047.8148	1857.6945	1555.1083	1200.3983	799.1863	513.3552	540.9050	859.1372	1301.1511	1734.3666	2102.6272	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1100.2513	875.8731	748.6875	439.4341	194.4603	0.0000	0.0000	0.0000	0.0000	448.2219	800.4127	1122.0367	(98)
Space heating												5729.3775	(98)
Space heating per m2											(98) / (4) =	44.6700	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6134.2372	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1100.2513	875.8731	748.6875	439.4341	194.4603	0.0000	0.0000	0.0000	0.0000	448.2219	800.4127	1122.0367	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1177.9993	937.7656	801.5926	470.4861	208.2016	0.0000	0.0000	0.0000	0.0000	479.8950	856.9729	1201.3241	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5530	88.3945	88.0436	87.1964	85.3037	80.3000	80.3000	80.3000	80.3000	87.1602	88.1919	88.6186	(217)
Fuel for water heating, kWh/month													
	247.0017	218.0664	229.8549	207.9456	206.2364	192.9601	184.8705	206.0873	207.8790	215.7223	225.5678	240.8453	(219)
Water heating fuel used												2583.0374	(219)
Annual totals kWh/year													
Space heating fuel - main system												6134.2372	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Total delivered energy for all uses												9276.6029	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6134.2372	0.2160	1324.9952	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2583.0374	0.2160	557.9361	(264)
Space and water heating			1882.9313	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Total CO2, kg/m2/year			2173.2227	(272)
Emissions per m2 for space and water heating			14.6806	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9598	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6806 * 1.00) + 1.9598 + 0.3035, rounded to 2 d.p.			16.9400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 248 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 248 - EPC	**Prop Type Ref**	As
Property	17 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.65	**TER**	16.94
Environmental	89 B	**% DER<TER**	25.34		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.31	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.94	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.65	$kgCO_2/m^2$	Pass
	-4.29 (-25.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.31	$kWh/m^2/yr$	
	-4.6 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.02 m², No overhang
Windows facing North East	1.09 m², No overhang
Windows facing South East	8.11 m², No overhang
Windows facing South West	1.42 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	8.13 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 248 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 248 - EPC	**Prop Type Ref**	As
Property	17 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.65	**TER**	16.94
Environmental	89 B	**% DER<TER**	25.34		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.31	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.75 m²	2.39 m
1st Storey:	1.00 m	63.51 m²	2.63 m

7.0 Living Area	17.59	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	169.52	144.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	63.51	63.51
Bay Roof	External Plane Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1a	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.02	10
W1b	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.25	10
W1c	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.02	10
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.71	10
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	10
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.09	10
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.50	10
W11	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		0.71	10
D1	Half Glazed Door	[1] External Wall	North West				2.12	10
D2	Half Glazed Door	[1] External Wall	South West				2.12	10
D3 w12	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		3.80	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.72	0.060	No
Independently assessed	E3 Sill	13.89	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	34.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.55	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.86	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.45	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 248 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 248 - EPC	**Prop Type Ref**	As
Property	17 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.65	**TER**	16.94
Environmental	89 B	**% DER<TER**	25.34		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.31	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.26	m^2	
DER	12.65	$kgCO_2/yr/m^2$	
TER	16.94	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.65	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.34	%	
CfSH ENE1 credits achieved	3.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.31	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.26	m^2	
DER	18.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.94	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.94	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.87	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.87	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 249 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 249 - EPC	**Prop Type Ref**	As
Property	10 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.54	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.31		
CO_2 Emissions (t/year)	1.09	**DFEE**	52.88	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.54	$kgCO_2/m^2$	Pass
	-4.95 (-28.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.88	$kWh/m^2/yr$	
	-5.9 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.04 m², No overhang
Windows facing North East	6.50 m², No overhang
Windows facing East	1.04 m², No overhang
Windows facing South East	8.18 m², No overhang
Windows facing North West	7.10 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 249 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 249 - EPC	**Prop Type Ref**	As
Property	10 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.54	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.31		
CO_2 Emissions (t/year)	1.09	**DFEE**	52.88	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.38 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.50 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 8.18 m², No overhang
Windows facing North West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3519	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2991	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3814	0.3739	0.3664	0.3291	0.3216	0.2842	0.2842	0.2767	0.2991	0.3216	0.3365	0.3515	(22b)
Effective ac	0.5727	0.5699	0.5671	0.5541	0.5517	0.5404	0.5404	0.5383	0.5447	0.5517	0.5566	0.5618	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.8723	56.5919	56.3170	55.0257	54.7842	53.6595	53.6595	53.4513	54.0927	54.7842	55.2729	55.7838	(38)
Heat transfer coeff	154.2947	154.0142	153.7393	152.4481	152.2065	151.0819	151.0819	150.8736	151.5151	152.2065	152.6952	153.2062	(39)
Average = Sum(39)m / 12 =												152.4469	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2864	1.2841	1.2818	1.2710	1.2690	1.2596	1.2596	1.2579	1.2633	1.2690	1.2731	1.2774	(40)
HLP (average)												1.2710	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165	(61)
Total heat required for water heating calculated for each month													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349	(64)
Heat gains from water heating, kWh/month													
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
Northeast	6.5000	11.2829	0.7200	0.7000	0.7700	25.6153	(75)
East	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(76)
Southeast	8.1800	36.7938	0.7200	0.7000	0.7700	105.1216	(77)
Northwest	7.1000	11.2829	0.7200	0.7000	0.7700	27.9798	(81)

Solar gains	169.7134	309.4928	477.0788	680.0300	842.1416	871.2531	825.3455	699.1446	546.5969	356.5691	207.0084	142.8174	(83)
Total gains	627.8879	765.3978	916.3692	1092.2773	1226.4781	1229.0218	1166.0590	1046.4112	907.9325	745.1815	626.9958	586.7683	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.9822	54.0805	54.1772	54.6361	54.7228	55.1302	55.1302	55.2063	54.9725	54.7228	54.5477	54.3657	
alpha	4.5988	4.6054	4.6118	4.6424	4.6482	4.6753	4.6753	4.6804	4.6648	4.6482	4.6365	4.6244	
util living area													
	0.9989	0.9969	0.9902	0.9622	0.8764	0.7132	0.5516	0.6270	0.8762	0.9838	0.9975	0.9992	(86)
MIT	19.5105	19.6879	19.9892	20.3920	20.7389	20.9306	20.9835	20.9709	20.8082	20.3487	19.8535	19.4790	(87)
Th 2	19.8515	19.8533	19.8551	19.8636	19.8652	19.8726	19.8726	19.8740	19.8697	19.8652	19.8620	19.8586	(88)
util rest of house													
	0.9984	0.9958	0.9864	0.9471	0.8283	0.6153	0.4196	0.4909	0.8075	0.9750	0.9965	0.9989	(89)
MIT 2	17.8679	18.1283	18.5680	19.1490	19.6105	19.8272	19.8667	19.8621	19.7113	19.0978	18.3769	17.8266	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.1040	18.3525	18.7723	19.3276	19.7727	19.9858	20.0273	20.0215	19.8689	19.2776	18.5892	18.0641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1040	18.3525	18.7723	19.3276	19.7727	19.9858	20.0273	20.0215	19.8689	19.2776	18.5892	18.0641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9935	0.9813	0.9377	0.8237	0.6261	0.4385	0.5099	0.8075	0.9683	0.9945	0.9981	(94)
Useful gains	626.2768	760.4598	899.2115	1024.2285	1010.2544	769.4478	511.2616	533.5996	733.1323	721.5421	623.5705	585.6599	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2129.8782	2071.8771	1886.7298	1589.6716	1228.7228	813.6990	517.7958	546.3921	874.0826	1320.7807	1754.3410	2124.0707	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1118.6794	881.2724	734.7137	407.1190	162.5405	0.0000	0.0000	0.0000	0.0000	445.8335	814.1547	1144.5777	(98)
Space heating												5708.8909	(98)
Space heating per m2											(98) / (4) =	47.5979	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6118.8541	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1118.6794	881.2724	734.7137	407.1190	162.5405	0.0000	0.0000	0.0000	0.0000	445.8335	814.1547	1144.5777	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1199.0133	944.5578	787.4744	436.3548	174.2127	0.0000	0.0000	0.0000	0.0000	477.8494	872.6203	1226.7713	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7869	89.7381	89.6268	89.3379	88.6132	86.7000	86.7000	86.7000	86.7000	89.3753	89.6880	89.8097	(217)
Fuel for water heating, kWh/month													
	198.8489	174.3750	181.0331	159.5716	155.2785	138.3272	129.5472	146.7160	147.8942	165.5560	178.5024	192.9289	(219)
Water heating fuel used												1968.5790	(219)
Annual totals kWh/year													
Space heating fuel - main system												6118.8541	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1029 * 1.00) =										-996.2527		-996.2527	(233)
Total delivered energy for all uses												7618.5243	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6118.8541	0.2160	1321.6725	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.5790	0.2160	425.2131	(264)
Space and water heating			1746.8856	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-996.2527	0.5190	-517.0552	(269)
Total CO2, kg/year			1503.5219	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5400	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.1925	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.1925	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	6.5000	11.2829	0.6300	0.7000	0.7700	22.4134	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	8.1800	36.7938	0.6300	0.7000	0.7700	91.9814	(77)
Northwest	7.1000	11.2829	0.6300	0.7000	0.7700	24.4823	(81)

Solar gains	148.4992	270.8062	417.4440	595.0262	736.8739	762.3465	722.1773	611.7515	478.2723	311.9980	181.1323	124.9653	(83)
Total gains	619.8227	739.8639	869.8948	1020.4445	1133.7181	1131.9353	1074.7186	971.5329	852.7893	713.7809	614.2780	582.0688	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9990	0.9973	0.9918	0.9682	0.8919	0.7339	0.5694	0.6426	0.8864	0.9856	0.9978	0.9992	(86)
MIT	19.5757	19.7391	20.0206	20.4027	20.7378	20.9305	20.9839	20.9720	20.8140	20.3759	19.9070	19.5492	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9986	0.9964	0.9886	0.9554	0.8484	0.6397	0.4395	0.5099	0.8224	0.9778	0.9968	0.9990	(89)
MIT 2	17.9934	18.2338	18.6453	19.2001	19.6511	19.8742	19.9150	19.9108	19.7606	19.1707	18.4869	17.9606	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9944	0.9842	0.9469	0.8434	0.6497	0.4581	0.5284	0.8220	0.9718	0.9951	0.9983	(94)
Useful gains	618.3833	735.7547	856.1824	966.2679	956.1327	735.4638	492.2997	513.3732	701.0141	693.6419	611.2573	581.0657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.6956	1995.4849	1813.6849	1522.8976	1176.5834	780.2351	498.7714	525.8656	838.7107	1268.9668	1688.8656	2046.7216	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating												5486.6932	(98)
Space heating per m2											(98) / (4) =	45.7453	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5874.4038	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1144.1289	906.3583	762.7215	429.0935	175.6053	0.0000	0.0000	0.0000	0.0000	458.2887	830.7045	1167.5032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5160	88.3471	87.9614	87.0021	84.8910	80.3000	80.3000	80.3000	80.3000	87.0683	88.1460	88.5835	(217)
Fuel for water heating, kWh/month													
	245.9123	217.1383	228.9865	207.4553	205.9348	191.7458	183.7071	204.7903	206.9573	214.9594	224.6170	239.7865	(219)
Water heating fuel used												2571.9908	(219)
Annual totals kWh/year													
Space heating fuel - main system												5874.4038	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8973.7385	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5874.4038	0.2160	1268.8712	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.9908	0.2160	555.5500	(264)
Space and water heating			1824.4212	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2098.1127	(272)
Emissions per m2 for space and water heating			15.2111	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2111 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.4900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 249 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 249 - EPC	**Prop Type Ref**	As
Property	10 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.54	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.31		
CO_2 Emissions (t/year)	1.09	**DFEE**	52.88	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.54	$kgCO_2/m^2$	Pass
	-4.95 (-28.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.88	$kWh/m^2/yr$	
	-5.9 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	1.04 m², No overhang		
Windows facing North East	6.50 m², No overhang		
Windows facing East	1.04 m², No overhang		
Windows facing South East	8.18 m², No overhang		
Windows facing North West	7.10 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	1.21	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 249 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 249 - EPC	**Prop Type Ref**	As
Property	10 Jay Road, Boorley Green, Southampton, SO32 2XF		

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Environmental	89 B	**% DER<TER**	28.31		
CO_2 Emissions (t/year)	1.09	**DFEE**	52.88	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.38	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 249 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 249 - EPC	**Prop Type Ref**	As
Property	10 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.54	**TER**	17.49
Environmental	89 B	**% DER<TER**	28.31		
CO_2 Emissions (t/year)	1.09	**DFEE**	52.88	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	12.54	$kgCO_2/yr/m^2$	
TER	17.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.54	$kgCO_2/yr/m^2$	
Reduction DER/TER	28.31	%	
CfSH ENE1 credits achieved	3.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.88	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	19.02	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.67	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.67	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.71	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.36	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.36	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 250 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 250 - EPC	**Prop Type Ref**	Opp
Property	8 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.55	**TER**	16.85
Environmental	89 B	**% DER<TER**	25.53		
CO_2 Emissions (t/year)	1.17	**DFEE**	51.87	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.55	$kgCO_2/m^2$	Pass
	-4.30 (-25.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.87	$kWh/m^2/yr$	
	-4.5 (-8.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

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Elmhurst Energy Quality Promise Accredited Member

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	8.11 m², No overhang
Windows facing South East	1.09 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	8.13 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 250 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 250 - EPC	**Prop Type Ref**	Opp
Property	8 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.55	**TER**	16.85
Environmental	89 B	**% DER<TER**	25.53		
CO_2 Emissions (t/year)	1.17	**DFEE**	51.87	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.55 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.9 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.46 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North East:              8.11 m², No overhang
Windows facing South East:              1.09 m², No overhang
Windows facing South:                   1.02 m², No overhang
Windows facing South West:              8.13 m², No overhang
Windows facing West:                    1.02 m², No overhang
Windows facing North West:              1.42 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.019 W/m²K
Photovoltaic array                      1.22 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1554	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3784	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4101	0.4020	0.3940	0.3538	0.3457	0.3055	0.3055	0.2975	0.3216	0.3457	0.3618	0.3779	(22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7900	1.2357	25.6911			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	169.5200	25.0300	144.4900	0.2700	39.0123			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7259			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7408	(36)
Total fabric heat loss (33) + (36) =	99.4667	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.0227	61.6760	61.3362	59.7400	59.4413	58.0511	58.0511	57.7936	58.5866	59.4413	60.0455	60.6771	(38)
Heat transfer coeff	161.4894	161.1427	160.8028	159.2067	158.9080	157.5178	157.5178	157.2603	158.0533	158.9080	159.5122	160.1438	(39)
Average = Sum(39)m / 12 =												159.2052	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2591	1.2564	1.2537	1.2413	1.2390	1.2281	1.2281	1.2261	1.2323	1.2390	1.2437	1.2486	(40)
HLP (average)												1.2413	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8298	10.6749	11.7954	11.3844	11.7346	11.3197	11.6743	11.7134	11.3542	11.7653	11.4214	11.8186	(61)
Total heat required for water heating calculated for each month													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.6449	(64)
Heat gains from water heating, kWh/month													
	58.7405	51.4569	53.2939	46.7381	45.0491	39.1723	36.5952	41.5727	41.9445	48.5155	52.6031	56.9775	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9522	76.5728	71.6316	64.9141	60.5498	54.4060	49.1871	55.8773	58.2562	65.2090	73.0599	76.5827	(72)
Total internal gains													
	471.3429	468.9646	451.7446	423.7583	394.8343	367.4205	349.9206	356.6097	371.2674	399.4890	431.8997	456.6924	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1100	11.2829	0.7200	0.7000	0.7700	31.9600	(75)
Southeast	1.0900	36.7938	0.7200	0.7000	0.7700	14.0077	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	8.1300	36.7938	0.7200	0.7000	0.7700	104.4791	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	1.4200	11.2829	0.7200	0.7000	0.7700	5.5960	(81)

Solar gains	179.6955	319.2385	471.1687	640.5035	768.5134	785.2553	747.8029	649.0091	529.3527	362.1482	217.6421	152.2162	(83)
Total gains	651.0384	788.2031	922.9133	1064.2618	1163.3477	1152.6757	1097.7235	1005.6187	900.6201	761.6371	649.5418	608.9086	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1550	55.2737	55.3905	55.9458	56.0509	56.5456	56.5456	56.6382	56.3541	56.0509	55.8387	55.6184	
alpha	4.6770	4.6849	4.6927	4.7297	4.7367	4.7697	4.7697	4.7759	4.7569	4.7367	4.7226	4.7079	
util living area													
	0.9990	0.9974	0.9922	0.9720	0.9082	0.7671	0.6035	0.6701	0.8950	0.9861	0.9979	0.9993	(86)
MIT	19.5307	19.7011	19.9824	20.3576	20.6965	20.9105	20.9779	20.9643	20.7948	20.3503	19.8703	19.5024	(87)
Th 2	19.8730	19.8752	19.8773	19.8871	19.8890	19.8976	19.8976	19.8992	19.8943	19.8890	19.8852	19.8813	(88)
util rest of house													
	0.9987	0.9964	0.9891	0.9604	0.8685	0.6733	0.4661	0.5328	0.8331	0.9784	0.9969	0.9990	(89)
MIT 2	17.9122	18.1627	18.5740	19.1200	19.5820	19.8358	19.8893	19.8839	19.7194	19.1176	18.4176	17.8765	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.1341	18.3736	18.7671	19.2898	19.7348	19.9832	20.0386	20.0321	19.8669	19.2867	18.6168	18.0995	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1341	18.3736	18.7671	19.2898	19.7348	19.9832	20.0386	20.0321	19.8669	19.2867	18.6168	18.0995	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9945	0.9847	0.9519	0.8618	0.6815	0.4847	0.5509	0.8312	0.9723	0.9952	0.9984	(94)
Useful gains	649.5932	783.8329	908.8215	1013.0258	1002.5248	785.4968	532.0346	553.9650	748.6042	740.5235	646.4377	607.9185	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2234.0653	2171.1782	1972.5873	1654.1187	1276.7953	847.9519	541.6404	571.1797	911.4769	1380.3847	1837.0696	2225.9155	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1178.8472	932.2960	791.4418	461.5869	204.0573	0.0000	0.0000	0.0000	0.0000	476.0567	857.2550	1203.7898	(98)
Space heating												6105.3307	(98)
Space heating per m2											(98) / (4) =	47.6012	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6543.7628	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1178.8472	932.2960	791.4418	461.5869	204.0573	0.0000	0.0000	0.0000	0.0000	476.0567	857.2550	1203.7898	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1263.5019	999.2455	848.2763	494.7341	218.7109	0.0000	0.0000	0.0000	0.0000	510.2430	918.8156	1290.2356	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8070	89.7616	89.6635	89.4200	88.8097	86.7000	86.7000	86.7000	86.7000	89.4157	89.7109	89.8283	(217)
Fuel for water heating, kWh/month													
	199.9825	175.3603	182.0240	160.3562	155.8361	139.1236	130.2852	147.5630	148.7497	166.4478	179.5086	194.0296	(219)
Water heating fuel used												1979.2666	(219)
Annual totals kWh/year													
Space heating fuel - main system												6543.7628	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												8077.8716	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6543.7628	0.2160	1413.4528	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.2666	0.2160	427.5216	(264)
Space and water heating			1840.9744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			1609.9374	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5500	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		27.6763	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.6763	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1243	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3743	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3977	0.3897	0.3500	0.3420	0.3023	0.3023	0.2943	0.3182	0.3420	0.3579	0.3738	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.7900	1.3258	27.5625			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	169.5200	25.0300	144.4900	0.1800	26.0082			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4937			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3325	(36)
Total fabric heat loss (33) + (36) =	88.8262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.8313	61.4921	61.1595	59.5975	59.3053	57.9449	57.9449	57.6929	58.4689	59.3053	59.8965	60.5146	(38)
Heat transfer coeff	150.6576	150.3183	149.9857	148.4238	148.1315	146.7711	146.7711	146.5192	147.2951	148.1315	148.7227	149.3408	(39)
Average = Sum(39)m / 12 =												148.4224	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1746	1.1720	1.1694	1.1572	1.1549	1.1443	1.1443	1.1424	1.1484	1.1549	1.1595	1.1644	(40)
HLP (average)												1.1572	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.4911	482.1166	464.9043	436.9286	407.4451	379.3395	361.8472	369.2276	384.4483	412.6589	445.0572	469.8444	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1100	11.2829	0.6300	0.7000	0.7700	27.9650	(75)
Southeast	1.0900	36.7938	0.6300	0.7000	0.7700	12.2567	(77)
South	1.0200	46.7521	0.6300	0.7000	0.7700	14.5738	(78)
Southwest	8.1300	36.7938	0.6300	0.7000	0.7700	91.4192	(79)
West	1.0200	19.6403	0.6300	0.7000	0.7700	6.1224	(80)
Northwest	1.4200	11.2829	0.6300	0.7000	0.7700	4.8965	(81)

Solar gains	157.2335	279.3337	412.2726	560.4406	672.4492	687.0984	654.3275	567.8829	463.1836	316.8796	190.4369	133.1891	(83)
Total gains	641.7247	761.4503	877.1769	997.3692	1079.8943	1066.4379	1016.1747	937.1105	847.6319	729.5385	635.4940	603.0335	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1205	59.2539	59.3853	60.0102	60.1286	60.6860	60.6860	60.7903	60.4701	60.1286	59.8896	59.6417	
alpha	4.9414	4.9503	4.9590	5.0007	5.0086	5.0457	5.0457	5.0527	5.0313	5.0086	4.9926	4.9761	
util living area													
	0.9991	0.9978	0.9934	0.9758	0.9169	0.7775	0.6104	0.6750	0.8999	0.9874	0.9981	0.9994	(86)
MIT	19.6333	19.7891	20.0489	20.3984	20.7166	20.9193	20.9813	20.9696	20.8143	20.3999	19.9526	19.6078	(87)
Th 2	19.9404	19.9425	19.9446	19.9544	19.9562	19.9648	19.9648	19.9664	19.9615	19.9562	19.9525	19.9486	(88)
util rest of house													
	0.9988	0.9970	0.9908	0.9657	0.8809	0.6886	0.4794	0.5443	0.8418	0.9806	0.9973	0.9991	(89)
MIT 2	18.1089	18.3380	18.7184	19.2287	19.6650	19.9078	19.9576	19.9530	19.8007	19.2377	18.5846	18.0774	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.3180	18.5370	18.9009	19.3891	19.8092	20.0465	20.0980	20.0924	19.9397	19.3971	18.7722	18.2873	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3180	18.5370	18.9009	19.3891	19.8092	20.0465	20.0980	20.0924	19.9397	19.3971	18.7722	18.2873	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9953	0.9871	0.9584	0.8746	0.6964	0.4971	0.5615	0.8403	0.9752	0.9958	0.9986	(94)
Useful gains	640.4827	757.8848	865.8972	955.8332	944.4940	742.7189	505.1611	526.2344	712.2315	711.4116	632.8191	602.1754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2111.9130	2049.8971	1859.9543	1556.8348	1201.2321	799.3947	513.3984	541.0134	860.1649	1303.1242	1735.9214	2103.8013	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1094.7442	868.2322	739.5785	432.7211	191.0132	0.0000	0.0000	0.0000	0.0000	440.2342	794.2337	1117.2096	(98)
Space heating												5677.9667	(98)
Space heating per m2											(98) / (4) =	44.2692	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6079.1934	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1094.7442	868.2322	739.5785	432.7211	191.0132	0.0000	0.0000	0.0000	0.0000	440.2342	794.2337	1117.2096	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1172.1030	929.5848	791.8399	463.2988	204.5109	0.0000	0.0000	0.0000	0.0000	471.3429	850.3572	1196.1559	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5454	88.3804	88.0214	87.1627	85.2586	80.3000	80.3000	80.3000	80.3000	87.1205	88.1785	88.6123	(217)
Fuel for water heating, kWh/month													
	247.0229	218.1013	229.9128	208.0261	206.3456	192.9601	184.8705	206.0873	207.8790	215.8206	225.6021	240.8625	(219)
Water heating fuel used												2583.4909	(219)
Annual totals kWh/year													
Space heating fuel - main system												6079.1934	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Total delivered energy for all uses												9222.0127	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6079.1934	0.2160	1313.1058	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2583.4909	0.2160	558.0340	(264)
Space and water heating			1871.1398	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Total CO2, kg/m2/year			2161.4312	(272)
Emissions per m2 for space and water heating			14.5886	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9598	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5886 * 1.00) + 1.9598 + 0.3035, rounded to 2 d.p.			16.8500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 250 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 250 - EPC	**Prop Type Ref**	Opp
Property	8 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.55	**TER**	16.85
Environmental	89 B	**% DER<TER**	25.53		
CO_2 Emissions (t/year)	1.17	**DFEE**	51.87	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.55	$kgCO_2/m^2$	Pass
	-4.30 (-25.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.87	$kWh/m^2/yr$	
	-4.5 (-8.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	8.11 m², No overhang
Windows facing South East	1.09 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	8.13 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 250 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 250 - EPC	**Prop Type Ref**	Opp
Property	8 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.55	**TER**	16.85
Environmental	89 B	**% DER<TER**	25.53		
CO_2 Emissions (t/year)	1.17	**DFEE**	51.87	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.75 m²	2.39 m
1st Storey:	1.00 m	63.51 m²	2.63 m

7.0 Living Area	17.59	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	169.52	144.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	63.51	63.51
Bay Roof	External Plane Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1a	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.02	10
W1b	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	10
W1c	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.02	10
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	10
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	10
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.09	10
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	10
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.71	10
D1	Half Glazed Door	[1] External Wall	South West				2.12	10
D2	Half Glazed Door	[1] External Wall	North West				2.12	10
D3 w12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		3.80	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.72	0.060	No
Independently assessed	E3 Sill	13.89	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	34.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.55	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.86	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.46	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 250 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 250 - EPC	**Prop Type Ref**	Opp
Property	8 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.55	**TER**	16.85
Environmental	89 B	**% DER<TER**	25.53		
CO_2 Emissions (t/year)	1.17	**DFEE**	51.87	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.26	m^2	
DER	12.55	$kgCO_2/yr/m^2$	
TER	16.85	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.55	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.53	%	
CfSH ENE1 credits achieved	3.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.87	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.26	m^2	
DER	18.70	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.83	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.83	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.63	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.76	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.76	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 251 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 251 - EPC	**Prop Type Ref**	Opp
Property	6 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.83	**TER**	16.85
Environmental	89 B	**% DER<TER**	23.87		
CO_2 Emissions (t/year)	1.19	**DFEE**	53.05	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.83	$kgCO_2/m^2$	Pass
	-4.02 (-23.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.05	$kWh/m^2/yr$	
	-3.4 (-6.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.80 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	8.11 m², No overhang
Windows facing South East	1.09 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	8.13 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.80 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 251 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 251 - EPC	**Prop Type Ref**	Opp
Property	6 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.83	**TER**	16.85
Environmental	89 B	**% DER<TER**	23.87		
CO_2 Emissions (t/year)	1.19	**DFEE**	53.05	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.83 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.0 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         5.80 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North East:              8.11 m², No overhang
Windows facing South East:              1.09 m², No overhang
Windows facing South:                   1.02 m², No overhang
Windows facing South West:              8.13 m², No overhang
Windows facing West:                    1.02 m², No overhang
Windows facing North West:              1.42 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.019 W/m²K
Photovoltaic array                      1.22 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1554	(8)
Pressure test		Yes	
Measured/design AP50		5.8000	
Infiltration rate		0.4454	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3786	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4827	0.4732	0.4638	0.4164	0.4070	0.3596	0.3596	0.3502	0.3786	0.4070	0.4259	0.4448	(22b)
Effective ac	0.6165	0.6120	0.6075	0.5867	0.5828	0.5647	0.5647	0.5613	0.5717	0.5828	0.5907	0.5989	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7900	1.2357	25.6911			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	169.5200	25.0300	144.4900	0.2700	39.0123			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7259			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7408	(36)
Total fabric heat loss (33) + (36) =	99.4667	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.4645	64.9841	64.5133	62.3018	61.8880	59.9619	59.9619	59.6052	60.7038	61.8880	62.7251	63.6002	(38)
Heat transfer coeff	164.9312	164.4508	163.9800	161.7685	161.3547	159.4286	159.4286	159.0719	160.1705	161.3547	162.1918	163.0669	(39)
Average = Sum(39)m / 12 =												161.7665	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2859	1.2822	1.2785	1.2613	1.2580	1.2430	1.2430	1.2402	1.2488	1.2580	1.2646	1.2714	(40)
HLP (average)												1.2612	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8298	10.6749	11.7954	11.3844	11.7346	11.3197	11.6743	11.7134	11.3542	11.7653	11.4214	11.8186	(61)
Total heat required for water heating calculated for each month													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.6449	(64)
Heat gains from water heating, kWh/month													
	58.7405	51.4569	53.2939	46.7381	45.0491	39.1723	36.5952	41.5727	41.9445	48.5155	52.6031	56.9775	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9522	76.5728	71.6316	64.9141	60.5498	54.4060	49.1871	55.8773	58.2562	65.2090	73.0599	76.5827	(72)
Total internal gains													
	471.3429	468.9646	451.7446	423.7583	394.8343	367.4205	349.9206	356.6097	371.2674	399.4890	431.8997	456.6924	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1100	11.2829	0.7200	0.7000	0.7700	31.9600	(75)
Southeast	1.0900	36.7938	0.7200	0.7000	0.7700	14.0077	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	8.1300	36.7938	0.7200	0.7000	0.7700	104.4791	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	1.4200	11.2829	0.7200	0.7000	0.7700	5.5960	(81)

Solar gains	179.6955	319.2385	471.1687	640.5035	768.5134	785.2553	747.8029	649.0091	529.3527	362.1482	217.6421	152.2162	(83)
Total gains	651.0384	788.2031	922.9133	1064.2618	1163.3477	1152.6757	1097.7235	1005.6187	900.6201	761.6371	649.5418	608.9086	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0040	54.1617	54.3173	55.0598	55.2010	55.8679	55.8679	55.9932	55.6091	55.2010	54.9161	54.6214	
alpha	4.6003	4.6108	4.6212	4.6707	4.6801	4.7245	4.7245	4.7329	4.7073	4.6801	4.6611	4.6414	
util living area													
	0.9990	0.9974	0.9922	0.9726	0.9107	0.7715	0.6089	0.6752	0.8975	0.9863	0.9978	0.9993	(86)
MIT	19.4966	19.6690	19.9540	20.3381	20.6832	20.9057	20.9762	20.9620	20.7865	20.3344	19.8478	19.4733	(87)
Th 2	19.8519	19.8548	19.8577	19.8713	19.8739	19.8857	19.8857	19.8880	19.8812	19.8739	19.8687	19.8633	(88)
util rest of house													
	0.9986	0.9964	0.9893	0.9611	0.8714	0.6774	0.4695	0.5364	0.8360	0.9787	0.9969	0.9990	(89)
MIT 2	17.8479	18.1018	18.5191	19.0809	19.5529	19.8205	19.8769	19.8717	19.6989	19.0840	18.3733	17.8216	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.0740	18.3167	18.7159	19.2533	19.7079	19.9693	20.0276	20.0212	19.8480	19.2555	18.5755	18.0481	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0740	18.3167	18.7159	19.2533	19.7079	19.9693	20.0276	20.0212	19.8480	19.2555	18.5755	18.0481	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9944	0.9848	0.9525	0.8642	0.6853	0.4884	0.5546	0.8337	0.9725	0.9952	0.9983	(94)
Useful gains	649.5575	783.7893	908.8752	1013.7283	1005.4218	789.9807	536.1022	557.6697	750.8814	740.6894	646.4063	607.8937	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2271.7649	2206.3889	2003.1586	1674.8433	1292.1162	856.0192	546.4605	576.0330	920.6660	1396.6082	1861.2378	2258.1707	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1206.9223	955.9869	814.1469	476.0028	213.3006	0.0000	0.0000	0.0000	0.0000	488.0036	874.6787	1227.8061	(98)
Space heating												6256.8479	(98)
Space heating per m2											(98) / (4) =	48.7825	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6706.1607	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1206.9223	955.9869	814.1469	476.0028	213.3006	0.0000	0.0000	0.0000	0.0000	488.0036	874.6787	1227.8061	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1293.5930	1024.6377	872.6119	510.1852	228.6181	0.0000	0.0000	0.0000	0.0000	523.0478	937.4906	1315.9765	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5982	157.4062	163.2090	143.3905	138.3976	120.6202	112.9573	127.9371	128.9660	148.8305	161.0388	174.2934	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8169	89.7730	89.6782	89.4403	88.8483	86.7000	86.7000	86.7000	86.7000	89.4322	89.7208	89.8363	(217)
Fuel for water heating, kWh/month													
	199.9603	175.3380	181.9941	160.3199	155.7685	139.1236	130.2852	147.5630	148.7497	166.4172	179.4889	194.0123	(219)
Water heating fuel used												1979.0208	(219)
Annual totals kWh/year													
Space heating fuel - main system												6706.1607	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												8240.0236	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6706.1607	0.2160	1448.5307	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.0208	0.2160	427.4685	(264)
Space and water heating			1875.9992	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			1644.9623	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.8300	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		27.9563	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9563	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1243	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3743	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3977	0.3897	0.3500	0.3420	0.3023	0.3023	0.2943	0.3182	0.3420	0.3579	0.3738	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.7900	1.3258	27.5625			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	169.5200	25.0300	144.4900	0.1800	26.0082			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4937			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3325	(36)
Total fabric heat loss (33) + (36) =	88.8262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.8313	61.4921	61.1595	59.5975	59.3053	57.9449	57.9449	57.6929	58.4689	59.3053	59.8965	60.5146	(38)
Heat transfer coeff	150.6576	150.3183	149.9857	148.4238	148.1315	146.7711	146.7711	146.5192	147.2951	148.1315	148.7227	149.3408	(39)
Average = Sum(39)m / 12 =												148.4224	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1746	1.1720	1.1694	1.1572	1.1549	1.1443	1.1443	1.1424	1.1484	1.1549	1.1595	1.1644	(40)
HLP (average)												1.1572	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.4911	482.1166	464.9043	436.9286	407.4451	379.3395	361.8472	369.2276	384.4483	412.6589	445.0572	469.8444	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	8.1100	11.2829	0.6300	0.7000	0.7700	27.9650	(75)
Southeast	1.0900	36.7938	0.6300	0.7000	0.7700	12.2567	(77)
South	1.0200	46.7521	0.6300	0.7000	0.7700	14.5738	(78)
Southwest	8.1300	36.7938	0.6300	0.7000	0.7700	91.4192	(79)
West	1.0200	19.6403	0.6300	0.7000	0.7700	6.1224	(80)
Northwest	1.4200	11.2829	0.6300	0.7000	0.7700	4.8965	(81)

Solar gains	157.2335	279.3337	412.2726	560.4406	672.4492	687.0984	654.3275	567.8829	463.1836	316.8796	190.4369	133.1891	(83)
Total gains	641.7247	761.4503	877.1769	997.3692	1079.8943	1066.4379	1016.1747	937.1105	847.6319	729.5385	635.4940	603.0335	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1205	59.2539	59.3853	60.0102	60.1286	60.6860	60.6860	60.7903	60.4701	60.1286	59.8896	59.6417	
alpha	4.9414	4.9503	4.9590	5.0007	5.0086	5.0457	5.0457	5.0527	5.0313	5.0086	4.9926	4.9761	
util living area													
	0.9991	0.9978	0.9934	0.9758	0.9169	0.7775	0.6104	0.6750	0.8999	0.9874	0.9981	0.9994	(86)
MIT	19.6333	19.7891	20.0489	20.3984	20.7166	20.9193	20.9813	20.9696	20.8143	20.3999	19.9526	19.6078	(87)
Th 2	19.9404	19.9425	19.9446	19.9544	19.9562	19.9648	19.9648	19.9664	19.9615	19.9562	19.9525	19.9486	(88)
util rest of house													
	0.9988	0.9970	0.9908	0.9657	0.8809	0.6886	0.4794	0.5443	0.8418	0.9806	0.9973	0.9991	(89)
MIT 2	18.1089	18.3380	18.7184	19.2287	19.6650	19.9078	19.9576	19.9530	19.8007	19.2377	18.5846	18.0774	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.3180	18.5370	18.9009	19.3891	19.8092	20.0465	20.0980	20.0924	19.9397	19.3971	18.7722	18.2873	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3180	18.5370	18.9009	19.3891	19.8092	20.0465	20.0980	20.0924	19.9397	19.3971	18.7722	18.2873	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9953	0.9871	0.9584	0.8746	0.6964	0.4971	0.5615	0.8403	0.9752	0.9958	0.9986	(94)
Useful gains	640.4827	757.8848	865.8972	955.8332	944.4940	742.7189	505.1611	526.2344	712.2315	711.4116	632.8191	602.1754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2111.9130	2049.8971	1859.9543	1556.8348	1201.2321	799.3947	513.3984	541.0134	860.1649	1303.1242	1735.9214	2103.8013	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1094.7442	868.2322	739.5785	432.7211	191.0132	0.0000	0.0000	0.0000	0.0000	440.2342	794.2337	1117.2096	(98)
Space heating												5677.9667	(98)
Space heating per m2											(98) / (4) =	44.2692	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6079.1934	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1094.7442	868.2322	739.5785	432.7211	191.0132	0.0000	0.0000	0.0000	0.0000	440.2342	794.2337	1117.2096	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1172.1030	929.5848	791.8399	463.2988	204.5109	0.0000	0.0000	0.0000	0.0000	471.3429	850.3572	1196.1559	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5454	88.3804	88.0214	87.1627	85.2586	80.3000	80.3000	80.3000	80.3000	87.1205	88.1785	88.6123	(217)
Fuel for water heating, kWh/month													
	247.0229	218.1013	229.9128	208.0261	206.3456	192.9601	184.8705	206.0873	207.8790	215.8206	225.6021	240.8625	(219)
Water heating fuel used												2583.4909	(219)
Annual totals kWh/year													
Space heating fuel - main system												6079.1934	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Total delivered energy for all uses												9222.0127	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6079.1934	0.2160	1313.1058	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2583.4909	0.2160	558.0340	(264)
Space and water heating			1871.1398	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Total CO2, kg/m2/year			2161.4312	(272)
Emissions per m2 for space and water heating			14.5886	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9598	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5886 * 1.00) + 1.9598 + 0.3035, rounded to 2 d.p.			16.8500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 251 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 251 - EPC	**Prop Type Ref**	Opp
Property	6 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.83	**TER**	16.85
Environmental	89 B	**% DER<TER**	23.87		
CO_2 Emissions (t/year)	1.19	**DFEE**	53.05	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.83	$kgCO_2/m^2$	Pass
	-4.02 (-23.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.05	$kWh/m^2/yr$	
	-3.4 (-6.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.80 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	8.11 m², No overhang
Windows facing South East	1.09 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	8.13 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	1.42 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.80 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 251 - BG2	**Issued on Date**	04/04/2025
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Environmental	89 B	**% DER<TER**	23.87		
CO_2 Emissions (t/year)	1.19	**DFEE**	53.05	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.75 m²	2.39 m
1st Storey:	1.00 m	63.51 m²	2.63 m

7.0 Living Area	17.59	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	169.52	144.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	63.51	63.51
Bay Roof	External Plane Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1a	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.02	10
W1b	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.25	10
W1c	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.02	10
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	10
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	10
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.09	10
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	10
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.71	10
D1	Half Glazed Door	[1] External Wall	South West				2.12	10
D2	Half Glazed Door	[1] External Wall	North West				2.12	10
D3 w12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		3.80	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.72	0.060	No
Independently assessed	E3 Sill	13.89	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	34.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.55	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.86	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	5.80	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 251 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 251 - EPC	**Prop Type Ref**	Opp
Property	6 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.83	**TER**	16.85
Environmental	89 B	**% DER<TER**	23.87		
CO_2 Emissions (t/year)	1.19	**DFEE**	53.05	**TFEE**	56.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.26	m^2	
DER	12.83	$kgCO_2/yr/m^2$	
TER	16.85	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.83	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.87	%	
CfSH ENE1 credits achieved	3.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	53.05	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.26	m^2	
DER	19.01	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.14	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.14	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.94	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.07	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.07	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 252 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 252 - EPC	**Prop Type Ref**	As
Property	4 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.37	**TER**	16.71
Environmental	89 B	**% DER<TER**	25.96		
CO_2 Emissions (t/year)	1.16	**DFEE**	51.11	**TFEE**	55.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.37	$kgCO_2/m^2$	Pass
	-4.34 (-26.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.11	$kWh/m^2/yr$	
	-4.1 (-7.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	10.75 m², No overhang 7.68 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.017	W/m^2K	
Photovoltaic array	1.22	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 252 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 252 - EPC	**Prop Type Ref**	As
Property	4 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.37	**TER**	16.71
Environmental	89 B	**% DER<TER**	25.96		
CO_2 Emissions (t/year)	1.16	**DFEE**	51.11	**TFEE**	55.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 10.75 m², No overhang
Windows facing South: 7.68 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.017 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3773	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3207	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4089	0.4009	0.3929	0.3528	0.3448	0.3047	0.3047	0.2967	0.3207	0.3448	0.3608	0.3768	(22b)
Effective ac	0.5836	0.5804	0.5772	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5651	0.5710	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.4300	1.2357	22.7747			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	163.0100	22.6700	140.3400	0.2700	37.8918			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		89.6190			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0359	(36)
Total fabric heat loss					(33) + (36) =		94.6549	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.4064	62.0592	61.7190	60.1208	59.8218	58.4298	58.4298	58.1720	58.9660	59.8218	60.4267	61.0591	(38)
Heat transfer coeff	157.0613	156.7141	156.3739	154.7756	154.4766	153.0846	153.0846	152.8269	153.6208	154.4766	155.0815	155.7139	(39)
Average = Sum(39)m / 12 =												154.7742	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2166	1.2139	1.2113	1.1989	1.1966	1.1858	1.1858	1.1838	1.1899	1.1966	1.2013	1.2061	(40)
HLP (average)												1.1989	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8299	10.6750	11.7956	11.3846	11.7349	11.3199	11.6745	11.7136	11.3543	11.7654	11.4216	11.8188	(61)
Total heat required for water heating calculated for each month													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.5011	(64)
Heat gains from water heating, kWh/month													
	58.7699	51.4827	53.3205	46.7613	45.0714	39.1916	36.6130	41.5932	41.9651	48.5396	52.6294	57.0061	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.2510	25.0923	20.4064	15.4490	11.5483	9.7495	10.5347	13.6934	18.3793	23.3367	27.2374	29.0361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9919	76.6111	71.6673	64.9463	60.5798	54.4327	49.2110	55.9048	58.2849	65.2414	73.0964	76.6211	(72)
Total internal gains													
	473.2646	470.8033	453.4169	425.2252	396.1131	368.5759	351.0512	357.8256	372.6483	401.0754	433.6761	458.5908	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.7500	10.6334	0.7200	0.7000	0.7700	39.9249	(74)
South	7.6800	46.7521	0.7200	0.7000	0.7700	125.4082	(78)

Solar gains	165.3331	281.6848	391.2756	503.9448	588.6644	596.8534	570.1184	503.8207	429.1801	312.3518	197.9040	141.6476	(83)
Total gains	638.5977	752.4882	844.6925	929.1700	984.7775	965.4294	921.1695	861.6463	801.8284	713.4272	631.5801	600.2384	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0814	57.2079	57.3323	57.9243	58.0365	58.5642	58.5642	58.6630	58.3598	58.0365	57.8101	57.5753	
alpha	4.8054	4.8139	4.8222	4.8616	4.8691	4.9043	4.9043	4.9109	4.8907	4.8691	4.8540	4.8384	
util living area													
	0.9991	0.9979	0.9946	0.9830	0.9439	0.8367	0.6810	0.7368	0.9229	0.9892	0.9982	0.9994	(86)
MIT	19.5734	19.7256	19.9732	20.3082	20.6342	20.8757	20.9665	20.9508	20.7689	20.3502	19.9007	19.5482	(87)
Th 2	19.9068	19.9089	19.9110	19.9209	19.9227	19.9314	19.9314	19.9330	19.9281	19.9227	19.9190	19.9151	(88)
util rest of house													
	0.9988	0.9972	0.9925	0.9756	0.9161	0.7542	0.5396	0.6015	0.8726	0.9832	0.9974	0.9992	(89)
MIT 2	17.9978	18.2219	18.5846	19.0768	19.5339	19.8382	19.9177	19.9100	19.7211	19.1423	18.4854	17.9667	(90)
Living area fraction									fLA = Living area / (4) =			0.1113	(91)
MIT	18.1732	18.3893	18.7392	19.2138	19.6563	19.9537	20.0345	20.0259	19.8377	19.2768	18.6429	18.1427	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1732	18.3893	18.7392	19.2138	19.6563	19.9537	20.0345	20.0259	19.8377	19.2768	18.6429	18.1427	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9955	0.9891	0.9686	0.9071	0.7562	0.5545	0.6148	0.8670	0.9777	0.9959	0.9986	(94)
Useful gains	637.3573	749.1230	835.4741	899.9835	893.3302	730.0988	510.7933	529.7059	695.1815	697.5526	628.9725	599.3744	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2178.9395	2113.9612	1913.8872	1596.3306	1229.0685	819.5685	525.7623	554.1320	881.4319	1340.3563	1790.0956	2171.0806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1146.9371	917.1712	802.3393	501.3699	249.7893	0.0000	0.0000	0.0000	0.0000	478.2460	836.0086	1169.3494	(98)
Space heating												6101.2109	(98)
Space heating per m2											(98) / (4) =	47.2596	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6539.3472	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1146.9371	917.1712	802.3393	501.3699	249.7893	0.0000	0.0000	0.0000	0.0000	478.2460	836.0086	1169.3494	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1229.3002	983.0346	859.9564	537.3740	267.7270	0.0000	0.0000	0.0000	0.0000	512.5895	896.0436	1253.3219	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7950	89.7539	89.6704	89.4735	88.9823	86.7000	86.7000	86.7000	86.7000	89.4185	89.6982	89.8160	(217)
Fuel for water heating, kWh/month													
	200.1080	175.4619	182.0993	160.3384	155.6092	139.1904	130.3471	147.6340	148.8214	166.5238	179.6223	194.1517	(219)
Water heating fuel used												1979.9075	(219)
Annual totals kWh/year													
Space heating fuel - main system												6539.3472	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												498.9209	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1068 * 1.00) =										-1042.4368		-1042.4368	(233)
Total delivered energy for all uses												8050.7388	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6539.3472	0.2160	1412.4990	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.9075	0.2160	427.6600	(264)
Space and water heating			1840.1590	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	498.9209	0.5190	258.9400	(268)
Energy saving/generation technologies				
PV Unit	-1042.4368	0.5190	-541.0247	(269)
Total CO2, kg/year			1596.9993	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.3700	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		27.4452	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4452	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.4300	1.3258	24.4337			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.6700	140.3400	0.1800	25.2612			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.5659			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0849	(36)
Total fabric heat loss (33) + (36) =	83.6508	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.8752	145.5351	145.2018	143.6361	143.3432	141.9796	141.9796	141.7270	142.5048	143.3432	143.9358	144.5553	(39)
Average = Sum(39)m / 12 =												143.6347	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1299	1.1273	1.1247	1.1126	1.1103	1.0998	1.0998	1.0978	1.1038	1.1103	1.1149	1.1197	(40)
HLP (average)												1.1126	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.2510	25.0923	20.4064	15.4490	11.5483	9.7495	10.5347	13.6934	18.3793	23.3367	27.2374	29.0361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.4128	483.9553	466.5766	438.3955	408.7325	380.5033	362.9861	370.4522	385.8291	414.2453	446.8336	471.7428	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.7500	10.6334	0.6300	0.7000	0.7700	34.9343	(74)
South	7.6800	46.7521	0.6300	0.7000	0.7700	109.7321	(78)

Solar gains	144.6664	246.4742	342.3661	440.9517	515.0813	522.2468	498.8536	440.8431	375.5326	273.3078	173.1660	123.9416	(83)
Total gains	631.0793	730.4295	808.9427	879.3472	923.8139	902.7500	861.8397	811.2953	761.3617	687.5531	619.9996	595.6844	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4585	61.6022	61.7436	62.4166	62.5441	63.1448	63.1448	63.2574	62.9121	62.5441	62.2866	62.0197	
alpha	5.0972	5.1068	5.1162	5.1611	5.1696	5.2097	5.2097	5.2172	5.1941	5.1696	5.1524	5.1346	
util living area													
	0.9992	0.9982	0.9954	0.9851	0.9485	0.8417	0.6817	0.7357	0.9248	0.9901	0.9983	0.9994	(86)
MIT	19.6817	19.8210	20.0498	20.3615	20.6653	20.8907	20.9727	20.9596	20.7952	20.4064	19.9884	19.6590	(87)
Th 2	19.9765	19.9786	19.9807	19.9906	19.9924	20.0010	20.0010	20.0026	19.9977	19.9924	19.9887	19.9848	(88)
util rest of house													
	0.9990	0.9976	0.9936	0.9786	0.9233	0.7636	0.5479	0.6073	0.8770	0.9846	0.9976	0.9993	(89)
MIT 2	18.2051	18.4103	18.7458	19.2048	19.6321	19.9177	19.9895	19.9834	19.8121	19.2740	18.6626	18.1778	(90)
Living area fraction									fLA = Living area / (4) =			0.1113	(91)
MIT	18.3695	18.5673	18.8909	19.3335	19.7471	20.0260	20.0990	20.0920	19.9215	19.4001	18.8102	18.3427	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3695	18.5673	18.8909	19.3335	19.7471	20.0260	20.0990	20.0920	19.9215	19.4001	18.8102	18.3427	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9907	0.9726	0.9153	0.7659	0.5621	0.6201	0.8723	0.9798	0.9963	0.9987	(94)
Useful gains	630.0074	727.6501	801.4314	855.2502	845.5575	691.4401	484.4505	503.0895	664.1234	673.6480	617.7285	594.9331	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2052.3921	1989.0785	1799.1869	1498.6285	1153.4948	770.3854	496.7836	523.2597	829.5932	1261.4279	1685.5155	2044.4023	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1058.2543	847.6799	742.3301	463.2324	229.1054	0.0000	0.0000	0.0000	0.0000	437.3083	768.8066	1078.4051	(98)
Space heating												5625.1220	(98)
Space heating per m2											(98) / (4) =	43.5718	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6022.6146	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1058.2543	847.6799	742.3301	463.2324	229.1054	0.0000	0.0000	0.0000	0.0000	437.3083	768.8066	1078.4051	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1133.0346	907.5802	794.7860	495.9661	245.2948	0.0000	0.0000	0.0000	0.0000	468.2102	823.1334	1154.6093	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4929	88.3408	88.0275	87.3099	85.7158	80.3000	80.3000	80.3000	80.3000	87.1049	88.1209	88.5591	(217)
Fuel for water heating, kWh/month													
	247.2695	218.2868	229.9879	207.7552	205.3534	193.0620	184.9681	206.1960	207.9563	215.9424	225.8391	241.1040	(219)
Water heating fuel used												2583.7208	(219)
Annual totals kWh/year													
Space heating fuel - main system												6022.6146	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												498.9209	(232)
Total delivered energy for all uses												9180.2563	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6022.6146	0.2160	1300.8848	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2583.7208	0.2160	558.0837	(264)
Space and water heating			1858.9684	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	498.9209	0.5190	258.9400	(268)
Total CO2, kg/m2/year			2156.8334	(272)
Emissions per m2 for space and water heating			14.3994	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0057	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3994 * 1.00) + 2.0057 + 0.3015, rounded to 2 d.p.			16.7100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 252 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 252 - EPC	**Prop Type Ref**	As
Property	4 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.37	**TER**	16.71
Environmental	89 B	**% DER<TER**	25.96		
CO_2 Emissions (t/year)	1.16	**DFEE**	51.11	**TFEE**	55.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.37	$kgCO_2/m^2$	Pass
	-4.34 (-26.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.11	$kWh/m^2/yr$	
	-4.1 (-7.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass
Based on:			
Overshading	Average		
Windows facing North	10.75 m², No overhang		
Windows facing South	7.68 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.017	W/m²K	
Photovoltaic array	1.22	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 252 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 252 - EPC	**Prop Type Ref**	As
Property	4 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.37	**TER**	16.71
Environmental	89 B	**% DER<TER**	25.96		
CO_2 Emissions (t/year)	1.16	**DFEE**	51.11	**TFEE**	55.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.55 m²	2.39 m
1st Storey:	1.00 m	64.55 m²	2.63 m

7.0 Living Area	14.37	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	163.01	140.34

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
D1	Half Glazed Door	[1] External Wall	South							2.12	100
D2 (W10)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.49	100
D3	Half Glazed Door	[1] External Wall	North							2.12	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.060	No
Independently assessed	E3 Sill	12.36	0.009	No
Independently assessed	E4 Jamb	33.90	0.011	No
Independently assessed	E5 Ground floor (normal)	32.54	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.053	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.017	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.46	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 252 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 252 - EPC	**Prop Type Ref**	As
Property	4 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.37	**TER**	16.71
Environmental	89 B	**% DER<TER**	25.96		
CO_2 Emissions (t/year)	1.16	**DFEE**	51.11	**TFEE**	55.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	12.37	$kgCO_2/yr/m^2$	
TER	16.71	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.96	%	
CfSH ENE1 credits achieved	3.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.11	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	18.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.42	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.50	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.50	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 253 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 253 - EPC	**Prop Type Ref**	As
Property	2 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.79	**TER**	16.60
Environmental	89 B	**% DER<TER**	22.96		
CO_2 Emissions (t/year)	1.23	**DFEE**	50.60	**TFEE**	56.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.15		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.60	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.79	$kgCO_2/m^2$	Pass
	-3.81 (-23.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.32	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.60	$kWh/m^2/yr$	
	-5.7 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	9.37 m², No overhang		
Windows facing East	7.69 m², No overhang		
Windows facing South East	1.04 m², No overhang		
Windows facing South	6.75 m², No overhang		
Windows facing South West	1.04 m², No overhang		
Windows facing West	0.72 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	1.22	kW	

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	Plot 253 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 253 - EPC	**Prop Type Ref**	As
Property	2 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.79	**TER**	16.60
Environmental	89 B	**% DER<TER**	22.96		
CO_2 Emissions (t/year)	1.23	**DFEE**	50.60	**TFEE**	56.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.15		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 130 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.79 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.6 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.49 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   9.37 m², No overhang
Windows facing East:                    7.69 m², No overhang
Windows facing South East:              1.04 m², No overhang
Windows facing South:                   6.75 m², No overhang
Windows facing South West:              1.04 m², No overhang
Windows facing West:                    0.72 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.019 W/m²K
Photovoltaic array                      1.22 kW



---------------------------------------------------------------------------------------------------
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7300	(1b)	x 2.3900	(2b) =	157.0947	(1b) - (3b)
First floor	64.5500	(1c)	x 2.6300	(2c) =	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		326.8612	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1530	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3775	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3208	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4091	0.4011	0.3930	0.3529	0.3449	0.3048	0.3048	0.2968	0.3208	0.3449	0.3610	0.3770	(22b)
Effective ac	0.5837	0.5804	0.5772	0.5623	0.5595	0.5465	0.5465	0.5440	0.5515	0.5595	0.5651	0.5711	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.6100	1.2357	32.8831			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	164.2000	30.8500	133.3500	0.2700	36.0045			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Bay roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			294.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.0289			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6869	(36)
Total fabric heat loss (33) + (36) =	103.7157	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.9576	62.6071	62.2636	60.6500	60.3481	58.9428	58.9428	58.6825	59.4841	60.3481	60.9589	61.5973	(38)
Heat transfer coeff	166.6733	166.3229	165.9793	164.3658	164.0639	162.6585	162.6585	162.3983	163.1999	164.0639	164.6746	165.3131	(39)
Average = Sum(39)m / 12 =												164.3643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2793	1.2767	1.2740	1.2616	1.2593	1.2485	1.2485	1.2465	1.2527	1.2593	1.2640	1.2689	(40)
HLP (average)												1.2616	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9732 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2705	109.1516	105.0326	100.9137	96.7948	92.6758	92.6758	96.7948	100.9137	105.0326	109.1516	113.2705	(44)
Energy conte	167.9768	146.9136	151.6017	132.1700	126.8203	109.4363	101.4088	116.3681	117.7579	137.2355	149.8032	162.6766	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1688	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1965	22.0370	22.7403	19.8255	19.0230	16.4154	15.2113	17.4552	17.6637	20.5853	22.4705	24.4015	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8302	10.6752	11.7958	11.3848	11.7352	11.3202	11.6748	11.7140	11.3545	11.7656	11.4218	11.8191	(61)
Total heat required for water heating calculated for each month													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(64)
								Total per year (kWh/year) = Sum(64)m =				1758.6600	(64)
Heat gains from water heating, kWh/month													
	58.8099	51.5176	53.3565	46.7927	45.1016	39.2176	36.6371	41.6209	41.9931	48.5722	52.6650	57.0447	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7045	23.7187	19.2893	14.6032	10.9161	9.2158	9.9580	12.9438	17.3732	22.0592	25.7464	27.4467	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0577	301.1506	293.3566	276.7640	255.8189	236.1334	222.9823	219.8894	227.6835	244.2760	265.2211	284.9066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	(71)
Water heating gains (Table 5)													
	79.0455	76.6631	71.7157	64.9899	60.6204	54.4689	49.2434	55.9420	58.3238	65.2852	73.1459	76.6730	(72)
Total internal gains													
	473.2433	470.9680	453.7973	425.7928	396.7911	369.2539	351.6195	358.2110	372.8161	401.0561	433.5491	458.4620	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.3700	10.6334	0.7200	0.7000	0.7700	34.7997	(74)
East	7.6900	19.6403	0.7200	0.7000	0.7700	52.7518	(76)
Southeast	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(77)
South	6.7500	46.7521	0.7200	0.7000	0.7700	110.2220	(78)
Southwest	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(79)
West	0.7200	19.6403	0.7200	0.7000	0.7700	4.9391	(80)

Solar gains	229.4428	405.4062	591.1060	789.6563	933.9946	948.2885	905.5459	795.1290	659.6896	458.1015	277.5309	194.5703	(83)
Total gains	702.6861	876.3742	1044.9033	1215.4491	1330.7856	1317.5423	1257.1654	1153.3400	1032.5057	859.1576	711.0800	653.0323	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2812	54.3955	54.5081	55.0432	55.1445	55.6209	55.6209	55.7101	55.4365	55.1445	54.9400	54.7278	
alpha	4.6187	4.6264	4.6339	4.6695	4.6763	4.7081	4.7081	4.7140	4.6958	4.6763	4.6627	4.6485	
util living area													
	0.9987	0.9962	0.9880	0.9584	0.8751	0.7161	0.5513	0.6156	0.8582	0.9795	0.9970	0.9991	(86)
MIT	19.5339	19.7283	20.0312	20.4179	20.7447	20.9310	20.9840	20.9737	20.8302	20.3888	19.8842	19.5007	(87)
Th 2	19.8570	19.8592	19.8612	19.8710	19.8728	19.8814	19.8814	19.8830	19.8781	19.8728	19.8691	19.8653	(88)
util rest of house													
	0.9982	0.9948	0.9836	0.9422	0.8269	0.6188	0.4202	0.4816	0.7851	0.9687	0.9958	0.9988	(89)
MIT 2	17.9059	18.1912	18.6326	19.1900	19.6240	19.8360	19.8757	19.8724	19.7409	19.1595	18.4265	17.8630	(90)
Living area fraction									fLA = Living area / (4) =			0.1218	(91)
MIT	18.1042	18.3784	18.8030	19.3396	19.7605	19.9694	20.0107	20.0065	19.8736	19.3092	18.6041	18.0625	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1042	18.3784	18.8030	19.3396	19.7605	19.9694	20.0107	20.0065	19.8736	19.3092	18.6041	18.0625	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9921	0.9776	0.9321	0.8212	0.6272	0.4360	0.4974	0.7847	0.9609	0.9935	0.9979	(94)
Useful gains	700.6450	869.4166	1021.4912	1132.9209	1092.8755	826.3934	548.1292	573.6262	810.2429	825.5418	706.4562	651.6671	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2300.7972	2241.7688	2042.0418	1715.9090	1322.4341	873.3800	554.7780	585.6950	942.2467	1428.8725	1894.4343	2291.6546	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1190.5132	922.2207	759.2897	419.7514	170.7916	0.0000	0.0000	0.0000	0.0000	448.8781	855.3443	1220.1506	(98)
Space heating												5986.9396	(98)
Space heating per m2											(98) / (4) =	45.9544	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6416.8699	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1190.5132	922.2207	759.2897	419.7514	170.7916	0.0000	0.0000	0.0000	0.0000	448.8781	855.3443	1220.1506	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1276.0056	988.4466	813.8153	449.8944	183.0564	0.0000	0.0000	0.0000	0.0000	481.1126	916.7677	1307.7713	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8107	89.7561	89.6409	89.3545	88.6513	86.7000	86.7000	86.7000	86.7000	89.3751	89.7092	89.8333	(217)
Fuel for water heating, kWh/month													
	200.2068	175.5746	182.2802	160.6576	156.2927	139.2808	130.4309	147.7302	148.9185	166.7142	179.7195	194.2439	(219)
Water heating fuel used												1982.0499	(219)
Annual totals kWh/year													
Space heating fuel - main system												6416.8699	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.6090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 853 * 1.00) =										-832.5572		-832.5572	(233)
Total delivered energy for all uses												8112.9716	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6416.8699	0.2160	1386.0439	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1982.0499	0.2160	428.1228	(264)
Space and water heating			1814.1667	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.6090	0.5190	244.7651	(268)
Energy saving/generation technologies				
PV Unit	-832.5572	0.5190	-432.0972	(269)
Total CO2, kg/year			1665.7596	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.7900	ZC1
Total Floor Area	TFA	130.2800	
Assumed number of occupants	N	2.8957	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5572	ZC2
CO2 emissions from cooking, equation (L16)		1.4469	ZC3
Total CO2 emissions		27.7940	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7940	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7300	(1b)	x 2.3900	(2b) =	157.0947	(1b) - (3b)
First floor	64.5500	(1c)	x 2.6300	(2c) =	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	326.8612	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1224	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3724	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4036	0.3956	0.3877	0.3482	0.3403	0.3007	0.3007	0.2928	0.3165	0.3403	0.3561	0.3719	(22b)
Effective ac	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5692	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.6100	1.3258	35.2784			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	164.2000	30.8500	133.3500	0.1800	24.0030			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Bay roof	1.1800		1.1800	0.1300	0.1534			(30)
Total net area of external elements Aum(A, m2)			294.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.3058			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.8239	(36)
Total fabric heat loss					(33) + (36) =		95.1297	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.7156	62.3746	62.0402	60.4699	60.1761	58.8085	58.8085	58.5552	59.3353	60.1761	60.7705	61.3919	(38)
Heat transfer coeff	157.8453	157.5043	157.1699	155.5996	155.3058	153.9382	153.9382	153.6849	154.4650	155.3058	155.9002	156.5216	(39)
Average = Sum(39)m / 12 =												155.5982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2116	1.2090	1.2064	1.1943	1.1921	1.1816	1.1816	1.1797	1.1856	1.1921	1.1967	1.2014	(40)
HLP (average)												1.1943	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8957	(42)
Average daily hot water use (litres/day)												102.9732	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2705	109.1516	105.0326	100.9137	96.7948	92.6758	92.6758	96.7948	100.9137	105.0326	109.1516	113.2705	(44)
Energy conte	167.9768	146.9136	151.6017	132.1700	126.8203	109.4363	101.4088	116.3681	117.7579	137.2355	149.8032	162.6766	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1688	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1965	22.0370	22.7403	19.8255	19.0230	16.4154	15.2113	17.4552	17.6637	20.5853	22.4705	24.4015	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.3256	45.7032	47.2266	49.3256	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355 (64)
								Total per year (kWh/year) = Sum(64)m =				2209.5579 (64)
Heat gains from water heating, kWh/month												
	68.5920	60.3556	63.1473	56.2753	54.4991	47.8134	45.5251	51.0238	51.4833	58.3705	62.1383	66.8297 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7045	23.7187	19.2893	14.6032	10.9161	9.2158	9.9580	12.9438	17.3732	22.0592	25.7464	27.4467	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0577	301.1506	293.3566	276.7640	255.8189	236.1334	222.9823	219.8894	227.6835	244.2760	265.2211	284.9066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	(71)
Water heating gains (Table 5)													
	92.1936	89.8149	84.8754	78.1601	73.2515	66.4074	61.1896	68.5803	71.5045	78.4550	86.3033	89.8249	(72)
Total internal gains													
	486.3914	484.1199	466.9570	438.9631	409.4222	381.1924	363.5657	370.8493	385.9969	414.2259	446.7065	471.6138	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.3700	10.6334	0.6300	0.7000	0.7700	30.4497	(74)
East	7.6900	19.6403	0.6300	0.7000	0.7700	46.1578	(76)
Southeast	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(77)
South	6.7500	46.7521	0.6300	0.7000	0.7700	96.4443	(78)
Southwest	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(79)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	200.7624	354.7304	517.2178	690.9492	817.2452	829.7524	792.3527	695.7379	577.2284	400.8388	242.8395	170.2490	(83)
Total gains	687.1538	838.8503	984.1747	1129.9123	1226.6674	1210.9448	1155.9184	1066.5872	963.2252	815.0647	689.5460	641.8628	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3170	57.4411	57.5633	58.1442	58.2542	58.7718	58.7718	58.8686	58.5713	58.2542	58.0321	57.8018	
alpha	4.8211	4.8294	4.8376	4.8763	4.8836	4.9181	4.9181	4.9246	4.9048	4.8836	4.8688	4.8535	
util living area													
	0.9989	0.9968	0.9901	0.9651	0.8901	0.7356	0.5677	0.6305	0.8698	0.9821	0.9974	0.9992	(86)
MIT	19.6101	19.7878	20.0692	20.4334	20.7478	20.9323	20.9849	20.9753	20.8367	20.4172	19.9426	19.5800	(87)
Th 2	19.9107	19.9128	19.9149	19.9245	19.9263	19.9348	19.9348	19.9363	19.9315	19.9263	19.9227	19.9189	(88)
util rest of house													
	0.9985	0.9957	0.9865	0.9512	0.8465	0.6422	0.4395	0.5003	0.8016	0.9727	0.9963	0.9989	(89)
MIT 2	18.0543	18.3152	18.7260	19.2536	19.6756	19.8891	19.9292	19.9260	19.7966	19.2394	18.5490	18.0159	(90)
Living area fraction									fLA = Living area / (4) =			0.1218	(91)
MIT	18.2438	18.4946	18.8896	19.3973	19.8062	20.0162	20.0578	20.0538	19.9233	19.3828	18.7188	18.2065	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2438	18.4946	18.8896	19.3973	19.8062	20.0162	20.0578	20.0538	19.9233	19.3828	18.7188	18.2065	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9934	0.9814	0.9423	0.8406	0.6501	0.4549	0.5157	0.8010	0.9658	0.9944	0.9982	(94)
Useful gains	685.4255	833.3020	965.9004	1064.6856	1031.1759	787.2120	525.8824	549.9909	771.5504	787.1843	685.6574	640.6928	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2200.9702	2141.2087	1947.2792	1633.3781	1258.9460	833.7540	532.2832	561.5376	899.4951	1364.0266	1811.3734	2192.3146	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1127.5653	878.9133	730.1458	409.4586	169.4610	0.0000	0.0000	0.0000	0.0000	429.1707	810.5155	1154.4066	(98)
Space heating												5709.6368	(98)
Space heating per m2											(98) / (4) =	43.8259	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6113.1015	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1127.5653	878.9133	730.1458	409.4586	169.4610	0.0000	0.0000	0.0000	0.0000	429.1707	810.5155	1154.4066	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1207.2433	941.0207	781.7407	438.3925	181.4357	0.0000	0.0000	0.0000	0.0000	459.4975	867.7896	1235.9814	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5883	88.3986	87.9963	87.0379	84.9540	80.3000	80.3000	80.3000	80.3000	87.0619	88.2118	88.6586	(217)
Fuel for water heating, kWh/month													
	247.1385	218.2626	230.1922	208.5127	207.3427	193.1998	185.1001	206.3433	208.0610	216.1615	225.7274	240.9643	(219)
Water heating fuel used												2587.0060	(219)
Annual totals kWh/year													
Space heating fuel - main system												6113.1015	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.6090	(232)
Total delivered energy for all uses												9246.7165	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6113.1015	0.2160	1320.4299	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2587.0060	0.2160	558.7933	(264)
Space and water heating			1879.2232	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.6090	0.5190	244.7651	(268)
Total CO2, kg/m2/year			2162.9133	(272)
Emissions per m2 for space and water heating			14.4245	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8788	(272b)
Emissions per m2 for pumps and fans			0.2988	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4245 * 1.00) + 1.8788 + 0.2988, rounded to 2 d.p.			16.6000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 253 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 253 - EPC	**Prop Type Ref**	As
Property	2 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.79	**TER**	16.60
Environmental	89 B	**% DER<TER**	22.96		
CO_2 Emissions (t/year)	1.23	**DFEE**	50.60	**TFEE**	56.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.15		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.60	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.79	$kgCO_2/m^2$	Pass
	-3.81 (-23.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.32	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.60	$kWh/m^2/yr$	
	-5.7 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	9.37 m², No overhang
Windows facing East	7.69 m², No overhang
Windows facing South East	1.04 m², No overhang
Windows facing South	6.75 m², No overhang
Windows facing South West	1.04 m², No overhang
Windows facing West	0.72 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 253 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 253 - EPC	**Prop Type Ref**	As
Property	2 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.79	**TER**	16.60
Environmental	89 B	**% DER<TER**	22.96		
CO_2 Emissions (t/year)	1.23	**DFEE**	50.60	**TFEE**	56.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.15		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	65.73 m²	2.39 m
1st Storey:	1.00 m	64.55 m²	2.63 m

7.0 Living Area	15.87	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	164.20	133.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	64.55	64.55
Bay roof	External Flat Roof	0.16	1.18	1.18

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.25	100
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.04	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
D2 (W16)	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.04	100
D3	Half Glazed Door	[1] External Wall	West							2.12	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100

W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.50	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.72	100
W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		2.17	100
W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.24	0.060	No
Independently assessed	E3 Sill	18.41	0.009	No
Independently assessed	E4 Jamb	50.10	0.011	No
Independently assessed	E5 Ground floor (normal)	33.04	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.023	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.49	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 253 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 253 - EPC	**Prop Type Ref**	As
Property	2 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.79	**TER**	16.60
Environmental	89 B	**% DER<TER**	22.96		
CO_2 Emissions (t/year)	1.23	**DFEE**	50.60	**TFEE**	56.32
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.15		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	130.28	m^2	
DER	12.79	$kgCO_2/yr/m^2$	
TER	16.60	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.79	$kgCO_2/yr/m^2$	
Reduction DER/TER	22.96	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	50.60	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	130.28	m^2	
DER	18.17	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.45	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.17	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.17	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.85	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.45	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.85	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.85	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	10	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 254 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 254 - EPC	**Prop Type Ref**	Opp
Property	4 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	90 B	**DER**	11.53	**TER**	16.25
Environmental	90 B	**% DER<TER**	29.03		
CO_2 Emissions (t/year)	1.07	**DFEE**	49.04	**TFEE**	54.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.25	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.53	$kgCO_2/m^2$	Pass
	-4.72 (-29.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.04	$kWh/m^2/yr$	
	-5.7 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

elmhurstenergy APPROVED ENERGY ASSESSOR

ELMHURST ENERGY QUALITY PROMISE ACCREDITED MEMBER

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	0.72 m², No overhang		
Windows facing North East	1.04 m², No overhang		
Windows facing East	6.75 m², No overhang		
Windows facing South East	1.04 m², No overhang		
Windows facing South	7.69 m², No overhang		
Windows facing West	9.37 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.019	W/m^2K	
Photovoltaic array	1.21	kW	

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 254 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 254 - EPC	**Prop Type Ref**	Opp
Property	4 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	90 B	**DER**	11.53	**TER**	16.25
Environmental	90 B	**% DER<TER**	29.03		
CO_2 Emissions (t/year)	1.07	**DFEE**	49.04	**TFEE**	54.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 130 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.25 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.53 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.41 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.72 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 6.75 m², No overhang
Windows facing South East: 1.04 m², No overhang
Windows facing South: 7.69 m², No overhang
Windows facing West: 9.37 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7300	(1b)	x 2.3900	(2b) =	157.0947	(1b) - (3b)
First floor	64.5500	(1c)	x 2.6300	(2c) =	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		326.8612	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1530	(8)
Pressure test		Yes	
Measured/design AP50		4.4100	
Infiltration rate		0.3735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3889	0.3492	0.3413	0.3016	0.3016	0.2936	0.3174	0.3413	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.6100	1.2357	32.8831			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	164.2000	30.8500	133.3500	0.2700	36.0045			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Bay roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			294.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.0289			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6869	(36)
Total fabric heat loss (33) + (36) =	103.7157	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.7673	62.4242	62.0879	60.5084	60.2129	58.8372	58.8372	58.5824	59.3671	60.2129	60.8107	61.4357	(38)
Heat transfer coeff	166.4831	166.1400	165.8037	164.2242	163.9286	162.5529	162.5529	162.2981	163.0828	163.9286	164.5265	165.1515	(39)
Average = Sum(39)m / 12 =												164.2227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2779	1.2753	1.2727	1.2605	1.2583	1.2477	1.2477	1.2458	1.2518	1.2583	1.2629	1.2677	(40)
HLP (average)												1.2605	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9732 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2705	109.1516	105.0326	100.9137	96.7948	92.6758	92.6758	96.7948	100.9137	105.0326	109.1516	113.2705	(44)
Energy conte	167.9768	146.9136	151.6017	132.1700	126.8203	109.4363	101.4088	116.3681	117.7579	137.2355	149.8032	162.6766	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1688	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1965	22.0370	22.7403	19.8255	19.0230	16.4154	15.2113	17.4552	17.6637	20.5853	22.4705	24.4015	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8302	10.6752	11.7958	11.3848	11.7352	11.3202	11.6748	11.7140	11.3545	11.7656	11.4218	11.8191	(61)
Total heat required for water heating calculated for each month													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(64)
								Total per year (kWh/year) = Sum(64)m =				1758.6600	(64)
Heat gains from water heating, kWh/month													
	58.8099	51.5176	53.3565	46.7927	45.1016	39.2176	36.6371	41.6209	41.9931	48.5722	52.6650	57.0447	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7045	23.7187	19.2893	14.6032	10.9161	9.2158	9.9580	12.9438	17.3732	22.0592	25.7464	27.4467	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0577	301.1506	293.3566	276.7640	255.8189	236.1334	222.9823	219.8894	227.6835	244.2760	265.2211	284.9066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	(71)
Water heating gains (Table 5)													
	79.0455	76.6631	71.7157	64.9899	60.6204	54.4689	49.2434	55.9420	58.3238	65.2852	73.1459	76.6730	(72)
Total internal gains													
	473.2433	470.9680	453.7973	425.7928	396.7911	369.2539	351.6195	358.2110	372.8161	401.0561	433.5491	458.4620	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.7200	0.7000	0.7700	2.6740	(74)
Northeast	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(75)
East	6.7500	19.6403	0.7200	0.7000	0.7700	46.3036	(76)
Southeast	1.0400	36.7938	0.7200	0.7000	0.7700	13.3651	(77)
South	7.6900	46.7521	0.7200	0.7000	0.7700	125.5715	(78)
West	9.3700	19.6403	0.7200	0.7000	0.7700	64.2763	(80)

Solar gains	256.2889	458.1898	673.0739	892.8677	1040.4741	1047.1449	1003.9152	893.9858	750.4650	519.9352	311.1891	216.4548	(83)
Total gains	729.5322	929.1578	1126.8712	1318.6606	1437.2651	1416.3987	1355.5347	1252.1968	1123.2811	920.9913	744.7382	674.9167	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3432	54.4554	54.5659	55.0907	55.1900	55.6571	55.6571	55.7445	55.4762	55.1900	54.9895	54.7814	
alpha	4.6229	4.6304	4.6377	4.6727	4.6793	4.7105	4.7105	4.7163	4.6984	4.6793	4.6660	4.6521	
util living area													
	0.9985	0.9951	0.9840	0.9451	0.8473	0.6795	0.5150	0.5741	0.8252	0.9734	0.9964	0.9989	(86)
MIT	19.5545	19.7664	20.0866	20.4765	20.7832	20.9448	20.9879	20.9803	20.8597	20.4286	19.9088	19.5177	(87)
Th 2	19.8582	19.8603	19.8623	19.8719	19.8737	19.8820	19.8820	19.8836	19.8788	19.8737	19.8700	19.8662	(88)
util rest of house													
	0.9979	0.9934	0.9781	0.9249	0.7938	0.5822	0.3906	0.4456	0.7453	0.9599	0.9949	0.9986	(89)
MIT 2	17.9368	18.2474	18.7126	19.2692	19.6677	19.8468	19.8778	19.8759	19.7698	19.2150	18.4629	17.8885	(90)
Living area fraction									fLA = Living area / (4) =			0.1218	(91)
MIT	18.1339	18.4324	18.8799	19.4163	19.8036	19.9806	20.0131	20.0105	19.9025	19.3628	18.6391	18.0869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1339	18.4324	18.8799	19.4163	19.8036	19.9806	20.0131	20.0105	19.9025	19.3628	18.6391	18.0869	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9901	0.9711	0.9145	0.7900	0.5915	0.4057	0.4609	0.7473	0.9513	0.9922	0.9976	(94)
Useful gains	727.0762	919.9832	1094.2685	1205.8551	1135.4311	837.7394	549.8986	577.1774	839.4513	876.1040	738.9623	673.3063	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2303.1102	2248.2727	2052.6403	1727.0291	1328.4053	874.6250	554.8036	585.9695	946.2910	1436.4739	1898.4816	2293.4462	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1172.5692	892.6105	713.0286	375.2453	143.5728	0.0000	0.0000	0.0000	0.0000	416.9152	834.8539	1205.3841	(98)
Space heating												5754.1796	(98)
Space heating per m2											(98) / (4) =	44.1678	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6167.3951	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1172.5692	892.6105	713.0286	375.2453	143.5728	0.0000	0.0000	0.0000	0.0000	416.9152	834.8539	1205.3841	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1256.7730	956.7101	764.2322	402.1922	153.8830	0.0000	0.0000	0.0000	0.0000	446.8545	894.8059	1291.9444	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8070	157.5889	163.3975	143.5548	138.5555	120.7565	113.0836	128.0821	129.1124	149.0011	161.2250	174.4957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8042	89.7409	89.6063	89.2743	88.4954	86.7000	86.7000	86.7000	86.7000	89.3235	89.6972	89.8283	(217)
Fuel for water heating, kWh/month													
	200.2211	175.6044	182.3504	160.8020	156.5681	139.2808	130.4309	147.7302	148.9185	166.8107	179.7437	194.2546	(219)
Water heating fuel used												1982.7154	(219)
Annual totals kWh/year													
Space heating fuel - main system												6167.3951	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.6090	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1080 * 1.00) =										-1044.9798		-1044.9798	(233)
Total delivered energy for all uses												7651.7397	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6167.3951	0.2160	1332.1573	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1982.7154	0.2160	428.2665	(264)
Space and water heating			1760.4239	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.6090	0.5190	244.7651	(268)
Energy saving/generation technologies				
PV Unit	-1044.9798	0.5190	-542.3445	(269)
Total CO2, kg/year			1501.7694	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.5300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.5300	ZC1
Total Floor Area	TFA	130.2800	
Assumed number of occupants	N	2.8957	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5572	ZC2
CO2 emissions from cooking, equation (L16)		1.4469	ZC3
Total CO2 emissions		26.5340	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.5340	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7300	(1b)	x 2.3900	(2b) =	157.0947	(1b) - (3b)
First floor	64.5500	(1c)	x 2.6300	(2c) =	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	326.8612	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1224	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3724	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4036	0.3956	0.3877	0.3482	0.3403	0.3007	0.3007	0.2928	0.3165	0.3403	0.3561	0.3719	(22b)
Effective ac	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5692	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.6100	1.3258	35.2784			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	164.2000	30.8500	133.3500	0.1800	24.0030			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Bay roof	1.1800		1.1800	0.1300	0.1534			(30)
Total net area of external elements Aum(A, m2)			294.4800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.3058			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.8239	(36)
Total fabric heat loss					(33) + (36) =		95.1297	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.7156	62.3746	62.0402	60.4699	60.1761	58.8085	58.8085	58.5552	59.3353	60.1761	60.7705	61.3919	(38)
Heat transfer coeff	157.8453	157.5043	157.1699	155.5996	155.3058	153.9382	153.9382	153.6849	154.4650	155.3058	155.9002	156.5216	(39)
Average = Sum(39)m / 12 =												155.5982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2116	1.2090	1.2064	1.1943	1.1921	1.1816	1.1816	1.1797	1.1856	1.1921	1.1967	1.2014	(40)
HLP (average)												1.1943	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8957	(42)
Average daily hot water use (litres/day)												102.9732	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2705	109.1516	105.0326	100.9137	96.7948	92.6758	92.6758	96.7948	100.9137	105.0326	109.1516	113.2705	(44)
Energy conte	167.9768	146.9136	151.6017	132.1700	126.8203	109.4363	101.4088	116.3681	117.7579	137.2355	149.8032	162.6766	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1688	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1965	22.0370	22.7403	19.8255	19.0230	16.4154	15.2113	17.4552	17.6637	20.5853	22.4705	24.4015	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.3256	45.7032	47.2266	49.3256	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355 (64)
								Total per year (kWh/year) = Sum(64)m =				2209.5579 (64)
Heat gains from water heating, kWh/month												
	68.5920	60.3556	63.1473	56.2753	54.4991	47.8134	45.5251	51.0238	51.4833	58.3705	62.1383	66.8297 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	144.7856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7045	23.7187	19.2893	14.6032	10.9161	9.2158	9.9580	12.9438	17.3732	22.0592	25.7464	27.4467	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0577	301.1506	293.3566	276.7640	255.8189	236.1334	222.9823	219.8894	227.6835	244.2760	265.2211	284.9066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	37.4786	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	-115.8285	(71)
Water heating gains (Table 5)													
	92.1936	89.8149	84.8754	78.1601	73.2515	66.4074	61.1896	68.5803	71.5045	78.4550	86.3033	89.8249	(72)
Total internal gains													
	486.3914	484.1199	466.9570	438.9631	409.4222	381.1924	363.5657	370.8493	385.9969	414.2259	446.7065	471.6138	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7200	10.6334	0.6300	0.7000	0.7700	2.3398	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	6.7500	19.6403	0.6300	0.7000	0.7700	40.5157	(76)
Southeast	1.0400	36.7938	0.6300	0.7000	0.7700	11.6945	(77)
South	7.6900	46.7521	0.6300	0.7000	0.7700	109.8750	(78)
West	9.3700	19.6403	0.6300	0.7000	0.7700	56.2417	(80)

Solar gains	224.2528	400.9161	588.9396	781.2592	910.4148	916.2518	878.4258	782.2376	656.6568	454.9433	272.2905	189.3979 (83)
Total gains	710.6442	885.0360	1055.8966	1220.2223	1319.8370	1297.4442	1241.9915	1153.0869	1042.6537	869.1692	718.9969	661.0117 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3170	57.4411	57.5633	58.1442	58.2542	58.7718	58.7718	58.8686	58.5713	58.2542	58.0321	57.8018	
alpha	4.8211	4.8294	4.8376	4.8763	4.8836	4.9181	4.9181	4.9246	4.9048	4.8836	4.8688	4.8535	
util living area													
	0.9987	0.9960	0.9869	0.9539	0.8652	0.7006	0.5324	0.5905	0.8396	0.9770	0.9969	0.9991	(86)
MIT	19.6268	19.8201	20.1174	20.4860	20.7836	20.9454	20.9885	20.9813	20.8637	20.4520	19.9634	19.5936	(87)
Th 2	19.9107	19.9128	19.9149	19.9245	19.9263	19.9348	19.9348	19.9363	19.9315	19.9263	19.9227	19.9189	(88)
util rest of house													
	0.9982	0.9945	0.9821	0.9366	0.8163	0.6067	0.4102	0.4651	0.7647	0.9653	0.9956	0.9988	(89)
MIT 2	18.0786	18.3622	18.7951	19.3248	19.7165	19.8990	19.9306	19.9288	19.8230	19.2877	18.5792	18.0358	(90)
Living area fraction									fLA = Living area / (4) =			0.1218	(91)
MIT	18.2672	18.5398	18.9562	19.4663	19.8465	20.0265	20.0595	20.0570	19.9498	19.4296	18.7478	18.2256	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2672	18.5398	18.9562	19.4663	19.8465	20.0265	20.0595	20.0570	19.9498	19.4296	18.7478	18.2256	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9918	0.9761	0.9271	0.8120	0.6154	0.4250	0.4801	0.7662	0.9576	0.9933	0.9979	(94)
Useful gains	708.5894	877.8109	1030.6695	1131.2967	1071.7370	798.4961	527.7906	553.5412	798.9174	832.3162	714.2033	659.6472	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2204.6594	2148.3303	1957.7408	1644.1120	1265.1961	835.3395	532.5481	562.0279	903.5873	1371.2824	1815.8973	2195.3098	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1113.0761	853.7890	689.7411	369.2270	143.9335	0.0000	0.0000	0.0000	0.0000	400.9909	793.2197	1142.5329	(98)
Space heating												5506.5102	(98)
Space heating per m2											(98) / (4) =	42.2667	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5895.6211	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1113.0761	853.7890	689.7411	369.2270	143.9335	0.0000	0.0000	0.0000	0.0000	400.9909	793.2197	1142.5329	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1191.7302	914.1210	738.4808	395.3180	154.1044	0.0000	0.0000	0.0000	0.0000	429.3264	849.2716	1223.2687	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.9358	192.9410	202.5606	181.4851	176.1459	155.1394	148.6354	165.6936	167.0729	188.1944	199.1183	213.6355	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5690	88.3516	87.8905	86.8021	84.5478	80.3000	80.3000	80.3000	80.3000	86.9084	88.1746	88.6436	(217)
Fuel for water heating, kWh/month													
	247.1924	218.3786	230.4693	209.0792	208.3389	193.1998	185.1001	206.3433	208.0610	216.5433	225.8226	241.0049	(219)
Water heating fuel used												2589.5334	(219)
Annual totals kWh/year													
Space heating fuel - main system												5895.6211	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.6090	(232)
Total delivered energy for all uses												9031.7636	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5895.6211	0.2160	1273.4542	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2589.5334	0.2160	559.3392	(264)
Space and water heating			1832.7934	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.6090	0.5190	244.7651	(268)
Total CO2, kg/m2/year			2116.4835	(272)
Emissions per m2 for space and water heating			14.0681	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8788	(272b)
Emissions per m2 for pumps and fans			0.2988	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0681 * 1.00) + 1.8788 + 0.2988, rounded to 2 d.p.			16.2500	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 254 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 254 - EPC	**Prop Type Ref**	Opp
Property	4 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	90 B	**DER**	11.53	**TER**	16.25
Environmental	90 B	**% DER<TER**	29.03		
CO_2 Emissions (t/year)	1.07	**DFEE**	49.04	**TFEE**	54.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.25	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.53	$kgCO_2/m^2$	Pass
	-4.72 (-29.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.04	$kWh/m^2/yr$	
	-5.7 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.72 m², No overhang
Windows facing North East	1.04 m², No overhang
Windows facing East	6.75 m², No overhang
Windows facing South East	1.04 m², No overhang
Windows facing South	7.69 m², No overhang
Windows facing West	9.37 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.41 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 254 BG2	**Issued on Date**	04/04/2025
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Property	4 Crane Way, Boorley Green, Southampton, SO32 2TF		

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Environmental	90 B	**% DER<TER**	29.03		
CO_2 Emissions (t/year)	1.07	**DFEE**	49.04	**TFEE**	54.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	65.73 m²	2.39 m
1st Storey:	1.00 m	64.55 m²	2.63 m

7.0 Living Area	15.87	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	164.20	133.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	64.55	64.55
Bay roof	External Flat Roof	0.16	1.18	1.18

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.25	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	South							2.12	100
D2 (W16)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.04	100
D3	Half Glazed Door	[1] External Wall	North							2.12	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100

W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.50	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W14	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		2.17	100
W15	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.24	0.060	No
Independently assessed	E3 Sill	18.41	0.009	No
Independently assessed	E4 Jamb	50.10	0.011	No
Independently assessed	E5 Ground floor (normal)	33.04	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.023	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.41	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery	No	

Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 254 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 254 - EPC	**Prop Type Ref**	Opp
Property	4 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	90 B	**DER**	11.53	**TER**	16.25
Environmental	90 B	**% DER<TER**	29.03		
CO_2 Emissions (t/year)	1.07	**DFEE**	49.04	**TFEE**	54.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	130.28	m^2	
DER	11.53	$kgCO_2/yr/m^2$	
TER	16.25	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.53	$kgCO_2/yr/m^2$	
Reduction DER/TER	29.03	%	
CfSH ENE1 credits achieved	3.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	49.04	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	130.28	m^2	
DER	17.73	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.45	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	13.57	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.45	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.57	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.57	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	13	%	

ENE7 credits achieved	1

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 255 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 255 - EPC	**Prop Type Ref**	Opp
Property	6 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.30	**TER**	17.71
Environmental	89 B	**% DER<TER**	24.89		
CO_2 Emissions (t/year)	1.18	**DFEE**	54.07	**TFEE**	59.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.30	$kgCO_2/m^2$	Pass
	-4.41 (-24.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.90	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.07	$kWh/m^2/yr$	
	-5.8 (-9.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.50 m², No overhang
Windows facing North East	1.04 m², No overhang
Windows facing East	7.10 m², No overhang
Windows facing West	8.18 m², No overhang
Windows facing North West	1.04 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.21	kW

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	Plot 255 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 255 - EPC	**Prop Type Ref**	Opp
Property	6 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.30	**TER**	17.71
Environmental	89 B	**% DER<TER**	24.89		
CO_2 Emissions (t/year)	1.18	**DFEE**	54.07	**TFEE**	59.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.30 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.50 m², No overhang
Windows facing North East: 1.04 m², No overhang
Windows facing East: 7.10 m², No overhang
Windows facing West: 8.18 m², No overhang
Windows facing North West: 1.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.21 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3564	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3787	0.3711	0.3333	0.3257	0.2878	0.2878	0.2802	0.3030	0.3257	0.3408	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5530	0.5414	0.5414	0.5393	0.5459	0.5530	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.0582	56.7705	56.4886	55.1641	54.9163	53.7627	53.7627	53.5491	54.2071	54.9163	55.4176	55.9417	(38)
Heat transfer coeff	154.4806	154.1929	153.9109	152.5864	152.3386	151.1851	151.1851	150.9714	151.6294	152.3386	152.8399	153.3640	(39)
Average = Sum(39)m / 12 =												152.5852	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2880	1.2856	1.2832	1.2722	1.2701	1.2605	1.2605	1.2587	1.2642	1.2701	1.2743	1.2787	(40)
HLP (average)												1.2722	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8275	10.6729	11.7934	11.3827	11.7314	11.3170	11.6718	11.7104	11.3526	11.7635	11.4194	11.8165	(61)
Total heat required for water heating calculated for each month													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
								Total per year (kWh/year) = Sum(64)m =				1746.4349	(64)
Heat gains from water heating, kWh/month													
	58.3889	51.1494	52.9766	46.4615	44.7832	38.9430	36.3826	41.3288	41.6980	48.2282	52.2896	56.6370	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4796	76.1152	71.2051	64.5298	60.1925	54.0874	48.9014	55.5495	57.9139	64.8229	72.6244	76.1250	(72)
Total internal gains													
	458.1745	455.9050	439.2904	412.2473	384.3365	357.7686	340.7135	347.2666	361.3356	388.6124	419.9874	443.9509	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.5000	10.6334	0.7200	0.7000	0.7700	24.1406	(74)
Northeast	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(75)
East	7.1000	19.6403	0.7200	0.7000	0.7700	48.7045	(76)
West	8.1800	19.6403	0.7200	0.7000	0.7700	56.1131	(80)
Northwest	1.0400	11.2829	0.7200	0.7000	0.7700	4.0984	(81)

Solar gains	137.1552	267.8646	446.1349	667.7756	839.5481	870.1896	823.9407	692.5408	523.6205	318.6108	170.7897	113.0158	(83)
Total gains	595.3297	723.7696	885.4253	1080.0229	1223.8846	1227.9583	1164.6543	1039.8074	884.9560	707.2232	590.7772	556.9666	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.9172	54.0178	54.1168	54.5865	54.6753	55.0925	55.0925	55.1705	54.9311	54.6753	54.4960	54.3098	
alpha	4.5945	4.6012	4.6078	4.6391	4.6450	4.6728	4.6728	4.6780	4.6621	4.6450	4.6331	4.6207	
util living area													
	0.9991	0.9976	0.9914	0.9637	0.8773	0.7139	0.5525	0.6305	0.8847	0.9868	0.9981	0.9993	(86)
MIT	19.4838	19.6547	19.9650	20.3831	20.7371	20.9302	20.9833	20.9702	20.7980	20.3208	19.8248	19.4546	(87)
Th 2	19.8503	19.8521	19.8540	19.8627	19.8643	19.8719	19.8719	19.8733	19.8690	19.8643	19.8610	19.8576	(88)
util rest of house													
	0.9988	0.9967	0.9881	0.9491	0.8294	0.6160	0.4202	0.4939	0.8186	0.9794	0.9972	0.9991	(89)
MIT 2	17.8280	18.0791	18.5323	19.1361	19.6077	19.8262	19.8660	19.8612	19.7001	19.0578	18.3344	17.7903	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.0660	18.3056	18.7383	19.3153	19.7701	19.9849	20.0266	20.0206	19.8579	19.2393	18.5487	18.0295	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0660	18.3056	18.7383	19.3153	19.7701	19.9849	20.0266	20.0206	19.8579	19.2393	18.5487	18.0295	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9948	0.9834	0.9398	0.8247	0.6267	0.4391	0.5130	0.8178	0.9734	0.9957	0.9985	(94)
Useful gains	594.0935	719.9970	870.7322	1014.9940	1009.3269	769.5917	511.4566	533.4616	723.6913	688.3817	588.2145	556.1144	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2126.5797	2067.0491	1883.6003	1589.2337	1229.3807	814.1205	518.0514	546.6044	873.0643	1316.1035	1749.8113	2120.9458	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1140.1697	905.2190	753.5739	413.4526	163.7201	0.0000	0.0000	0.0000	0.0000	467.0250	836.3497	1164.2346	(98)
Space heating												5843.7445	(98)
Space heating per m2											(98) / (4) =	48.7222	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6263.3917	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1140.1697	905.2190	753.5739	413.4526	163.7201	0.0000	0.0000	0.0000	0.0000	467.0250	836.3497	1164.2346	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1222.0468	970.2240	807.6890	443.1432	175.4770	0.0000	0.0000	0.0000	0.0000	500.5627	896.4091	1247.8399	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5402	156.4809	162.2542	142.5580	137.5972	119.9297	112.3175	127.2027	128.2243	147.9661	160.0953	173.2688	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7952	89.7507	89.6406	89.3488	88.6197	86.7000	86.7000	86.7000	86.7000	89.4068	89.7016	89.8169	(217)
Fuel for water heating, kWh/month													
	198.8305	174.3505	181.0053	159.5523	155.2672	138.3272	129.5472	146.7160	147.8942	165.4976	178.4754	192.9135	(219)
Water heating fuel used												1968.3768	(219)
Annual totals kWh/year													
Space heating fuel - main system												6263.3917	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 908 * 1.00) =										-878.8029		-878.8029	(233)
Total delivered energy for all uses												7880.3096	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6263.3917	0.2160	1352.8926	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.3768	0.2160	425.1694	(264)
Space and water heating			1778.0620	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-878.8029	0.5190	-456.0987	(269)
Total CO2, kg/year			1595.6548	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3000	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.9525	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.9525	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.5000	10.6334	0.6300	0.7000	0.7700	21.1231	(74)
Northeast	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(75)
East	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(76)
West	8.1800	19.6403	0.6300	0.7000	0.7700	49.0990	(80)
Northwest	1.0400	11.2829	0.6300	0.7000	0.7700	3.5861	(81)

Solar gains	120.0108	234.3815	390.3681	584.3036	734.6045	761.4159	720.9481	605.9732	458.1679	278.7844	149.4410	98.8888	(83)
Total gains	591.3343	703.4392	842.8189	1009.7219	1131.4488	1131.0048	1073.4894	965.7546	832.6849	680.5674	582.5867	555.9924	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9992	0.9979	0.9928	0.9695	0.8925	0.7344	0.5700	0.6457	0.8939	0.9881	0.9982	0.9994	(86)
MIT	19.5538	19.7114	20.0005	20.3956	20.7368	20.9304	20.9838	20.9715	20.8050	20.3518	19.8827	19.5291	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9989	0.9971	0.9900	0.9570	0.8491	0.6401	0.4400	0.5126	0.8324	0.9815	0.9975	0.9992	(89)
MIT 2	17.9615	18.1933	18.6163	19.1904	19.6499	19.8741	19.9150	19.9105	19.7512	19.1367	18.4515	17.9313	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.1903	18.4115	18.8153	19.3636	19.8062	20.0259	20.0686	20.0630	19.9027	19.3114	18.6572	18.1609	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1903	18.4115	18.8153	19.3636	19.8062	20.0259	20.0686	20.0630	19.9027	19.3114	18.6572	18.1609	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9955	0.9860	0.9486	0.8441	0.6502	0.4586	0.5312	0.8313	0.9761	0.9960	0.9986	(94)
Useful gains	590.2044	700.2436	830.9920	957.8609	955.0466	735.3241	492.2651	513.0427	692.2218	664.3084	580.2737	555.2027	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2050.1902	1989.7926	1809.6142	1521.5359	1176.4141	780.2153	498.7666	525.8197	837.3656	1264.2474	1683.9446	2042.6186	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1086.2295	866.5769	728.0949	405.8460	164.6974	0.0000	0.0000	0.0000	0.0000	446.3546	794.6430	1106.6374	(98)
Space heating												5599.0798	(98)
Space heating per m2											(98) / (4) =	46.6823	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5994.7321	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1086.2295	866.5769	728.0949	405.8460	164.6974	0.0000	0.0000	0.0000	0.0000	446.3546	794.6430	1106.6374	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1162.9866	927.8125	779.5448	434.5246	176.3355	0.0000	0.0000	0.0000	0.0000	477.8958	850.7955	1184.8367	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5409	88.3851	88.0015	87.0304	84.9014	80.3000	80.3000	80.3000	80.3000	87.1612	88.1876	88.6053	(217)
Fuel for water heating, kWh/month													
	245.8430	217.0450	228.8821	207.3879	205.9096	191.7458	183.7071	204.7903	206.9573	214.7304	224.5111	239.7274	(219)
Water heating fuel used												2571.2371	(219)
Annual totals kWh/year													
Space heating fuel - main system												5994.7321	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												9093.3131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5994.7321	0.2160	1294.8621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.2371	0.2160	555.3872	(264)
Space and water heating			1850.2493	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2123.9408	(272)
Emissions per m2 for space and water heating			15.4265	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4265 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.7100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 255 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 255 - EPC	**Prop Type Ref**	Opp
Property	6 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.30	**TER**	17.71
Environmental	89 B	**% DER<TER**	24.89		
CO_2 Emissions (t/year)	1.18	**DFEE**	54.07	**TFEE**	59.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.30	$kgCO_2/m^2$	Pass
	-4.41 (-24.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.90	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.07	$kWh/m^2/yr$	
	-5.8 (-9.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	6.50 m², No overhang		
Windows facing North East	1.04 m², No overhang		
Windows facing East	7.10 m², No overhang		
Windows facing West	8.18 m², No overhang		
Windows facing North West	1.04 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	1.21	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 255 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 255 - EPC	**Prop Type Ref**	Opp
Property	6 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.30	**TER**	17.71
Environmental	89 B	**% DER<TER**	24.89		
CO_2 Emissions (t/year)	1.18	**DFEE**	54.07	**TFEE**	59.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.47	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	B 89	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 255 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 255 - EPC	**Prop Type Ref**	Opp
Property	6 Crane Way, Boorley Green, Southampton, SO32 2TF		

SAP Rating	88 B	**DER**	13.30	**TER**	17.71
Environmental	89 B	**% DER<TER**	24.89		
CO_2 Emissions (t/year)	1.18	**DFEE**	54.07	**TFEE**	59.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	13.30	$kgCO_2/yr/m^2$	
TER	17.71	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.30	$kgCO_2/yr/m^2$	
Reduction DER/TER	24.89	%	
CfSH ENE1 credits achieved	3.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	54.07	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	19.30	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.95	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.95	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.50	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.15	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.15	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	1

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 256 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 256	**Prop Type Ref**	As
Property	Calver Det, Plot 256, Boorley Gardens, SOUTHAMPTON, SO32		

SAP Rating	89 B	**DER**	12.93	**TER**	16.90
Environmental	89 B	**% DER<TER**	23.51		
CO_2 Emissions (t/year)	1.22	**DFEE**	51.98	**TFEE**	56.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.93 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.13 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 1.09 m², No overhang
Windows facing South: 8.11 m², No overhang
Windows facing West: 1.42 m², No overhang
Windows facing North West: 1.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.09 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1554	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3804	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3233	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4122	0.4042	0.3961	0.3557	0.3476	0.3072	0.3072	0.2991	0.3233	0.3476	0.3637	0.3799	(22b)
Effective ac	0.5850	0.5817	0.5784	0.5632	0.5604	0.5472	0.5472	0.5447	0.5523	0.5604	0.5662	0.5722	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.7900	1.2357	25.6911			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	169.5200	25.0300	144.4900	0.2700	39.0123			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.7259			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7408	(36)
Total fabric heat loss (33) + (36) =	99.4667	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.1173	61.7669	61.4235	59.8104	59.5086	58.1036	58.1036	57.8435	58.6448	59.5086	60.1191	60.7575	(38)
Heat transfer coeff	161.5840	161.2336	160.8902	159.2771	158.9753	157.5703	157.5703	157.3101	158.1115	158.9753	159.5858	160.2241	(39)
Average = Sum(39)m / 12 =												159.2757	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2598	1.2571	1.2544	1.2418	1.2395	1.2285	1.2285	1.2265	1.2327	1.2395	1.2442	1.2492	(40)
HLP (average)												1.2418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	471.3455	468.9683	451.7505	423.7672	394.8461	367.4359	349.9381	356.6235	371.2793	399.4978	431.9049	456.6961	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1300	10.6334	0.7200	0.7000	0.7700	30.1944	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	1.0900	19.6403	0.7200	0.7000	0.7700	7.4772	(76)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	187.8814	324.6351	459.2783	599.0644	701.7754	711.1430	679.5406	600.1061	506.9297	362.5846	225.8074	160.3276	(83)
Total gains	659.2270	793.6035	911.0288	1022.8316	1096.6214	1078.5788	1029.4788	956.7296	878.2090	762.0824	657.7124	617.0237	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1227	55.2425	55.3604	55.9211	56.0272	56.5268	56.5268	56.6203	56.3333	56.0272	55.8129	55.5905	
alpha	4.6748	4.6828	4.6907	4.7281	4.7351	4.7685	4.7685	4.7747	4.7556	4.7351	4.7209	4.7060	
util living area													
	0.9990	0.9973	0.9926	0.9759	0.9234	0.7977	0.6363	0.6957	0.9025	0.9861	0.9977	0.9992	(86)
MIT	19.5356	19.7040	19.9734	20.3309	20.6644	20.8931	20.9724	20.9581	20.7848	20.3502	19.8755	19.5074	(87)
Th 2	19.8724	19.8746	19.8767	19.8867	19.8885	19.8972	19.8972	19.8989	19.8939	19.8885	19.8848	19.8808	(88)
util rest of house													
	0.9986	0.9963	0.9897	0.9656	0.8882	0.7071	0.4949	0.5571	0.8432	0.9784	0.9968	0.9990	(89)
MIT 2	17.9189	18.1665	18.5606	19.0826	19.5427	19.8211	19.8866	19.8805	19.7084	19.1171	18.4248	17.8835	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.1406	18.3774	18.7544	19.2538	19.6966	19.9681	20.0355	20.0282	19.8560	19.2862	18.6238	18.1062	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1406	18.3774	18.7544	19.2538	19.6966	19.9681	20.0355	20.0282	19.8560	19.2862	18.6238	18.1062	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9943	0.9854	0.9576	0.8806	0.7138	0.5139	0.5751	0.8407	0.9722	0.9950	0.9983	(94)
Useful gains	657.6863	789.0837	897.7572	979.4209	965.6893	769.8897	529.0585	550.1701	738.2687	740.9191	654.4093	615.9632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2236.4273	2173.0102	1971.6054	1649.1259	1271.2546	845.8592	541.3347	570.7601	910.0947	1380.8966	1839.0302	2228.1088	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1174.5832	929.9986	798.9430	482.1876	227.3406	0.0000	0.0000	0.0000	0.0000	476.1432	852.9270	1199.4363	(98)
Space heating												6141.5595	(98)
Space heating per m2											(98) / (4) =	47.8837	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6610.9360	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1174.5832	929.9986	798.9430	482.1876	227.3406	0.0000	0.0000	0.0000	0.0000	476.1432	852.9270	1199.4363	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1264.3522	1001.0749	860.0032	519.0394	244.7154	0.0000	0.0000	0.0000	0.0000	512.5331	918.1130	1291.1047	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4621	89.4222	89.3406	89.1457	88.6615	86.7000	86.7000	86.7000	86.7000	89.1166	89.3760	89.4810	(217)
Fuel for water heating, kWh/month													
	200.7623	176.0370	182.7016	160.8785	156.1361	139.1747	130.3455	147.6104	148.7894	167.0359	180.1982	194.7950	(219)
Water heating fuel used												1984.4646	(219)
Annual totals kWh/year													
Space heating fuel - main system												6610.9360	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.09 * 1080 * 1.00) =										-941.3455		-941.3455	(233)
Total delivered energy for all uses												8213.3835	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6610.9360	0.2160	1427.9622	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1984.4646	0.2160	428.6444	(264)
Space and water heating			1856.6065	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Energy saving/generation technologies				
PV Unit	-941.3455	0.5190	-488.5583	(269)
Total CO2, kg/year			1658.3397	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.9300	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		28.0563	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0563	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.3900 (2b)	=	154.7525	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	321.7838	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1243	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3743	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3977	0.3897	0.3500	0.3420	0.3023	0.3023	0.2943	0.3182	0.3420	0.3579	0.3738	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5612	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.7900	1.3258	27.5625			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	169.5200	25.0300	144.4900	0.1800	26.0082			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			299.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.4937			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3325	(36)
Total fabric heat loss (33) + (36) =	88.8262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.8313	61.4921	61.1595	59.5975	59.3053	57.9449	57.9449	57.6929	58.4689	59.3053	59.8965	60.5146	(38)
Heat transfer coeff	150.6576	150.3183	149.9857	148.4238	148.1315	146.7711	146.7711	146.5192	147.2951	148.1315	148.7227	149.3408	(39)
Average = Sum(39)m / 12 =												148.4224	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1746	1.1720	1.1694	1.1572	1.1549	1.1443	1.1443	1.1424	1.1484	1.1549	1.1595	1.1644	(40)
HLP (average)												1.1572	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.4247	24.3584	19.8095	14.9971	11.2105	9.4644	10.2266	13.2929	17.8417	22.6542	26.4408	28.1869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.4911	482.1166	464.9043	436.9286	407.4451	379.3395	361.8472	369.2276	384.4483	412.6589	445.0572	469.8444	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1300	10.6334	0.6300	0.7000	0.7700	26.4201	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	1.0900	19.6403	0.6300	0.7000	0.7700	6.5425	(76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	164.3963	284.0557	401.8685	524.1814	614.0535	622.2501	594.5981	525.0929	443.5635	317.2615	197.5815	140.2866 (83)
Total gains	648.8874	766.1723	866.7729	961.1100	1021.4986	1001.5896	956.4453	894.3205	828.0117	729.9204	642.6387	610.1310 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1205	59.2539	59.3853	60.0102	60.1286	60.6860	60.6860	60.7903	60.4701	60.1286	59.8896	59.6417	
alpha	4.9414	4.9503	4.9590	5.0007	5.0086	5.0457	5.0457	5.0527	5.0313	5.0086	4.9926	4.9761	
util living area													
	0.9991	0.9977	0.9937	0.9791	0.9307	0.8067	0.6419	0.6994	0.9069	0.9874	0.9980	0.9993	(86)
MIT	19.6385	19.7925	20.0416	20.3748	20.6877	20.9037	20.9766	20.9644	20.8056	20.4002	19.9577	19.6130	(87)
Th 2	19.9404	19.9425	19.9446	19.9544	19.9562	19.9648	19.9648	19.9664	19.9615	19.9562	19.9525	19.9486	(88)
util rest of house													
	0.9988	0.9969	0.9913	0.9702	0.8988	0.7210	0.5073	0.5676	0.8511	0.9805	0.9971	0.9991	(89)
MIT 2	18.1165	18.3430	18.7078	19.1958	19.6296	19.8948	19.9555	19.9503	19.7913	19.2380	18.5921	18.0849	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.3252	18.5418	18.8907	19.3575	19.7747	20.0331	20.0955	20.0894	19.9304	19.3974	18.7794	18.2945	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3252	18.5418	18.8907	19.3575	19.7747	20.0331	20.0955	20.0894	19.9304	19.3974	18.7794	18.2945	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9952	0.9877	0.9633	0.8919	0.7275	0.5254	0.5847	0.8490	0.9751	0.9956	0.9985	(94)
Useful gains	647.5702	762.4920	856.1283	925.8157	911.0566	728.6279	502.5349	522.9295	703.0173	711.7495	639.8042	609.2172	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2113.0078	2050.6104	1858.4320	1552.1457	1196.1167	797.4265	513.0440	540.5677	858.7939	1303.1767	1736.9932	2104.8806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1090.2856	865.6156	745.7139	450.9576	212.0847	0.0000	0.0000	0.0000	0.0000	440.0218	789.9760	1112.7735	(98)
Space heating												5707.4288	(98)
Space heating per m2											(98) / (4) =	44.4989	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6110.7374	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1090.2856	865.6156	745.7139	450.9576	212.0847	0.0000	0.0000	0.0000	0.0000	440.0218	789.9760	1112.7735	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1167.3293	926.7832	798.4089	482.8240	227.0714	0.0000	0.0000	0.0000	0.0000	471.1155	845.7988	1191.4063	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5392	88.3755	88.0364	87.2528	85.5227	80.3000	80.3000	80.3000	80.3000	87.1195	88.1691	88.6064	(217)
Fuel for water heating, kWh/month													
	247.0402	218.1133	229.8737	207.8113	205.7083	192.9601	184.8705	206.0873	207.8790	215.8233	225.6260	240.8784	(219)
Water heating fuel used												2582.6713	(219)
Annual totals kWh/year													
Space heating fuel - main system												6110.7374	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												484.3284	(232)
Total delivered energy for all uses												9252.7371	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6110.7374	0.2160	1319.9193	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2582.6713	0.2160	557.8570	(264)
Space and water heating			1877.7763	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	484.3284	0.5190	251.3664	(268)
Total CO2, kg/m2/year			2168.0677	(272)
Emissions per m2 for space and water heating			14.6404	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9598	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6404 * 1.00) + 1.9598 + 0.3035, rounded to 2 d.p.			16.9000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 256 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 256	**Prop Type Ref**	As
Property	Calver Det, Plot 256, Boorley Gardens, SOUTHAMPTON, SO32		

SAP Rating	89 B	**DER**	12.93	**TER**	16.90
Environmental	89 B	**% DER<TER**	23.51		
CO_2 Emissions (t/year)	1.22	**DFEE**	51.98	**TFEE**	56.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.90	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.93	$kgCO_2/m^2$	Pass
	-3.97 (-23.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.55	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.98	$kWh/m^2/yr$	
	-4.5 (-8.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.13 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	1.09 m², No overhang
Windows facing South	8.11 m², No overhang
Windows facing West	1.42 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	1.09	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 256 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 256	**Prop Type Ref**	As
Property	Calver Det, Plot 256, Boorley Gardens, SOUTHAMPTON, SO32		

SAP Rating	89 B	**DER**	12.93	**TER**	16.90
Environmental	89 B	**% DER<TER**	23.51		
CO_2 Emissions (t/year)	1.22	**DFEE**	51.98	**TFEE**	56.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.75 m²	2.39 m
1st Storey:	1.00 m	63.51 m²	2.63 m

7.0 Living Area	17.59	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	169.52	144.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	63.51	63.51
Bay Roof	External Plane Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1a	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.02	10
W1b	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.25	10
W1c	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.02	10
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.71	10
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.31	10
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	10
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.71	10
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	10
W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.09	10
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	10

W10	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.50	10
W11	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.71	10
D1	Half Glazed Door	[1] External Wall	North				2.12	10
D2	Half Glazed Door	[1] External Wall	West				2.12	10
D3 w12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		3.80	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.72	0.060	No
Independently assessed	E3 Sill	13.89	0.009	No
Independently assessed	E4 Jamb	44.40	0.011	No
Independently assessed	E5 Ground floor (normal)	34.15	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.55	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	13.69	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.86	0.052	No
Table K1 - Default	E14 Flat roof	3.14	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.09	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 256 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 256	**Prop Type Ref**	As
Property	Calver Det, Plot 256, Boorley Gardens, SOUTHAMPTON, SO32		

SAP Rating	89 B	**DER**	12.93	**TER**	16.90
Environmental	89 B	**% DER<TER**	23.51		
CO_2 Emissions (t/year)	1.22	**DFEE**	51.98	**TFEE**	56.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.26	m^2	
DER	12.93	$kgCO_2/yr/m^2$	
TER	16.90	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.93	$kgCO_2/yr/m^2$	
Reduction DER/TER	23.51	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.98	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.26	m^2	
DER	18.76	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.89	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.89	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.08	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.08	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	0

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 257 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 257	**Prop Type Ref**	As
Property	Melbourne Det, Plot 257, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.05 m², No overhang
Windows facing South East: 0.71 m², No overhang
Windows facing South West: 7.61 m², No overhang
Windows facing North West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669 (8)
Pressure test		Yes
Measured/design AP50		4.5000
Infiltration rate		0.3919 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3331 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4247	0.4164	0.4080	0.3664	0.3581	0.3164	0.3164	0.3081	0.3331	0.3581	0.3747	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5832	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6869	46.4099	46.1384	44.8631	44.6244	43.5137	43.5137	43.3080	43.9415	44.6244	45.1072	45.6118	(38)
Heat transfer coeff	123.2914	123.0144	122.7429	121.4675	121.2289	120.1181	120.1181	119.9124	120.5460	121.2289	121.7116	122.2163	(39)
Average = Sum(39)m / 12 =												121.4664	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2909	1.2880	1.2851	1.2718	1.2693	1.2576	1.2576	1.2555	1.2621	1.2693	1.2743	1.2796	(40)
HLP (average)												1.2718	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8262	10.6748	11.8028	11.3941	11.7533	11.3505	11.7141	11.7395	11.3742	11.7822	11.4264	11.8186	(61)
Total heat required for water heating calculated for each month													
	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.4095	(64)
Heat gains from water heating, kWh/month													
	56.2090	49.2437	51.0119	44.7494	43.1432	37.5314	35.0774	39.8262	40.1755	46.4523	50.3476	54.5268	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5498	73.2793	68.5643	62.1520	57.9882	52.1270	47.1471	53.5298	55.7993	62.4359	69.9273	73.2887	(72)
Total internal gains													
	414.3548	412.0348	396.9082	372.5116	347.6101	323.8141	308.5081	314.9404	327.6215	352.2423	380.4715	401.7677	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.7200	0.7000	0.7700	19.9011	(75)
Southeast	0.7100	36.7938	0.7200	0.7000	0.7700	9.1242	(77)
Southwest	7.6100	36.7938	0.7200	0.7000	0.7700	97.7965	(79)
Northwest	0.7100	11.2829	0.7200	0.7000	0.7700	2.7980	(81)

Solar gains	129.6199	228.3303	332.4384	445.4753	529.6089	539.2562	514.2920	449.4641	371.2592	257.7534	156.6278	110.0391	(83)
Total gains	543.9747	640.3651	729.3466	817.9870	877.2190	863.0703	822.8001	764.4045	698.8807	609.9957	537.0993	511.8068	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.7965	53.9176	54.0369	54.6042	54.7117	55.2176	55.2176	55.3123	55.0216	54.7117	54.4947	54.2697	
alpha	4.5864	4.5945	4.6025	4.6403	4.6474	4.6812	4.6812	4.6875	4.6681	4.6474	4.6330	4.6180	
util living area													
	0.9984	0.9962	0.9902	0.9697	0.9087	0.7732	0.6109	0.6700	0.8870	0.9820	0.9966	0.9988	(86)
MIT	19.5467	19.7122	19.9851	20.3491	20.6822	20.9022	20.9750	20.9620	20.7958	20.3631	19.8880	19.5187	(87)
Th 2	19.8480	19.8503	19.8525	19.8630	19.8650	19.8742	19.8742	19.8759	19.8706	19.8650	19.8610	19.8568	(88)
util rest of house													
	0.9978	0.9949	0.9865	0.9571	0.8687	0.6785	0.4700	0.5303	0.8216	0.9723	0.9952	0.9983	(89)
MIT 2	17.9184	18.1616	18.5601	19.0898	19.5439	19.8065	19.8649	19.8597	19.6993	19.1178	18.4264	17.8834	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1666	18.3979	18.7774	19.2818	19.7174	19.9735	20.0341	20.0278	19.8664	19.3077	18.6492	18.1327	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1666	18.3979	18.7774	19.2818	19.7174	19.9735	20.0341	20.0278	19.8664	19.3077	18.6492	18.1327	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9922	0.9814	0.9484	0.8623	0.6880	0.4913	0.5509	0.8213	0.9654	0.9928	0.9973	(94)
Useful gains	542.0292	635.4020	715.7770	775.7471	756.4630	593.7698	404.2154	421.1070	574.0233	588.9128	533.2347	510.4153	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1709.6378	1660.4406	1506.9587	1261.0474	971.9466	645.4592	412.4977	435.0150	695.1224	1055.6206	1405.6775	1702.8058	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	868.7008	688.8259	588.6392	349.4162	160.3198	0.0000	0.0000	0.0000	0.0000	347.2305	628.1588	887.1386	(98)
Space heating												4518.4298	(98)
Space heating per m2											(98) / (4) =	47.3084	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4863.7566 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	868.7008	688.8259	588.6392	349.4162	160.3198	0.0000	0.0000	0.0000	0.0000	347.2305	628.1588	887.1386	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	935.0923	741.4703	633.6267	376.1208	172.5725	0.0000	0.0000	0.0000	0.0000	373.7681	676.1666	954.9393	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3550	89.3081	89.2090	88.9731	88.4222	86.7000	86.7000	86.7000	86.7000	88.9442	89.2505	89.3776	(217)
Fuel for water heating, kWh/month	192.4728	168.7975	175.2600	154.4420	150.0419	133.4403	125.0317	141.5120	142.6190	160.3586	172.8355	186.7614	(219)

Water heating fuel used	1903.5725 (219)
Annual totals kWh/year	
Space heating fuel - main system	4863.7566 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	415.6986 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1029 * 1.00) = -601.0450	-601.0450 (233)
Total delivered energy for all uses	6656.9827 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4863.7566	0.2160	1050.5714	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1903.5725	0.2160	411.1717	(264)
Space and water heating			1461.7431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-601.0450	0.5190	-311.9424	(269)
Total CO2, kg/year			1404.4733	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7000	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		32.0629	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.0629	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.6300	0.7000	0.7700	17.4135	(75)
Southeast	0.7100	36.7938	0.6300	0.7000	0.7700	7.9837	(77)
Southwest	7.6100	36.7938	0.6300	0.7000	0.7700	85.5720	(79)
Northwest	0.7100	11.2829	0.6300	0.7000	0.7700	2.4482	(81)

Solar gains	113.4174	199.7890	290.8836	389.7909	463.4078	471.8492	450.0055	393.2811	324.8518	225.5342	137.0493	96.2842	(83)
Total gains	540.9216	624.9759	700.9491	774.8217	822.8714	806.8526	769.7079	720.0797	664.9994	590.9408	530.6766	511.2039	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9985	0.9965	0.9911	0.9719	0.9121	0.7732	0.6056	0.6625	0.8851	0.9824	0.9968	0.9988	(86)
MIT	19.6815	19.8321	20.0820	20.4160	20.7214	20.9198	20.9814	20.9714	20.8284	20.4347	19.9971	19.6553	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9979	0.9953	0.9878	0.9604	0.8745	0.6834	0.4743	0.5318	0.8220	0.9731	0.9954	0.9984	(89)
MIT 2	18.1736	18.3950	18.7603	19.2469	19.6639	19.9006	19.9497	19.9460	19.8084	19.2805	18.6438	18.1412	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9931	0.9834	0.9528	0.8692	0.6929	0.4942	0.5512	0.8227	0.9670	0.9933	0.9975	(94)
Useful gains	539.1509	620.6474	689.2840	738.2293	715.2193	559.0608	380.3841	396.9269	547.1207	571.4246	527.1138	509.9286	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1595.6745	1548.1367	1403.6675	1173.2218	903.9176	601.4195	386.5847	407.4193	648.6895	985.2778	1312.3945	1589.4586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating												4070.8930	(98)
Space heating per m2											(98) / (4) =	42.6227	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4358.5579	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	841.5991	667.3157	569.0592	335.3261	150.3121	0.0000	0.0000	0.0000	0.0000	329.6647	605.3556	859.9254	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0552	87.8591	87.4424	86.5210	84.6038	80.3000	80.3000	80.3000	80.3000	86.3671	87.6052	88.1366	(217)
Fuel for water heating, kWh/month													
	239.7551	211.8193	223.5802	200.4910	198.5094	184.2067	176.4840	196.7383	198.9111	210.5042	219.3309	233.7999	(219)
Water heating fuel used												2494.1301	(219)
Annual totals kWh/year													
Space heating fuel - main system												4358.5579	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7343.3866	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4358.5579	0.2160	941.4485	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2494.1301	0.2160	538.7321	(264)
Space and water heating			1480.1806	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1734.8532	(272)
Emissions per m2 for space and water heating			15.4977	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4977 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.1600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 257 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 257	**Prop Type Ref**	As
Property	Melbourne Det, Plot 257, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.16	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.70	$kgCO_2/m^2$	Pass
	-3.46 (-19.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.03	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.70	$kWh/m^2/yr$	
	-3.3 (-6.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.05 m², No overhang
Windows facing South East	0.71 m², No overhang
Windows facing South West	7.61 m², No overhang
Windows facing North West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 257 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 257	**Prop Type Ref**	As
Property	Melbourne Det, Plot 257, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
D2 (W9)	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.73	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£227	B 88	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 257 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 257	**Prop Type Ref**	As
Property	Melbourne Det, Plot 257, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	14.70	$kgCO_2/yr/m^2$	
TER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.70	$kgCO_2/yr/m^2$	
Reduction DER/TER	19.07	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.70	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.06	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 258 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 258	**Prop Type Ref**	As
Property	Melbourne Det, Plot 258, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.16 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 5.05 m², No overhang
Windows facing South East: 0.71 m², No overhang
Windows facing South West: 7.61 m², No overhang
Windows facing North West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100 (1b)	x	2.3900 (2b)	=	114.2659	(1b) - (3b)
First floor	47.7000 (1c)	x	2.6300 (2c)	=	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1669 (8)
Pressure test		Yes
Measured/design AP50		4.5000
Infiltration rate		0.3919 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3331 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4247	0.4164	0.4080	0.3664	0.3581	0.3164	0.3164	0.3081	0.3331	0.3581	0.3747	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5832	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0800	1.2357	17.3992			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8100	0.2000	9.5620			(28a)
External Wall	143.5500	16.2000	127.3500	0.2700	34.3845			(29a)
Main Roof	47.7000		47.7000	0.1600	7.6320			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.1577			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4467	(36)
Total fabric heat loss					(33) + (36) =		76.6045	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6869	46.4099	46.1384	44.8631	44.6244	43.5137	43.5137	43.3080	43.9415	44.6244	45.1072	45.6118	(38)
Heat transfer coeff	123.2914	123.0144	122.7429	121.4675	121.2289	120.1181	120.1181	119.9124	120.5460	121.2289	121.7116	122.2163	(39)
Average = Sum(39)m / 12 =												121.4664	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2909	1.2880	1.2851	1.2718	1.2693	1.2576	1.2576	1.2555	1.2621	1.2693	1.2743	1.2796	(40)
HLP (average)												1.2718	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6939	(42)
Average daily hot water use (litres/day)												98.1799	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8262	10.6748	11.8028	11.3941	11.7533	11.3505	11.7141	11.7395	11.3742	11.7822	11.4264	11.8186	(61)
Total heat required for water heating calculated for each month													
	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(64)
								Total per year (kWh/year) = Sum(64)m =				1683.4095	(64)
Heat gains from water heating, kWh/month													
	56.2090	49.2437	51.0119	44.7494	43.1432	37.5314	35.0774	39.8262	40.1755	46.4523	50.3476	54.5268	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	75.5498	73.2793	68.5643	62.1520	57.9882	52.1270	47.1471	53.5298	55.7993	62.4359	69.9273	73.2887	(72)
Total internal gains													
	414.3548	412.0348	396.9082	372.5116	347.6101	323.8141	308.5081	314.9404	327.6215	352.2423	380.4715	401.7677	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.7200	0.7000	0.7700	19.9011	(75)
Southeast	0.7100	36.7938	0.7200	0.7000	0.7700	9.1242	(77)
Southwest	7.6100	36.7938	0.7200	0.7000	0.7700	97.7965	(79)
Northwest	0.7100	11.2829	0.7200	0.7000	0.7700	2.7980	(81)

Solar gains	129.6199	228.3303	332.4384	445.4753	529.6089	539.2562	514.2920	449.4641	371.2592	257.7534	156.6278	110.0391	(83)
Total gains	543.9747	640.3651	729.3466	817.9870	877.2190	863.0703	822.8001	764.4045	698.8807	609.9957	537.0993	511.8068	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.7965	53.9176	54.0369	54.6042	54.7117	55.2176	55.2176	55.3123	55.0216	54.7117	54.4947	54.2697	
alpha	4.5864	4.5945	4.6025	4.6403	4.6474	4.6812	4.6812	4.6875	4.6681	4.6474	4.6330	4.6180	
util living area													
	0.9984	0.9962	0.9902	0.9697	0.9087	0.7732	0.6109	0.6700	0.8870	0.9820	0.9966	0.9988	(86)
MIT	19.5467	19.7122	19.9851	20.3491	20.6822	20.9022	20.9750	20.9620	20.7958	20.3631	19.8880	19.5187	(87)
Th 2	19.8480	19.8503	19.8525	19.8630	19.8650	19.8742	19.8742	19.8759	19.8706	19.8650	19.8610	19.8568	(88)
util rest of house													
	0.9978	0.9949	0.9865	0.9571	0.8687	0.6785	0.4700	0.5303	0.8216	0.9723	0.9952	0.9983	(89)
MIT 2	17.9184	18.1616	18.5601	19.0898	19.5439	19.8065	19.8649	19.8597	19.6993	19.1178	18.4264	17.8834	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.1666	18.3979	18.7774	19.2818	19.7174	19.9735	20.0341	20.0278	19.8664	19.3077	18.6492	18.1327	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1666	18.3979	18.7774	19.2818	19.7174	19.9735	20.0341	20.0278	19.8664	19.3077	18.6492	18.1327	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9922	0.9814	0.9484	0.8623	0.6880	0.4913	0.5509	0.8213	0.9654	0.9928	0.9973	(94)
Useful gains	542.0292	635.4020	715.7770	775.7471	756.4630	593.7698	404.2154	421.1070	574.0233	588.9128	533.2347	510.4153	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1709.6378	1660.4406	1506.9587	1261.0474	971.9466	645.4592	412.4977	435.0150	695.1224	1055.6206	1405.6775	1702.8058	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	868.7008	688.8259	588.6392	349.4162	160.3198	0.0000	0.0000	0.0000	0.0000	347.2305	628.1588	887.1386	(98)
Space heating												4518.4298	(98)
Space heating per m2											(98) / (4) =	47.3084	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4863.7566 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	868.7008	688.8259	588.6392	349.4162	160.3198	0.0000	0.0000	0.0000	0.0000	347.2305	628.1588	887.1386	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	935.0923	741.4703	633.6267	376.1208	172.5725	0.0000	0.0000	0.0000	0.0000	373.7681	676.1666	954.9393	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement	171.9840	150.7499	156.3477	137.4118	132.6704	115.6927	108.4025	122.6909	123.6507	142.6296	154.2566	166.9229	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3550	89.3081	89.2090	88.9731	88.4222	86.7000	86.7000	86.7000	86.7000	88.9442	89.2505	89.3776	(217)
Fuel for water heating, kWh/month	192.4728	168.7975	175.2600	154.4420	150.0419	133.4403	125.0317	141.5120	142.6190	160.3586	172.8355	186.7614	(219)

Water heating fuel used	1903.5725 (219)
Annual totals kWh/year	
Space heating fuel - main system	4863.7566 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	415.6986 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1029 * 1.00) = -601.0450	-601.0450 (233)
Total delivered energy for all uses	6656.9827 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4863.7566	0.2160	1050.5714	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1903.5725	0.2160	411.1717	(264)
Space and water heating			1461.7431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Energy saving/generation technologies				
PV Unit	-601.0450	0.5190	-311.9424	(269)
Total CO2, kg/year			1404.4733	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7000	ZC1
Total Floor Area	TFA	95.5100	
Assumed number of occupants	N	2.6939	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4401	ZC2
CO2 emissions from cooking, equation (L16)		1.9229	ZC3
Total CO2 emissions		32.0629	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.0629	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8100	(1b)	x 2.3900	(2b) =	114.2659	(1b) - (3b)
First floor	47.7000	(1c)	x 2.6300	(2c) =	125.4510	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.5100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	239.7169	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1251	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3189	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4066	0.3986	0.3906	0.3508	0.3428	0.3029	0.3029	0.2950	0.3189	0.3428	0.3587	0.3747	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5588	0.5459	0.5459	0.5435	0.5508	0.5588	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0800	1.3258	18.6667			(27)
Ground floor			47.8100	0.1300	6.2153			(28a)
External Wall	143.5500	16.2000	127.3500	0.1800	22.9230			(29a)
Main Roof	47.7000		47.7000	0.1300	6.2010			(30)
Total net area of external elements Aum(A, m2)			239.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.5500			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.4991	(36)
Total fabric heat loss (33) + (36) =	67.0490	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0913	45.8374	45.5886	44.4197	44.2010	43.1830	43.1830	42.9945	43.5751	44.2010	44.6434	45.1059	(38)
Heat transfer coeff	113.1403	112.8865	112.6376	111.4688	111.2501	110.2320	110.2320	110.0435	110.6242	111.2501	111.6925	112.1550	(39)
Average = Sum(39)m / 12 =												111.4677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1846	1.1819	1.1793	1.1671	1.1648	1.1541	1.1541	1.1522	1.1582	1.1648	1.1694	1.1743	(40)
HLP (average)												1.1671	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6939 (42)
Average daily hot water use (litres/day)	98.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9979	104.0707	100.1435	96.2163	92.2891	88.3619	88.3619	92.2891	96.2163	100.1435	104.0707	107.9979	(44)
Energy conte	160.1578	140.0750	144.5449	126.0177	120.9170	104.3422	96.6884	110.9513	112.2764	130.8474	142.8301	155.1043	(45)
Energy content (annual)										Total = Sum(45)m =		1544.7527	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0237	21.0113	21.6817	18.9027	18.1376	15.6513	14.5033	16.6427	16.8415	19.6271	21.4245	23.2656	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4492	47.0295	43.5758	45.0283	47.0295	47.4492	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
								Total per year (kWh/year) = Sum(64)m =				2121.4922	(64)
Heat gains from water heating, kWh/month													
	65.9922	58.0818	60.8009	53.7632	51.9623	45.5877	43.4060	48.6487	49.1942	56.2465	59.8198	64.3119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	134.6946	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5386	20.9068	17.0025	12.8720	9.6220	8.1233	8.7775	11.4093	15.3135	19.4441	22.6941	24.1928	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	248.8581	251.4404	244.9329	231.0793	213.5915	197.1555	186.1752	183.5928	190.1003	203.9540	221.4418	237.8778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	36.4695	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	-107.7557	(71)
Water heating gains (Table 5)													
	88.6992	86.4313	81.7216	74.6711	69.8418	63.3163	58.3413	65.3880	68.3253	75.6001	83.0830	86.4407	(72)
Total internal gains													
	427.5042	425.1868	410.0655	385.0308	359.4637	335.0034	319.7024	326.7986	340.1475	365.4065	393.6273	414.9197	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	5.0500	11.2829	0.6300	0.7000	0.7700	17.4135	(75)
Southeast	0.7100	36.7938	0.6300	0.7000	0.7700	7.9837	(77)
Southwest	7.6100	36.7938	0.6300	0.7000	0.7700	85.5720	(79)
Northwest	0.7100	11.2829	0.6300	0.7000	0.7700	2.4482	(81)

Solar gains	113.4174	199.7890	290.8836	389.7909	463.4078	471.8492	450.0055	393.2811	324.8518	225.5342	137.0493	96.2842	(83)
Total gains	540.9216	624.9759	700.9491	774.8217	822.8714	806.8526	769.7079	720.0797	664.9994	590.9408	530.6766	511.2039	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6231	58.7550	58.8848	59.5022	59.6192	60.1698	60.1698	60.2729	59.9565	59.6192	59.3830	59.1382	
alpha	4.9082	4.9170	4.9257	4.9668	4.9746	5.0113	5.0113	5.0182	4.9971	4.9746	4.9589	4.9425	
util living area													
	0.9985	0.9965	0.9911	0.9719	0.9121	0.7732	0.6056	0.6625	0.8851	0.9824	0.9968	0.9988	(86)
MIT	19.6815	19.8321	20.0820	20.4160	20.7214	20.9198	20.9814	20.9714	20.8284	20.4347	19.9971	19.6553	(87)
Th 2	19.9323	19.9345	19.9366	19.9464	19.9483	19.9569	19.9569	19.9585	19.9535	19.9483	19.9445	19.9406	(88)
util rest of house													
	0.9979	0.9953	0.9878	0.9604	0.8745	0.6834	0.4743	0.5318	0.8220	0.9731	0.9954	0.9984	(89)
MIT 2	18.1736	18.3950	18.7603	19.2469	19.6639	19.9006	19.9497	19.9460	19.8084	19.2805	18.6438	18.1412	(90)
Living area fraction									fLA = Living area / (4) =			0.1524	(91)
MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4035	18.6141	18.9618	19.4251	19.8251	20.0559	20.1070	20.1023	19.9639	19.4564	18.8501	18.3720	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9931	0.9834	0.9528	0.8692	0.6929	0.4942	0.5512	0.8227	0.9670	0.9933	0.9975	(94)
Useful gains	539.1509	620.6474	689.2840	738.2293	715.2193	559.0608	380.3841	396.9269	547.1207	571.4246	527.1138	509.9286	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1595.6745	1548.1367	1403.6675	1173.2218	903.9176	601.4195	386.5847	407.4193	648.6895	985.2778	1312.3945	1589.4586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating												4070.8930	(98)
Space heating per m2											(98) / (4) =	42.6227	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4358.5579	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	786.0536	623.2728	531.5013	313.1946	140.3915	0.0000	0.0000	0.0000	0.0000	307.9068	565.4021	803.1703	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	841.5991	667.3157	569.0592	335.3261	150.3121	0.0000	0.0000	0.0000	0.0000	329.6647	605.3556	859.9254	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.1167	186.1024	195.5038	173.4669	167.9466	147.9180	141.7167	157.9809	159.7256	181.8063	192.1452	206.0632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0552	87.8591	87.4424	86.5210	84.6038	80.3000	80.3000	80.3000	80.3000	86.3671	87.6052	88.1366	(217)
Fuel for water heating, kWh/month													
	239.7551	211.8193	223.5802	200.4910	198.5094	184.2067	176.4840	196.7383	198.9111	210.5042	219.3309	233.7999	(219)
Water heating fuel used												2494.1301	(219)
Annual totals kWh/year													
Space heating fuel - main system												4358.5579	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												415.6986	(232)
Total delivered energy for all uses												7343.3866	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4358.5579	0.2160	941.4485	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2494.1301	0.2160	538.7321	(264)
Space and water heating			1480.1806	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.6986	0.5190	215.7476	(268)
Total CO2, kg/m2/year			1734.8532	(272)
Emissions per m2 for space and water heating			15.4977	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2589	(272b)
Emissions per m2 for pumps and fans			0.4075	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4977 * 1.00) + 2.2589 + 0.4075, rounded to 2 d.p.			18.1600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 258 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 258	**Prop Type Ref**	As
Property	Melbourne Det, Plot 258, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.16	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.70	$kgCO_2/m^2$	Pass
	-3.46 (-19.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.03	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.70	$kWh/m^2/yr$	
	-3.3 (-6.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	5.05 m², No overhang
Windows facing South East	0.71 m², No overhang
Windows facing South West	7.61 m², No overhang
Windows facing North West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.019	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 258 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 258	**Prop Type Ref**	As
Property	Melbourne Det, Plot 258, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	47.81 m²	2.39 m
1st Storey:	1.00 m	47.70 m²	2.63 m

7.0 Living Area	14.56	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	143.55	127.35

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	47.70	47.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.20	47.81

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.71	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.71	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
D2 (W9)	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					3.32	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.49	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.02	0.060	No
Independently assessed	E3 Sill	9.42	0.009	No
Independently assessed	E4 Jamb	26.40	0.011	No
Independently assessed	E5 Ground floor (normal)	28.65	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	28.65	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.61	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.04	0.052	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.73	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£227	B 88	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 258 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 258	**Prop Type Ref**	As
Property	Melbourne Det, Plot 258, Boorley Gardens, Southampton, SO32		

SAP Rating	87 B	**DER**	14.70	**TER**	18.16
Environmental	88 B	**% DER<TER**	19.07		
CO_2 Emissions (t/year)	1.06	**DFEE**	51.70	**TFEE**	55.03
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	95.51	m^2	
DER	14.70	$kgCO_2/yr/m^2$	
TER	18.16	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	14.70	$kgCO_2/yr/m^2$	
Reduction DER/TER	19.07	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	51.70	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	95.51	m^2	
DER	20.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	17.06	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.92	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	34.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	9	%	

ENE7 credits achieved	0

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 259 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 259	**Prop Type Ref**	As
Property	Darley Det, Plot 259, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	13.04	**TER**	17.49
Environmental	89 B	**% DER<TER**	25.46		
CO_2 Emissions (t/year)	1.15	**DFEE**	52.98	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.04 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.50 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 8.18 m², No overhang
Windows facing North West: 7.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.019 W/m²K
Photovoltaic array 1.09 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3579	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3042	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3879	0.3803	0.3727	0.3347	0.3271	0.2890	0.2890	0.2814	0.3042	0.3271	0.3423	0.3575	(22b)
Effective ac	0.5752	0.5723	0.5695	0.5560	0.5535	0.5418	0.5418	0.5396	0.5463	0.5535	0.5586	0.5639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.8600	1.2357	29.4848			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1700	10.2952			(28a)
External Wall	170.8400	25.9800	144.8600	0.2700	39.1122			(29a)
Main Roof	59.3800		59.3800	0.1600	9.5008			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	91.7602			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6621	(36)
Total fabric heat loss (33) + (36) =	97.4223	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.1207	56.8306	56.5462	55.2106	54.9607	53.7974	53.7974	53.5820	54.2455	54.9607	55.4663	55.9948	(38)
Heat transfer coeff	154.5430	154.2529	153.9686	152.6329	152.3831	151.2198	151.2198	151.0043	151.6678	152.3831	152.8886	153.4171	(39)
Average = Sum(39)m / 12 =												152.6317	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2885	1.2861	1.2837	1.2726	1.2705	1.2608	1.2608	1.2590	1.2645	1.2705	1.2747	1.2791	(40)
HLP (average)												1.2726	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8360	10.6834	11.8116	11.4090	11.7673	11.3621	11.7248	11.7524	11.3875	11.7902	11.4352	11.8281 (61)
Total heat required for water heating calculated for each month												
	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805 (64)
								Total per year (kWh/year) = Sum(64)m =				1746.7634 (64)
Heat gains from water heating, kWh/month												
	58.3910	51.1520	52.9811	46.4680	44.7922	38.9542	36.3959	41.3393	41.7067	48.2349	52.2935	56.6399 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	78.4825	76.1191	71.2112	64.5390	60.2046	54.1031	48.9192	55.5636	57.9260	64.8319	72.6299	76.1289	(72)
Total internal gains													
	458.1773	455.9089	439.2965	412.2565	384.3486	357.7843	340.7313	347.2807	361.3477	388.6214	419.9929	443.9548	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
Northeast	6.5000	11.2829	0.7200	0.7000	0.7700	25.6153	(75)
East	1.0400	19.6403	0.7200	0.7000	0.7700	7.1342	(76)
Southeast	8.1800	36.7938	0.7200	0.7000	0.7700	105.1216	(77)
Northwest	7.1000	11.2829	0.7200	0.7000	0.7700	27.9798	(81)

Solar gains	169.7134	309.4928	477.0788	680.0300	842.1416	871.2531	825.3455	699.1446	546.5969	356.5691	207.0084	142.8174	(83)
Total gains	627.8908	765.4017	916.3753	1092.2865	1226.4902	1229.0374	1166.0768	1046.4253	907.9446	745.1905	627.0013	586.7722	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8954	53.9968	54.0965	54.5699	54.6594	55.0799	55.0799	55.1585	54.9172	54.6594	54.4787	54.2910	
alpha	4.5930	4.5998	4.6064	4.6380	4.6440	4.6720	4.6720	4.6772	4.6611	4.6440	4.6319	4.6194	
util living area													
	0.9989	0.9969	0.9902	0.9623	0.8767	0.7136	0.5520	0.6274	0.8764	0.9838	0.9975	0.9992	(86)
MIT	19.5078	19.6854	19.9870	20.3905	20.7380	20.9303	20.9834	20.9708	20.8076	20.3475	19.8518	19.4767	(87)
Th 2	19.8499	19.8518	19.8536	19.8624	19.8640	19.8717	19.8717	19.8731	19.8687	19.8640	19.8607	19.8572	(88)
util rest of house													
	0.9984	0.9958	0.9865	0.9472	0.8286	0.6156	0.4198	0.4911	0.8078	0.9750	0.9965	0.9989	(89)
MIT 2	17.8629	18.1237	18.5638	19.1460	19.6084	19.8261	19.8658	19.8612	19.7097	19.0952	18.3735	17.8224	(90)
Living area fraction										fLA = Living area / (4) =		0.1437	(91)
MIT	18.0994	18.3481	18.7683	19.3249	19.7708	19.9848	20.0264	20.0207	19.8675	19.2752	18.5860	18.0602	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0994	18.3481	18.7683	19.3249	19.7708	19.9848	20.0264	20.0207	19.8675	19.2752	18.5860	18.0602	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9935	0.9813	0.9378	0.8239	0.6264	0.4387	0.5102	0.8077	0.9683	0.9945	0.9981	(94)
Useful gains	626.2768	760.4605	899.2248	1024.3144	1010.5581	769.8342	511.5707	533.8853	733.3334	721.5652	623.5735	585.6617	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2132.5955	2074.4163	1888.9394	1591.1782	1229.8501	814.2905	518.1443	546.7434	874.7517	1321.9513	1756.0812	2126.3932	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1120.7011	882.9783	736.3477	408.1419	163.1533	0.0000	0.0000	0.0000	0.0000	446.6872	815.4056	1146.3042	(98)
Space heating												5719.7193	(98)
Space heating per m2											(98) / (4) =	47.6882	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6156.8560	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1120.7011	882.9783	736.3477	408.1419	163.1533	0.0000	0.0000	0.0000	0.0000	446.6872	815.4056	1146.3042	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1206.3521	950.4610	792.6240	439.3347	175.6225	0.0000	0.0000	0.0000	0.0000	480.8259	877.7240	1233.9119	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4463	89.4032	89.3048	89.0491	88.4069	86.7000	86.7000	86.7000	86.7000	89.0818	89.3587	89.4664	(217)
Fuel for water heating, kWh/month													
	199.6155	175.0400	181.7063	160.1188	155.6815	138.3792	129.6083	146.7643	147.9344	166.1315	179.1780	193.6822	(219)
Water heating fuel used												1973.8399	(219)
Annual totals kWh/year													
Space heating fuel - main system												6156.8560	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.09 * 1029 * 1.00) =										-897.4508		-897.4508	(233)
Total delivered energy for all uses												7760.5891	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6156.8560	0.2160	1329.8809	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.8399	0.2160	426.3494	(264)
Space and water heating			1756.2303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Energy saving/generation technologies				
PV Unit	-897.4508	0.5190	-465.7770	(269)
Total CO2, kg/year			1564.1448	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0400	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		28.6925	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6925	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.8600	1.3258	31.6326			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.9800	144.8600	0.1800	26.0748			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.9957			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4018	(36)
Total fabric heat loss (33) + (36) =	89.3975	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.5983	147.2662	146.9407	145.4120	145.1260	143.7945	143.7945	143.5480	144.3074	145.1260	145.7046	146.3095	(39)
Average = Sum(39)m / 12 =												145.4107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2278	1.2251	1.2124	1.2100	1.1989	1.1989	1.1968	1.2032	1.2100	1.2148	1.2199	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6136	22.7498	18.5013	14.0067	10.4702	8.8394	9.5512	12.4151	16.6635	21.1581	24.6947	26.3255	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3235	469.0577	452.4508	425.4183	396.8442	369.5889	352.5413	359.7814	374.5170	401.7829	433.1457	457.1036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	6.5000	11.2829	0.6300	0.7000	0.7700	22.4134	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	8.1800	36.7938	0.6300	0.7000	0.7700	91.9814	(77)
Northwest	7.1000	11.2829	0.6300	0.7000	0.7700	24.4823	(81)

Solar gains	148.4992	270.8062	417.4440	595.0262	736.8739	762.3465	722.1773	611.7515	478.2723	311.9980	181.1323	124.9653	(83)
Total gains	619.8227	739.8639	869.8948	1020.4445	1133.7181	1131.9353	1074.7186	971.5329	852.7893	713.7809	614.2780	582.0688	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4313	56.5586	56.6838	57.2798	57.3927	57.9241	57.9241	58.0236	57.7182	57.3927	57.1647	56.9284	
alpha	4.7621	4.7706	4.7789	4.8187	4.8262	4.8616	4.8616	4.8682	4.8479	4.8262	4.8110	4.7952	
util living area													
	0.9990	0.9973	0.9918	0.9682	0.8919	0.7339	0.5694	0.6426	0.8864	0.9856	0.9978	0.9992	(86)
MIT	19.5757	19.7391	20.0206	20.4027	20.7378	20.9305	20.9839	20.9720	20.8140	20.3759	19.9070	19.5492	(87)
Th 2	19.8956	19.8978	19.9000	19.9101	19.9120	19.9209	19.9209	19.9225	19.9175	19.9120	19.9082	19.9041	(88)
util rest of house													
	0.9986	0.9964	0.9886	0.9554	0.8484	0.6397	0.4395	0.5099	0.8224	0.9778	0.9968	0.9990	(89)
MIT 2	17.9934	18.2338	18.6453	19.2001	19.6511	19.8742	19.9150	19.9108	19.7606	19.1707	18.4869	17.9606	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2209	18.4502	18.8430	19.3730	19.8073	20.0260	20.0686	20.0633	19.9120	19.3439	18.6910	18.1890	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9944	0.9842	0.9469	0.8434	0.6497	0.4581	0.5284	0.8220	0.9718	0.9951	0.9983	(94)
Useful gains	618.3833	735.7547	856.1824	966.2679	956.1327	735.4638	492.2997	513.3732	701.0141	693.6419	611.2573	581.0657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2054.6956	1995.4849	1813.6849	1522.8976	1176.5834	780.2351	498.7714	525.8656	838.7107	1268.9668	1688.8656	2046.7216	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating												5486.6932	(98)
Space heating per m2											(98) / (4) =	45.7453	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5874.4038	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1068.6164	846.5387	712.3818	400.7733	164.0154	0.0000	0.0000	0.0000	0.0000	428.0417	775.8780	1090.4480	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1144.1289	906.3583	762.7215	429.0935	175.6053	0.0000	0.0000	0.0000	0.0000	458.2887	830.7045	1167.5032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5160	88.3471	87.9614	87.0021	84.8910	80.3000	80.3000	80.3000	80.3000	87.0683	88.1460	88.5835	(217)
Fuel for water heating, kWh/month													
	245.9123	217.1383	228.9865	207.4553	205.9348	191.7458	183.7071	204.7903	206.9573	214.9594	224.6170	239.7865	(219)
Water heating fuel used												2571.9908	(219)
Annual totals kWh/year													
Space heating fuel - main system												5874.4038	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.3439	(232)
Total delivered energy for all uses												8973.7385	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5874.4038	0.2160	1268.8712	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.9908	0.2160	555.5500	(264)
Space and water heating			1824.4212	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	452.3439	0.5190	234.7665	(268)
Total CO2, kg/m2/year			2098.1127	(272)
Emissions per m2 for space and water heating			15.2111	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9574	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2111 * 1.00) + 1.9574 + 0.3245, rounded to 2 d.p.			17.4900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 259 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 259	**Prop Type Ref**	As
Property	Darley Det, Plot 259, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	13.04	**TER**	17.49
Environmental	89 B	**% DER<TER**	25.46		
CO_2 Emissions (t/year)	1.15	**DFEE**	52.98	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.04	$kgCO_2/m^2$	Pass
	-4.45 (-25.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.76	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.98	$kWh/m^2/yr$	
	-5.8 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average	
Windows facing North	1.04 m², No overhang	
Windows facing North East	6.50 m², No overhang	
Windows facing East	1.04 m², No overhang	
Windows facing South East	8.18 m², No overhang	
Windows facing North West	7.10 m², No overhang	
Air change rate	8.00 ach	
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.019	W/m²K	
Photovoltaic array	1.09	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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Assessment Reference	Plot 259	**Prop Type Ref**	As
Property	Darley Det, Plot 259, Boorley Gardens, Southampton, SO32		

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General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	60.56 m²	2.39 m
1st Storey:	1.00 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	170.84	144.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.16	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.17	60.56

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.50	100
W13	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.060	No
Independently assessed	E3 Sill	13.66	0.009	No
Independently assessed	E4 Jamb	45.00	0.011	No
Independently assessed	E5 Ground floor (normal)	34.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.052	No
Table K1 - Default	E14 Flat roof	3.05	0.080	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.019	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.09	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£236	B 90	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 259 BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 259	**Prop Type Ref**	As
Property	Darley Det, Plot 259, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	13.04	**TER**	17.49
Environmental	89 B	**% DER<TER**	25.46		
CO_2 Emissions (t/year)	1.15	**DFEE**	52.98	**TFEE**	58.76
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	13.04	$kgCO_2/yr/m^2$	
TER	17.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	13.04	$kgCO_2/yr/m^2$	
Reduction DER/TER	25.46	%	
CfSH ENE1 credits achieved	0.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	52.98	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	0.0		
CfSH ENE1 and 2 overall level achieved	0		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	19.04	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.81	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.81	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	11	%	

ENE7 credits achieved	0

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 260 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 260 - EPC	**Prop Type Ref**	As
Property	12 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.42	**TER**	16.50
Environmental	89 B	**% DER<TER**	24.73		
CO_2 Emissions (t/year)	1.17	**DFEE**	50.31	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.50	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.42	$kgCO_2/m^2$	Pass
	-4.08 (-24.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.36	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.31	$kWh/m^2/yr$	
	-4.1 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	10.75 m², No overhang 7.68 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

10 Key features

Thermal bridging y-value	0.017	W/m^2K	
Photovoltaic array	1.21	kW	

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 260 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 260 - EPC	**Prop Type Ref**	As
Property	12 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.42	**TER**	16.50
Environmental	89 B	**% DER<TER**	24.73		
CO_2 Emissions (t/year)	1.17	**DFEE**	50.31	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.50 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.42 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.3 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.34 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.48 (measured in this dwelling)
Maximum                                 10.0                                    OK
-------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
-------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
-------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing South East:              10.75 m², No overhang
Windows facing North West:              7.68 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.017 W/m²K
Photovoltaic array                      1.21 kW



-------------------------------------------------------------------------------------------------
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3618	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.4300	1.2357	22.7747			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	163.0100	22.6700	140.3400	0.2700	37.8918			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		89.6190			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0359	(36)
Total fabric heat loss (33) + (36) =	94.6549	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.4538	62.1049	61.7628	60.1561	59.8555	58.4561	58.4561	58.1970	58.9951	59.8555	60.4636	61.0994	(38)
Heat transfer coeff	157.1087	156.7597	156.4177	154.8110	154.5104	153.1110	153.1110	152.8518	153.6500	154.5104	155.1185	155.7542	(39)
Average = Sum(39)m / 12 =												154.8095	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2170	1.2143	1.2116	1.1992	1.1968	1.1860	1.1860	1.1840	1.1902	1.1968	1.2015	1.2065	(40)
HLP (average)												1.1991	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8299	10.6750	11.7956	11.3846	11.7349	11.3199	11.6745	11.7136	11.3543	11.7654	11.4216	11.8188	(61)
Total heat required for water heating calculated for each month													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.5011	(64)
Heat gains from water heating, kWh/month													
	58.7699	51.4827	53.3205	46.7613	45.0714	39.1916	36.6130	41.5932	41.9651	48.5396	52.6294	57.0061	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.2510	25.0923	20.4064	15.4490	11.5483	9.7495	10.5347	13.6934	18.3793	23.3367	27.2374	29.0361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9919	76.6111	71.6673	64.9463	60.5798	54.4327	49.2110	55.9048	58.2849	65.2414	73.0964	76.6211	(72)
Total internal gains													
	473.2646	470.8033	453.4169	425.2252	396.1131	368.5759	351.0512	357.8256	372.6483	401.0754	433.6761	458.5908	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7500	36.7938	0.7200	0.7000	0.7700	138.1488	(77)
Northwest	7.6800	11.2829	0.7200	0.7000	0.7700	30.2655	(81)

Solar gains	168.4143	296.9248	432.9680	581.2257	691.8738	704.8402	672.0630	586.7673	483.8778	335.3649	203.5523	142.9429	(83)
Total gains	641.6790	767.7282	886.3849	1006.4509	1087.9869	1073.4161	1023.1142	944.5929	856.5261	736.4403	637.2284	601.5338	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0642	57.1912	57.3163	57.9111	58.0238	58.5541	58.5541	58.6534	58.3487	58.0238	57.7963	57.5604	
alpha	4.8043	4.8127	4.8211	4.8607	4.8683	4.9036	4.9036	4.9102	4.8899	4.8683	4.8531	4.8374	
util living area													
	0.9991	0.9977	0.9934	0.9768	0.9221	0.7907	0.6268	0.6903	0.9054	0.9877	0.9981	0.9994	(86)
MIT	19.5751	19.7360	20.0018	20.3582	20.6871	20.9052	20.9766	20.9631	20.7944	20.3656	19.9044	19.5487	(87)
Th 2	19.9065	19.9086	19.9107	19.9207	19.9225	19.9312	19.9312	19.9328	19.9279	19.9225	19.9188	19.9148	(88)
util rest of house													
	0.9988	0.9969	0.9909	0.9670	0.8870	0.7011	0.4902	0.5554	0.8481	0.9810	0.9973	0.9992	(89)
MIT 2	18.0001	18.2369	18.6259	19.1467	19.5999	19.8638	19.9222	19.9165	19.7491	19.1640	18.4907	17.9673	(90)
Living area fraction									fLA = Living area / (4) =			0.1113	(91)
MIT	18.1754	18.4037	18.7791	19.2816	19.7209	19.9797	20.0395	20.0330	19.8655	19.2977	18.6480	18.1433	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1754	18.4037	18.7791	19.2816	19.7209	19.9797	20.0395	20.0330	19.8655	19.2977	18.6480	18.1433	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9952	0.9869	0.9589	0.8788	0.7057	0.5049	0.5692	0.8439	0.9751	0.9957	0.9985	(94)
Useful gains	640.4067	764.0056	874.7812	965.1223	956.0881	757.5328	516.5860	537.6935	722.8105	718.0966	634.4997	600.6596	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2179.9526	2116.8400	1920.6620	1607.1785	1239.3087	823.6926	526.6296	555.3112	885.8619	1343.8919	1791.3111	2171.7336	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1145.4221	909.1047	778.1353	462.2805	210.7162	0.0000	0.0000	0.0000	0.0000	465.5917	832.9042	1168.8790	(98)
Space heating												5973.0338	(98)
Space heating per m2											(98) / (4) =	46.2667	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6401.9655	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1145.4221	909.1047	778.1353	462.2805	210.7162	0.0000	0.0000	0.0000	0.0000	465.5917	832.9042	1168.8790	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1227.6764	974.3888	834.0142	495.4775	225.8480	0.0000	0.0000	0.0000	0.0000	499.0265	892.7162	1252.8178	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6870	157.4838	163.2891	143.4603	138.4647	120.6781	113.0110	127.9987	129.0282	148.9030	161.1179	174.3794	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7944	89.7498	89.6543	89.4206	88.8373	86.7000	86.7000	86.7000	86.7000	89.4005	89.6963	89.8159	(217)
Fuel for water heating, kWh/month													
	200.1093	175.4699	182.1319	160.4331	155.8633	139.1904	130.3471	147.6340	148.8214	166.5572	179.6260	194.1521	(219)
Water heating fuel used												1980.3359	(219)
Annual totals kWh/year													
Space heating fuel - main system												6401.9655	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												498.9209	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1004 * 1.00) =										-971.8683		-971.8683	(233)
Total delivered energy for all uses												7984.3539	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6401.9655	0.2160	1382.8245	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1980.3359	0.2160	427.7525	(264)
Space and water heating			1810.5771	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	498.9209	0.5190	258.9400	(268)
Energy saving/generation technologies				
PV Unit	-971.8683	0.5190	-504.3997	(269)
Total CO2, kg/year			1604.0424	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.4200	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		27.4952	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4952	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.4300	1.3258	24.4337			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.6700	140.3400	0.1800	25.2612			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.5659			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.0849	(36)
Total fabric heat loss (33) + (36) =	83.6508	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.8752	145.5351	145.2018	143.6361	143.3432	141.9796	141.9796	141.7270	142.5048	143.3432	143.9358	144.5553	(39)
Average = Sum(39)m / 12 =												143.6347	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1299	1.1273	1.1247	1.1126	1.1103	1.0998	1.0998	1.0978	1.1038	1.1103	1.1149	1.1197	(40)
HLP (average)												1.1126	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.2510	25.0923	20.4064	15.4490	11.5483	9.7495	10.5347	13.6934	18.3793	23.3367	27.2374	29.0361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.4128	483.9553	466.5766	438.3955	408.7325	380.5033	362.9861	370.4522	385.8291	414.2453	446.8336	471.7428	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.7500	36.7938	0.6300	0.7000	0.7700	120.8802	(77)
Northwest	7.6800	11.2829	0.6300	0.7000	0.7700	26.4823	(81)

Solar gains	147.3625	259.8092	378.8470	508.5725	605.3896	616.7351	588.0551	513.4214	423.3931	293.4443	178.1082	125.0751	(83)
Total gains	633.7753	743.7645	845.4236	946.9680	1014.1221	997.2384	951.0412	883.8736	809.2222	707.6895	624.9418	596.8178	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4585	61.6022	61.7436	62.4166	62.5441	63.1448	63.1448	63.2574	62.9121	62.5441	62.2866	62.0197	
alpha	5.0972	5.1068	5.1162	5.1611	5.1696	5.2097	5.2097	5.2172	5.1941	5.1696	5.1524	5.1346	
util living area													
	0.9992	0.9981	0.9944	0.9797	0.9286	0.7976	0.6296	0.6910	0.9082	0.9887	0.9983	0.9994	(86)
MIT	19.6837	19.8306	20.0757	20.4065	20.7132	20.9168	20.9810	20.9698	20.8178	20.4203	19.9920	19.6599	(87)
Th 2	19.9765	19.9786	19.9807	19.9906	19.9924	20.0010	20.0010	20.0026	19.9977	19.9924	19.9887	19.9848	(88)
util rest of house													
	0.9990	0.9974	0.9922	0.9711	0.8966	0.7128	0.5003	0.5633	0.8540	0.9826	0.9976	0.9992	(89)
MIT 2	18.2080	18.4244	18.7834	19.2682	19.6925	19.9408	19.9934	19.9889	19.8372	19.2938	18.6678	18.1790	(90)
Living area fraction									fLA = Living area / (4) =			0.1113	(91)
MIT	18.3723	18.5809	18.9272	19.3949	19.8061	20.0494	20.1034	20.0981	19.9463	19.4192	18.8152	18.3439	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3723	18.5809	18.9272	19.3949	19.8061	20.0494	20.1034	20.0981	19.9463	19.4192	18.8152	18.3439	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9959	0.9889	0.9642	0.8892	0.7174	0.5143	0.5765	0.8505	0.9774	0.9962	0.9987	(94)
Useful gains	632.6783	740.7063	836.0446	913.0766	901.7327	715.4256	489.1521	509.5947	688.2544	691.7224	622.5726	596.0586	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2052.7955	1991.0537	1804.4513	1507.4455	1161.9566	773.7037	497.4046	524.1211	833.1330	1264.1683	1686.2416	2044.5710	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1056.5672	840.2334	720.4946	427.9456	193.6066	0.0000	0.0000	0.0000	0.0000	425.8997	765.8417	1077.6932	(98)
Space heating												5508.2821	(98)
Space heating per m2											(98) / (4) =	42.6668	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5897.5183	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1056.5672	840.2334	720.4946	427.9456	193.6066	0.0000	0.0000	0.0000	0.0000	425.8997	765.8417	1077.6932	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1131.2283	899.6075	771.4075	458.1859	207.2875	0.0000	0.0000	0.0000	0.0000	455.9954	819.9590	1153.8471	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4904	88.3263	87.9728	87.1374	85.2913	80.3000	80.3000	80.3000	80.3000	87.0460	88.1140	88.5581	(217)
Fuel for water heating, kWh/month													
	247.2764	218.3226	230.1307	208.1665	206.3753	193.0620	184.9681	206.1960	207.9563	216.0887	225.8566	241.1067	(219)
Water heating fuel used												2585.5060	(219)
Annual totals kWh/year													
Space heating fuel - main system												5897.5183	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												498.9209	(232)
Total delivered energy for all uses												9056.9452	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5897.5183	0.2160	1273.8640	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.5060	0.2160	558.4693	(264)
Space and water heating			1832.3332	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	498.9209	0.5190	258.9400	(268)
Total CO2, kg/m2/year			2130.1982	(272)
Emissions per m2 for space and water heating			14.1931	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0057	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1931 * 1.00) + 2.0057 + 0.3015, rounded to 2 d.p.			16.5000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 260 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 260 - EPC	**Prop Type Ref**	As
Property	12 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.42	**TER**	16.50
Environmental	89 B	**% DER<TER**	24.73		
CO_2 Emissions (t/year)	1.17	**DFEE**	50.31	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.50	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.42	$kgCO_2/m^2$	Pass
	-4.08 (-24.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.36	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.31	$kWh/m^2/yr$	
	-4.1 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 536 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	10.75 m², No overhang 7.68 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.017	W/m²K	
Photovoltaic array	1.21	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 260 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 260 - EPC	**Prop Type Ref**	As
Property	12 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.42	**TER**	16.50
Environmental	89 B	**% DER<TER**	24.73		
CO_2 Emissions (t/year)	1.17	**DFEE**	50.31	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2024
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	1.00 m	64.55 m²	2.39 m
1st Storey:	1.00 m	64.55 m²	2.63 m

7.0 Living Area	14.37	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.27	163.01	140.34

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.16	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Timber		0.19	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.17	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.49	100
D3	Half Glazed Door	[1] External Wall	South East							2.12	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.17	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.060	No
Independently assessed	E3 Sill	12.36	0.009	No
Independently assessed	E4 Jamb	33.90	0.011	No
Independently assessed	E5 Ground floor (normal)	32.54	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.001	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.030	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.053	No
Independently assessed	E16 Corner (normal)	20.04	0.033	No

Y-value	0.017	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.21	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 260 - BG2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 260 - EPC	**Prop Type Ref**	As
Property	12 Jay Road, Boorley Green, Southampton, SO32 2XF		

SAP Rating	89 B	**DER**	12.42	**TER**	16.50
Environmental	89 B	**% DER<TER**	24.73		
CO_2 Emissions (t/year)	1.17	**DFEE**	50.31	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	12.42	$kgCO_2/yr/m^2$	
TER	16.50	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.42	$kgCO_2/yr/m^2$	
Reduction DER/TER	24.73	%	
CfSH ENE1 credits achieved	3.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	50.31	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	18.37	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.45	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.45	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.46	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.54	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.54	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	12	%	

ENE7 credits achieved	1

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 261 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 261	**Prop Type Ref**	
Property	Buridge Det, Plot 261, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.31	**TER**	16.76
Environmental	96 A	**% DER<TER**	68.32		
CO_2 Emissions (t/year)	0.12	**DFEE**	45.54	**TFEE**	55.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.31 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 10.51 m², No overhang
Windows facing South West: 7.51 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6611	0.6530	0.6449	0.6046	0.5966	0.5563	0.5563	0.5482	0.5724	0.5966	0.6127	0.6288	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.0200	1.2357	22.2681			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1400	9.0370			(28a)
External Wall	163.0100	22.2600	140.7500	0.2100	29.5575			(29a)
Main Roof	64.5500		64.5500	0.0700	4.5185			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.7411			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9257	(36)
Total fabric heat loss					(33) + (36) =		77.6668	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.6903	69.8284	68.9665	64.6570	63.7951	59.4856	59.4856	58.6237	61.2094	63.7951	65.5189	67.2427	(38)
Heat transfer coeff	148.3571	147.4952	146.6333	142.3238	141.4619	137.1524	137.1524	136.2905	138.8762	141.4619	143.1857	144.9095	(39)
Average = Sum(39)m / 12 =												142.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1425	1.1358	1.1024	1.0958	1.0624	1.0624	1.0557	1.0757	1.0958	1.1091	1.1225	(40)
HLP (average)												1.1008	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8377 10.6849 11.8132 11.4103 11.7698 11.3641 11.7267 11.7547 11.3887 11.7916 11.4367 11.8298 (61)
Total heat required for water heating calculated for each month
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (64)
Total per year (kWh/year) = Sum(64)m = 1757.8213 (64)
Heat gains from water heating, kWh/month
58.7719 51.4852 53.3249 46.7678 45.0801 39.2026 36.6260 41.6034 41.9737 48.5461 52.6332 57.0088 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.6397	23.6611	19.2425	14.5678	10.8896	9.1935	9.9339	12.9124	17.3310	22.0057	25.6839	27.3801	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)

Water heating gains (Table 5)

	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)

Total internal gains

	471.6560	469.3759	452.2590	424.3530	395.4662	368.0352	350.4679	357.0584	371.6120	399.7532	432.1279	456.9385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5100	11.2829	0.4100	1.0000	0.7700	33.6932	(75)
Southwest	7.5100	36.7938	0.4100	1.0000	0.7700	78.5113	(79)

Solar gains	112.2045	202.3172	306.5459	429.6517	526.7250	542.9208	515.1085	439.6291	348.6956	231.6187	136.4332	94.7048	(83)
Total gains	583.8604	671.6931	758.8049	854.0047	922.1912	910.9561	865.5764	796.6875	720.3076	631.3719	568.5611	551.6433	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5860	48.8700	49.1572	50.6457	50.9542	52.5553	52.5553	52.8877	51.9029	50.9542	50.3408	49.7420	
alpha	4.2391	4.2580	4.2771	4.3764	4.3969	4.5037	4.5037	4.5258	4.4602	4.3969	4.3561	4.3161	
util living area													
	0.9983	0.9967	0.9921	0.9760	0.9265	0.8028	0.6490	0.7097	0.9119	0.9860	0.9970	0.9987	(86)
MIT	19.3687	19.5297	19.8141	20.2271	20.5983	20.8715	20.9634	20.9459	20.7364	20.2608	19.7637	19.3689	(87)
Th 2	19.9609	19.9663	19.9717	19.9988	20.0043	20.0317	20.0317	20.0372	20.0207	20.0043	19.9934	19.9825	(88)
util rest of house													
	0.9979	0.9957	0.9896	0.9677	0.8983	0.7278	0.5272	0.5926	0.8665	0.9798	0.9959	0.9984	(89)
MIT 2	17.7656	18.0045	18.4231	19.0393	19.5624	19.9264	20.0133	20.0068	19.7669	19.0963	18.3653	17.7803	(90)
Living area fraction										fLA = Living area / (4) =		0.1138	(91)
MIT	17.9480	18.1781	18.5814	19.1745	19.6803	20.0339	20.1214	20.1137	19.8772	19.2288	18.5244	17.9610	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9480	18.1781	18.5814	19.1745	19.6803	20.0339	20.1214	20.1137	19.8772	19.2288	18.5244	17.9610	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9931	0.9846	0.9582	0.8867	0.7280	0.5394	0.6029	0.8580	0.9726	0.9934	0.9972	(94)
Useful gains	581.7233	667.0431	747.1281	818.2682	817.7310	663.2001	466.8961	480.3488	618.0159	614.0857	564.8321	550.0848	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2024.7809	1958.4515	1771.5350	1462.3015	1128.9105	745.2738	482.9678	506.1395	802.3128	1220.6482	1635.8102	1994.1025	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1073.6348	867.8264	762.1587	463.7039	231.5175	0.0000	0.0000	0.0000	0.0000	451.2825	771.1042	1074.3492	(98)
Space heating												5695.5773	(98)
Space heating per m2											(98) / (4) =	44.1176	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6130.8690	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1073.6348	867.8264	762.1587	463.7039	231.5175	0.0000	0.0000	0.0000	0.0000	451.2825	771.1042	1074.3492	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1155.6887	934.1512	820.4077	499.1431	249.2115	0.0000	0.0000	0.0000	0.0000	485.7723	830.0368	1156.4576	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4268	89.3932	89.3183	89.1227	88.6749	86.7000	86.7000	86.7000	86.7000	89.0842	89.3301	89.4390	(217)
Fuel for water heating, kWh/month													
	200.9406	176.1809	182.8368	160.9984	156.1880	139.2414	130.4073	147.6813	148.8611	167.1781	180.3794	194.9824	(219)
Water heating fuel used												1985.8759	(219)
Annual totals kWh/year													
Space heating fuel - main system												6130.8690	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.4651	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1004 * 1.00) =										-2602.3582		-2602.3582	(233)
Total delivered energy for all uses												6059.8518	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6130.8690	0.2160	1324.2677	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.8759	0.2160	428.9492	(264)
Space and water heating			1753.2169	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.4651	0.5190	244.1714	(268)
Energy saving/generation technologies				
PV Unit	-2602.3582	0.5190	-1350.6239	(269)
Total CO2, kg/year			685.6894	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.3100	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		20.3852	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.3852	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.0200	1.3258	23.8902			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.2600	140.7500	0.1800	25.3350			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.0962			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0549	(36)
Total fabric heat loss					(33) + (36) =		83.1511	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.3754	145.0354	144.7020	143.1364	142.8434	141.4798	141.4798	141.2273	142.0051	142.8434	143.4360	144.0556	(39)
Average = Sum(39)m / 12 =												143.1350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1261	1.1234	1.1209	1.1087	1.1065	1.0959	1.0959	1.0939	1.1000	1.1065	1.1110	1.1158	(40)
HLP (average)												1.1087	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3891	25.2150	20.5062	15.5245	11.6047	9.7972	10.5862	13.7604	18.4692	23.4508	27.3706	29.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.5510	484.0780	466.6764	438.4711	408.7890	380.5509	363.0376	370.5191	385.9190	414.3594	446.9668	471.8847	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.5100	11.2829	0.6300	0.7000	0.7700	36.2407	(75)
Southwest	7.5100	36.7938	0.6300	0.7000	0.7700	84.4475	(79)

Solar gains	120.6882	217.6144	329.7238	462.1376	566.5506	583.9709	554.0557	472.8694	375.0604	249.1314	146.7488	101.8655	(83)
Total gains	607.2392	701.6923	796.4002	900.6086	975.3396	964.5219	917.0934	843.3885	760.9794	663.4907	593.7156	573.7502	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6698	61.8144	61.9568	62.6345	62.7630	63.3679	63.3679	63.4812	63.1335	62.7630	62.5037	62.2349	
alpha	5.1113	5.1210	5.1305	5.1756	5.1842	5.2245	5.2245	5.2321	5.2089	5.1842	5.1669	5.1490	
util living area													
	0.9994	0.9985	0.9957	0.9834	0.9371	0.8117	0.6471	0.7141	0.9244	0.9915	0.9987	0.9995	(86)
MIT	19.6695	19.8052	20.0454	20.3797	20.6961	20.9099	20.9787	20.9652	20.7971	20.3930	19.9737	19.6482	(87)
Th 2	19.9796	19.9817	19.9838	19.9937	19.9956	20.0042	20.0042	20.0058	20.0009	19.9956	19.9918	19.9879	(88)
util rest of house													
	0.9992	0.9980	0.9940	0.9763	0.9079	0.7288	0.5164	0.5860	0.8765	0.9867	0.9981	0.9994	(89)
MIT 2	18.1896	18.3896	18.7418	19.2329	19.6739	19.9379	19.9955	19.9896	19.8170	19.2573	18.6434	18.1642	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	18.3580	18.5506	18.8901	19.3634	19.7902	20.0485	20.1074	20.1006	19.9285	19.3865	18.7948	18.3331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3580	18.5506	18.8901	19.3634	19.7902	20.0485	20.1074	20.1006	19.9285	19.3865	18.7948	18.3331	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9968	0.9913	0.9700	0.9003	0.7331	0.5308	0.5994	0.8720	0.9824	0.9970	0.9989	(94)
Useful gains	606.3751	699.4538	789.4662	873.6242	878.1296	707.0529	486.8187	505.5046	663.5855	651.7823	591.9212	573.1435	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2043.6828	1979.8256	1792.8793	1497.6964	1155.6386	770.8544	496.2257	522.6247	827.6835	1255.0956	1677.4505	2035.9520	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1069.3569	860.4098	746.5394	449.3320	206.4667	0.0000	0.0000	0.0000	0.0000	448.8651	781.5811	1088.3295	(98)
Space heating												5650.8806	(98)
Space heating per m2											(98) / (4) =	43.7713	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6050.1933	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1069.3569	860.4098	746.5394	449.3320	206.4667	0.0000	0.0000	0.0000	0.0000	448.8651	781.5811	1088.3295	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1144.9218	921.2097	799.2927	481.0835	221.0564	0.0000	0.0000	0.0000	0.0000	480.5836	836.8106	1165.2350	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5090	88.3651	88.0377	87.2441	85.4537	80.3000	80.3000	80.3000	80.3000	87.1625	88.1498	88.5728	(217)
Fuel for water heating, kWh/month													
	247.2246	218.2267	229.9611	207.9118	205.9832	193.0620	184.9681	206.1960	207.9563	215.7996	225.7650	241.0666	(219)
Water heating fuel used												2584.1208	(219)
Annual totals kWh/year													
Space heating fuel - main system												6050.1933	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												501.3605	(232)
Total delivered energy for all uses												9210.6747	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6050.1933	0.2160	1306.8418	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2584.1208	0.2160	558.1701	(264)
Space and water heating			1865.0119	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	501.3605	0.5190	260.2061	(268)
Total CO2, kg/m2/year			2164.1430	(272)
Emissions per m2 for space and water heating			14.4463	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0155	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4463 * 1.00) + 2.0155 + 0.3015, rounded to 2 d.p.			16.7600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 261 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 261	**Prop Type Ref**	
Property	Buridge Det, Plot 261, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.31	**TER**	16.76
Environmental	96 A	**% DER<TER**	68.32		
CO_2 Emissions (t/year)	0.12	**DFEE**	45.54	**TFEE**	55.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.76	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	5.31	$kgCO_2/m^2$	Pass
	-11.45 (-68.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.60	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.54	$kWh/m^2/yr$	
	-10.1 (-18.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	10.51 m², No overhang
Windows facing South West	7.51 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.020	W/m²K
Photovoltaic array	3.24	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 261 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 261	**Prop Type Ref**	
Property	Buridge Det, Plot 261, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.31	**TER**	16.76
Environmental	96 A	**% DER<TER**	68.32		
CO_2 Emissions (t/year)	0.12	**DFEE**	45.54	**TFEE**	55.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.54 m	64.55 m²	2.39 m
1st Storey:	32.54 m	64.55 m²	2.63 m

7.0 Living Area	14.69	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	201.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	163.01	140.75

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	South West							2.12	100
D2 (W10)	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	North East							2.12	100
W9	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.052	No
Independently assessed	E3 Sill	12.36	0.004	No
Independently assessed	E4 Jamb	33.30	0.005	No
Independently assessed	E5 Ground floor (normal)	32.54	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.051	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff | Standard

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 261 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 261	**Prop Type Ref**	
Property	Buridge Det, Plot 261, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.31	**TER**	16.76
Environmental	96 A	**% DER<TER**	68.32		
CO_2 Emissions (t/year)	0.12	**DFEE**	45.54	**TFEE**	55.60
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	5.31	$kgCO_2/yr/m^2$	
TER	16.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.31	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.32	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.54	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	17.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.88	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.88	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.41	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.41	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	32	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 262 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 262	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.52	**TER**	18.64
Environmental	93 A	**% DER<TER**	48.91		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.67	**TFEE**	52.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.64 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.44 m², No overhang
Windows facing East: 4.36 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.4235	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3599	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4589	0.4499	0.4409	0.3959	0.3869	0.3420	0.3420	0.3330	0.3599	0.3869	0.4049	0.4229	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7089	0.6999	0.6909	0.6459	0.6369	0.5920	0.5920	0.5830	0.6099	0.6369	0.6549	0.6729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.1300	1.2357	14.9895			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	14.2500	74.8900	0.2100	15.7269			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.2019			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0621	(36)
Total fabric heat loss (33) + (36) =	46.2640	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4484	45.8588	45.2692	42.3213	41.7317	38.7838	38.7838	38.1942	39.9630	41.7317	42.9109	44.0901	(38)
Heat transfer coeff	92.7124	92.1228	91.5332	88.5853	87.9957	85.0478	85.0478	84.4582	86.2270	87.9957	89.1749	90.3541	(39)
Average = Sum(39)m / 12 =												88.4379	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1721	1.1646	1.1572	1.1199	1.1125	1.0752	1.0752	1.0677	1.0901	1.1125	1.1274	1.1423	(40)
HLP (average)												1.1181	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)

Total heat required for water heating calculated for each month

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)

Total per year (kWh/year) = Sum(64)m = 1590.3950 (64)

Heat gains from water heating, kWh/month

	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.4041	17.2346	14.0161	10.6111	7.9319	6.6965	7.2358	9.4053	12.6238	16.0288	18.7080	19.9434	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)

Total internal gains

	370.8820	368.8343	355.4929	333.9505	312.0704	290.9580	277.2180	283.1290	294.1691	315.9223	340.9326	359.6973	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	10.6334	0.4100	1.0000	0.7700	4.3506	(74)
East	4.3600	19.6403	0.4100	1.0000	0.7700	24.3305	(76)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	64.0050	125.0108	206.3106	302.9800	374.0718	384.3613	365.3251	311.8041	240.5027	148.3673	79.7490	52.6837	(83)
Total gains	434.8870	493.8451	561.8035	636.9305	686.1423	675.3194	642.5431	594.9331	534.6718	464.2896	420.6816	412.3810	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3987	47.7020	48.0093	49.6069	49.9393	51.6703	51.6703	52.0310	50.9637	49.9393	49.2789	48.6358	
alpha	4.1599	4.1801	4.2006	4.3071	4.3293	4.4447	4.4447	4.4687	4.3976	4.3293	4.2853	4.2424	
util living area	0.9963	0.9933	0.9842	0.9540	0.8763	0.7192	0.5592	0.6156	0.8555	0.9732	0.9935	0.9971	(86)
MIT	19.4350	19.6045	19.9097	20.3410	20.6913	20.9160	20.9786	20.9681	20.8034	20.3412	19.8357	19.4365	(87)
Th 2	19.9424	19.9484	19.9544	19.9846	19.9907	20.0211	20.0211	20.0273	20.0089	19.9907	19.9785	19.9665	(88)
util rest of house	0.9953	0.9914	0.9795	0.9395	0.8364	0.6373	0.4454	0.5017	0.7946	0.9621	0.9914	0.9963	(89)
MIT 2	17.8509	18.1020	18.5495	19.1871	19.6665	19.9568	20.0111	20.0107	19.8317	19.2001	18.4604	17.8691	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.1607	18.3958	18.8155	19.4128	19.8669	20.1444	20.2003	20.1980	20.0218	19.4233	18.7294	18.1756	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1607	18.3958	18.8155	19.4128	19.8669	20.1444	20.2003	20.1980	20.0218	19.4233	18.7294	18.1756	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9872	0.9724	0.9290	0.8307	0.6485	0.4671	0.5229	0.7955	0.9536	0.9875	0.9941	(94)
Useful gains	431.7017	487.5170	546.2699	591.7122	569.9549	437.9575	300.1492	311.0873	425.3345	442.7487	415.4027	409.9659	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1285.0599	1243.2750	1127.2791	931.2794	718.6557	471.5371	306.2014	320.7691	510.6169	776.4105	1037.0469	1262.7549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	634.8985	507.8694	432.2708	244.4883	110.6335	0.0000	0.0000	0.0000	0.0000	248.2444	447.5838	634.4750	(98)
Space heating												3260.4635	(98)
Space heating per m2											(98) / (4) =	41.2195	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3509.6486	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	634.8985	507.8694	432.2708	244.4883	110.6335	0.0000	0.0000	0.0000	0.0000	248.2444	447.5838	634.4750	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	683.4214	546.6839	465.3077	263.1737	119.0888	0.0000	0.0000	0.0000	0.0000	267.2167	481.7909	682.9655	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2294	89.1795	89.0631	88.7637	88.1711	86.7000	86.7000	86.7000	86.7000	88.7476	89.0926	89.2446	(217)
Fuel for water heating, kWh/month													
	181.9453	159.5864	165.7697	146.2540	142.2089	126.1921	118.3152	133.8039	134.8180	151.8315	163.4920	176.5838	(219)
Water heating fuel used												1800.8008	(219)
Annual totals kWh/year													
Space heating fuel - main system												3509.6486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.6828	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4551.5531	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3509.6486	0.2160	758.0841	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.8008	0.2160	388.9730	(264)
Space and water heating			1147.0571	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.6828	0.5190	177.8524	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			753.1899	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.5200	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		28.0642	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0642	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.1300	1.3258	16.0814			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	14.2500	74.8900	0.1800	13.4802			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3886			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3328	(36)
Total fabric heat loss (33) + (36) =	51.7214	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	90.6709	90.4305	90.1949	89.0882	88.8812	87.9173	87.9173	87.7388	88.2886	88.8812	89.3000	89.7379	(39)
Average = Sum(39)m / 12 =												89.0872	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1463	1.1432	1.1403	1.1263	1.1237	1.1115	1.1115	1.1092	1.1162	1.1237	1.1290	1.1345	(40)
HLP (average)												1.1263	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4082	18.1263	14.7413	11.1601	8.3423	7.0429	7.6102	9.8920	13.2770	16.8582	19.6760	20.9754	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.0404	382.5109	368.3783	346.0363	323.3917	301.5905	287.8828	294.5305	306.3651	328.9180	354.6889	373.8859	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	10.6334	0.6300	0.7000	0.7700	4.6796	(74)
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	68.8444	134.4629	221.9097	325.8883	402.3553	413.4228	392.9472	335.3796	258.6871	159.5854	85.7788	56.6671	(83)
Total gains	453.8847	516.9737	590.2880	671.9246	725.7470	715.0133	680.8300	629.9101	565.0522	488.5033	440.4677	430.5531	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5824	60.7434	60.9021	61.6586	61.8022	62.4798	62.4798	62.6069	62.2171	61.8022	61.5124	61.2122	
alpha	5.0388	5.0496	5.0601	5.1106	5.1201	5.1653	5.1653	5.1738	5.1478	5.1201	5.1008	5.0808	
util living area													
	0.9984	0.9965	0.9901	0.9644	0.8859	0.7239	0.5545	0.6161	0.8671	0.9816	0.9967	0.9988	(86)
MIT	19.7393	19.8817	20.1396	20.4873	20.7809	20.9461	20.9889	20.9815	20.8576	20.4693	20.0438	19.7170	(87)
Th 2	19.9632	19.9657	19.9681	19.9794	19.9816	19.9915	19.9915	19.9933	19.9877	19.9816	19.9773	19.9728	(88)
util rest of house													
	0.9978	0.9953	0.9865	0.9506	0.8425	0.6339	0.4345	0.4934	0.8005	0.9721	0.9954	0.9984	(89)
MIT 2	18.2800	18.4895	18.8663	19.3710	19.7637	19.9551	19.9873	19.9855	19.8696	19.3543	18.7352	18.2540	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.5654	18.7618	19.1154	19.5893	19.9627	20.1489	20.1832	20.1803	20.0628	19.5724	18.9911	18.5401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5654	18.7618	19.1154	19.5893	19.9627	20.1489	20.1832	20.1803	20.0628	19.5724	18.9911	18.5401	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9933	0.9823	0.9438	0.8415	0.6491	0.4580	0.5173	0.8063	0.9668	0.9934	0.9974	(94)
Useful gains	452.3769	513.4888	579.8313	634.1526	610.7301	464.0833	311.8378	325.8835	455.6199	472.3064	437.5576	429.4522	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1293.4543	1253.5260	1137.8406	952.2947	734.3942	487.8476	315.0259	331.6797	526.4469	797.4775	1061.8780	1286.8541	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	625.7615	497.3050	415.1589	229.0623	92.0061	0.0000	0.0000	0.0000	0.0000	241.9273	449.5107	637.9070	(98)
Space heating												3188.6389	(98)
Space heating per m2											(98) / (4) =	40.3115	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3413.9603	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	625.7615	497.3050	415.1589	229.0623	92.0061	0.0000	0.0000	0.0000	0.0000	241.9273	449.5107	637.9070	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	669.9802	532.4465	444.4956	245.2488	98.5076	0.0000	0.0000	0.0000	0.0000	259.0228	481.2748	682.9839	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7128	87.5144	87.0401	85.9070	83.7453	80.3000	80.3000	80.3000	80.3000	85.9251	87.2319	87.7969	(217)
Fuel for water heating, kWh/month													
	229.7221	201.8913	211.1995	189.7942	188.4974	173.1411	165.8823	184.9199	186.9622	198.9565	209.2006	224.0919	(219)
Water heating fuel used												2364.2591	(219)
Annual totals kWh/year													
Space heating fuel - main system												3413.9603	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.4144	(232)
Total delivered energy for all uses												6213.6338	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3413.9603	0.2160	737.4154	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.2591	0.2160	510.6800	(264)
Space and water heating			1248.0954	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	360.4144	0.5190	187.0551	(268)
Total CO2, kg/m2/year			1474.0755	(272)
Emissions per m2 for space and water heating			15.7787	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3648	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7787 * 1.00) + 2.3648 + 0.4921, rounded to 2 d.p.			18.6400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 262 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 262	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.52	**TER**	18.64
Environmental	93 A	**% DER<TER**	48.91		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.67	**TFEE**	52.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.64	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.52	$kgCO_2/m^2$	Pass
	-9.12 (-48.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.74	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.67	$kWh/m^2/yr$	
	-11.0 (-20.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.44 m², No overhang 4.36 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 262 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 262	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.52	**TER**	18.64
Environmental	93 A	**% DER<TER**	48.91		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.67	**TFEE**	52.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	74.89

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
W8*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.22	0.052	No
Independently assessed	E3 Sill	7.39	0.004	No
Independently assessed	E4 Jamb	25.95	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.44	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 262 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 262	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.52	**TER**	18.64
Environmental	93 A	**% DER<TER**	48.91		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.67	**TFEE**	52.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.52	$kgCO_2/yr/m^2$	
TER	18.64	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.52	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.91	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.67	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.35	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.35	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.09	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.63	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.63	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	Plot 263 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 263	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.51	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.85		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.47	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r19

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.51 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 4.36 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2015	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.4255	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3616	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4611	0.4521	0.4430	0.3978	0.3888	0.3436	0.3436	0.3345	0.3616	0.3888	0.4069	0.4249	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7111	0.7021	0.6930	0.6478	0.6388	0.5936	0.5936	0.5845	0.6116	0.6388	0.6569	0.6749	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.5904	45.9980	45.4057	42.4438	41.8515	38.8896	38.8896	38.2973	40.0744	41.8515	43.0362	44.2209	(38)
Heat transfer coeff	92.3258	91.7334	91.1411	88.1792	87.5869	84.6250	84.6250	84.0327	85.8098	87.5869	88.7716	89.9563	(39)
Average = Sum(39)m / 12 =												88.0311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1672	1.1597	1.1522	1.1148	1.1073	1.0698	1.0698	1.0624	1.0848	1.1073	1.1223	1.1372	(40)
HLP (average)												1.1129	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)

Total heat required for water heating calculated for each month

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)

Total per year (kWh/year) = Sum(64)m = 1590.3950 (64)

Heat gains from water heating, kWh/month

	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.4453	17.2711	14.0458	10.6336	7.9487	6.7107	7.2511	9.4253	12.6506	16.0628	18.7477	19.9857	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)

Total internal gains

	370.9232	368.8708	355.5226	333.9730	312.0873	290.9722	277.2334	283.1489	294.1958	315.9563	340.9723	359.7396	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	4.3600	19.6403	0.4100	1.0000	0.7700	24.3305	(76)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	62.5548	122.2394	201.6013	295.4156	363.8819	373.4527	355.1405	303.7240	234.8406	145.0683	77.9600	51.4748	(83)
Total gains	433.4780	491.1102	557.1239	629.3886	675.9692	664.4250	632.3739	586.8729	529.0364	461.0246	418.9323	411.2144	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5971	47.9045	48.2159	49.8354	50.1724	51.9284	51.9284	52.2945	51.2115	50.1724	49.5028	48.8509	
alpha	4.1731	4.1936	4.2144	4.3224	4.3448	4.4619	4.4619	4.4863	4.4141	4.3448	4.3002	4.2567	
util living area	0.9964	0.9934	0.9846	0.9554	0.8801	0.7251	0.5647	0.6202	0.8581	0.9737	0.9936	0.9971	(86)
MIT	19.4405	19.6081	19.9104	20.3383	20.6873	20.9142	20.9781	20.9676	20.8024	20.3424	19.8399	19.4427	(87)
Th 2	19.9463	19.9524	19.9584	19.9888	19.9949	20.0255	20.0255	20.0317	20.0132	19.9949	19.9827	19.9705	(88)
util rest of house	0.9954	0.9915	0.9801	0.9413	0.8410	0.6437	0.4507	0.5064	0.7979	0.9628	0.9915	0.9963	(89)
MIT 2	17.8615	18.1099	18.5533	19.1867	19.6654	19.9594	20.0152	20.0148	19.8345	19.2048	18.4694	17.8807	(90)

Living area fraction fLA = Living area / (4) = 0.1956 (91)

MIT	18.1703	18.4029	18.8187	19.4119	19.8653	20.1462	20.2035	20.2012	20.0238	19.4273	18.7374	18.1862	(92)

Temperature adjustment 0.0000

adjusted MIT	18.1703	18.4029	18.8187	19.4119	19.8653	20.1462	20.2035	20.2012	20.0238	19.4273	18.7374	18.1862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9874	0.9730	0.9310	0.8351	0.6547	0.4724	0.5275	0.7987	0.9544	0.9876	0.9942	(94)
Useful gains	430.3456	484.9366	542.0913	585.9486	564.4823	434.9723	298.7374	309.5676	422.5173	440.0113	413.7525	408.8372	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1280.5873	1238.6689	1122.7386	926.9327	715.1696	469.3431	304.9496	319.4209	508.3219	773.1523	1033.0727	1258.1467	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	632.5799	506.5081	432.0015	245.5085	112.1113	0.0000	0.0000	0.0000	0.0000	247.8569	445.9106	631.8863	(98)

Space heating 3254.3631 (98)

Space heating per m2 (98) / (4) = 41.1424 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3503.0819	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	632.5799	506.5081	432.0015	245.5085	112.1113	0.0000	0.0000	0.0000	0.0000	247.8569	445.9106	631.8863	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	680.9256	545.2186	465.0178	264.2718	120.6796	0.0000	0.0000	0.0000	0.0000	266.7997	479.9899	680.1790	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2274	89.1780	89.0627	88.7668	88.1817	86.7000	86.7000	86.7000	86.7000	88.7464	89.0904	89.2425	(217)
Fuel for water heating, kWh/month													
	181.9493	159.5891	165.7704	146.2490	142.1918	126.1921	118.3152	133.8039	134.8180	151.8335	163.4961	176.5880	(219)
Water heating fuel used												1800.7964	(219)
Annual totals kWh/year													
Space heating fuel - main system												3503.0819	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4545.7090	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3503.0819	0.2160	756.6657	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.7964	0.2160	388.9720	(264)
Space and water heating			1145.6377	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			752.1479	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.5100	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		28.0542	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0542	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1818	(36)
Total fabric heat loss (33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains	67.2845	131.4819	216.8443	317.7519	391.3949	401.6894	381.9926	326.6885	252.5968	156.0369	83.8545	55.3668	(83)
Total gains	452.4980	514.1465	585.3477	663.8829	714.8574	703.3397	669.9400	621.3029	559.0746	485.0979	438.7103	429.4306	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9984	0.9966	0.9904	0.9655	0.8891	0.7289	0.5589	0.6195	0.8690	0.9819	0.9968	0.9988	(86)
MIT	19.7496	19.8900	20.1447	20.4882	20.7796	20.9455	20.9888	20.9815	20.8582	20.4733	20.0518	19.7276	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9979	0.9954	0.9869	0.9521	0.8466	0.6395	0.4389	0.4972	0.8031	0.9726	0.9954	0.9984	(89)
MIT 2	18.3000	18.5068	18.8790	19.3781	19.7688	19.9617	19.9945	19.9927	19.8769	19.3655	18.7520	18.2747	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9828	0.9454	0.8455	0.6545	0.4624	0.5210	0.8088	0.9674	0.9935	0.9975	(94)
Useful gains	451.0208	510.7593	575.2587	627.6528	604.4347	460.3276	309.7951	323.7249	452.2013	469.2936	435.8608	428.3512	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1285.0885	1245.2019	1129.9957	945.3221	728.9393	484.4116	313.0159	329.5333	522.7943	792.0526	1054.8826	1278.4672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating												3166.4842	(98)
Space heating per m2											(98) / (4) =	40.0314	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3390.2400	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	664.3966	528.4213	441.8890	244.8843	99.1771	0.0000	0.0000	0.0000	0.0000	257.1014	477.1902	677.1802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6963	87.4988	87.0269	85.9033	83.7607	80.3000	80.3000	80.3000	80.3000	85.9066	87.2133	87.7804	(217)
Fuel for water heating, kWh/month													
	229.7654	201.9275	211.2315	189.8024	188.4628	173.1411	165.8823	184.9199	186.9622	198.9995	209.2451	224.1341	(219)
Water heating fuel used												2364.4739	(219)
Annual totals kWh/year													
Space heating fuel - main system												3390.2400	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6193.1853	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3390.2400	0.2160	732.2918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4739	0.2160	510.7264	(264)
Space and water heating			1243.0182	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1470.5849	(272)
Emissions per m2 for space and water heating			15.7145	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7145 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.5900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 263 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 263	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.51	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.85		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.47	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.51	$kgCO_2/m^2$	Pass
	-9.08 (-48.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.47	$kWh/m^2/yr$	
	-10.9 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 4.36 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 263 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 263	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.51	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.85		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.47	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.48	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 263 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 263	**Prop Type Ref**	
Property			

SAP Rating	91 B	**DER**	9.51	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.85		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.47	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.51	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.51	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.85	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.47	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.79	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.33	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.33	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.07	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.61	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.61	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 264 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 264	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.87	**TER**	18.14
Environmental	94 A	**% DER<TER**	51.10		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.00	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.87 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.43 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.22 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2015	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.4230	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3595	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4584	0.4494	0.4404	0.3955	0.3865	0.3415	0.3415	0.3326	0.3595	0.3865	0.4045	0.4224	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7084	0.6994	0.6904	0.6455	0.6365	0.5915	0.5915	0.5826	0.6095	0.6365	0.6545	0.6724	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8404	(36)
Total fabric heat loss (33) + (36) =	43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4129	45.8240	45.2351	42.2907	41.7018	38.7574	38.7574	38.1685	39.9351	41.7018	42.8796	44.0573	(38)
Heat transfer coeff	89.6884	89.0995	88.5107	85.5662	84.9773	82.0329	82.0329	81.4440	83.2107	84.9773	86.1551	87.3329	(39)
Average = Sum(39)m / 12 =												85.4190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1339	1.1264	1.1190	1.0817	1.0743	1.0371	1.0371	1.0296	1.0520	1.0743	1.0892	1.1041	(40)
HLP (average)												1.0799	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
South	0.9600	46.7521	0.4100	1.0000	0.7700	12.7523	(78)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	71.6254	136.0533	216.2695	306.6842	370.3363	377.1839	359.8489	312.4091	248.3799	159.1833	88.5237	59.4335	(83)
Total gains	442.5659	504.9394	571.8046	640.6666	682.4306	668.1621	637.0887	595.5664	542.5870	475.1538	429.5125	419.1909	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.1372	42.4157	42.6979	44.1672	44.4733	46.0696	46.0696	46.4027	45.4175	44.4733	43.8653	43.2738	
alpha	3.8091	3.8277	3.8465	3.9445	3.9649	4.0713	4.0713	4.0935	4.0278	3.9649	3.9244	3.8849	
util living area													
	0.9932	0.9880	0.9748	0.9367	0.8526	0.6964	0.5408	0.5904	0.8231	0.9586	0.9885	0.9945	(86)
MIT	19.3256	19.5170	19.8471	20.3025	20.6653	20.9032	20.9734	20.9627	20.7941	20.3124	19.7635	19.3261	(87)
Th 2	19.9733	19.9793	19.9854	20.0158	20.0219	20.0525	20.0525	20.0587	20.0403	20.0219	20.0097	19.9975	(88)
util rest of house													
	0.9916	0.9851	0.9684	0.9200	0.8125	0.6198	0.4353	0.4852	0.7621	0.9445	0.9852	0.9932	(89)
MIT 2	17.7327	18.0150	18.4972	19.1667	19.6629	19.9738	20.0386	20.0373	19.8493	19.1945	18.3953	17.7489	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0583	18.3220	18.7731	19.3989	19.8678	20.1638	20.2297	20.2265	20.0424	19.4230	18.6750	18.0713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0583	18.3220	18.7731	19.3989	19.8678	20.1638	20.2297	20.2265	20.0424	19.4230	18.6750	18.0713	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9870	0.9784	0.9580	0.9069	0.8053	0.6295	0.4559	0.5050	0.7623	0.9330	0.9788	0.9893	(94)
Useful gains	436.8126	494.0122	547.7913	581.0191	549.5525	420.5785	290.4304	300.7560	413.6069	443.3220	420.4008	414.7249	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1233.9614	1195.8957	1086.3031	898.3537	694.0802	456.4128	297.7522	311.6420	494.4728	749.7573	997.2463	1211.4218	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	593.0787	471.6657	400.6527	228.4809	107.5286	0.0000	0.0000	0.0000	0.0000	227.9879	415.3287	592.7425	(98)
Space heating												3037.4656	(98)
Space heating per m2											(98) / (4) =	38.4003	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3269.6077	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	593.0787	471.6657	400.6527	228.4809	107.5286	0.0000	0.0000	0.0000	0.0000	227.9879	415.3287	592.7425	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	638.4054	507.7134	431.2731	245.9428	115.7466	0.0000	0.0000	0.0000	0.0000	245.4121	447.0707	638.0436	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1925	89.1374	89.0153	88.7136	88.1485	86.7000	86.7000	86.7000	86.7000	88.6841	89.0466	89.2085	(217)
Fuel for water heating, kWh/month													
	182.0204	159.6618	165.8587	146.3366	142.2453	126.1921	118.3152	133.8039	134.8180	151.9402	163.5764	176.6554	(219)
Water heating fuel used												1801.4241	(219)
Annual totals kWh/year													
Space heating fuel - main system												3269.6077	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4313.1668	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3269.6077	0.2160	706.2353	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.4241	0.2160	389.1076	(264)
Space and water heating			1095.3429	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			702.0109	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.8700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.8700	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.4142	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4142	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3077	(36)
Total fabric heat loss	(33) + (36) = 48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Total storage loss
    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     50.9589   45.0236   47.9665   44.5988   44.2044   40.9581   42.3234   44.2044   44.5988   47.9665   48.2395   50.9589 (61)
Total heat required for water heating calculated for each month
   201.4958  176.6841  183.8283  163.0465  157.8577  139.0323  133.2035  148.4907  150.1306  170.9536  182.4896  196.7458 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
   201.4958  176.6841  183.8283  163.0465  157.8577  139.0323  133.2035  148.4907  150.1306  170.9536  182.4896  196.7458 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m =   2003.9586 (64)
Heat gains from water heating, kWh/month
    62.7932   55.0330   57.1657   50.5335   48.8408   42.8492   40.7985   45.7263   46.2390   52.8849   56.6980   61.2139 (65)


-------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m     122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
     20.6343   18.3272   14.9047   11.2838    8.4348    7.1210    7.6945   10.0016   13.4241   17.0450   19.8940   21.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
    217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
     35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
    -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
     84.3995   81.8944   76.8356   70.1855   65.6463   59.5128   54.8367   61.4601   64.2209   71.0818   78.7473   82.2767 (72)
Total internal gains
    385.2665  382.7117  368.5417  346.1600  323.4841  301.6686  287.9671  294.6402  306.5123  329.1048  354.9069  374.1184 (73)


-------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------

[Jan]                                Area          Solar flux             g               FF           Access            Gains
                                     m2            Table 6a       Specific data   Specific data      factor                W
                                                      W/m2         or Table 6b     or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------
East                                4.2200           19.6403           0.6300          0.7000       0.7700           25.3298 (76)
South                               0.9600           46.7521           0.6300          0.7000       0.7700           13.7165 (78)
West                                6.3300           19.6403           0.6300          0.7000       0.7700           37.9947 (80)
-------------------------------------------------------------------------------------------------------

Solar gains    77.0410  146.3402  232.6216  329.8725  398.3373  405.7027  387.0570  336.0303  267.1598  171.2191   95.2169   63.9273 (83)
Total gains   462.3075  529.0520  601.1633  676.0325  721.8214  707.3713  675.0242  630.6705  573.6721  500.3239  450.1239  438.0457 (84)


-------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau        62.5002   62.6716   62.8405   63.6463   63.7994   64.5217   64.5217   64.6572   64.2415   63.7994   63.4905   63.1708
alpha       5.1667    5.1781    5.1894    5.2431    5.2533    5.3014    5.3014    5.3105    5.2828    5.2533    5.2327    5.2114
util living area
     0.9982    0.9961    0.9889    0.9614    0.8803    0.7153    0.5438    0.6001    0.8524    0.9787    0.9963    0.9987 (86)

MIT        19.7968   19.9422   20.1944   20.5267   20.8015   20.9532   20.9909   20.9852   20.8786   20.5128   20.0954   19.7736 (87)
Th 2       19.9918   19.9942   19.9967   20.0081   20.0103   20.0202   20.0202   20.0221   20.0164   20.0103   20.0059   20.0014 (88)
util rest of house
     0.9977    0.9948    0.9849    0.9468    0.8364    0.6271    0.4285    0.4823    0.7837    0.9680    0.9948    0.9982 (89)
MIT 2      18.3842   18.5981   18.9663   19.4480   19.8136   19.9887   20.0168   20.0159   19.9172   19.4371   18.8309   18.3572 (90)
Living area fraction                                                                 fLA = Living area / (4) =     0.2044 (91)
MIT        18.6729   18.8729   19.2174   19.6685   20.0156   20.1859   20.2160   20.2140   20.1137   19.6570   19.0894   18.6468 (92)
Temperature adjustment                                                                                           0.0000
adjusted MIT  18.6729   18.8729   19.2174   19.6685   20.0156   20.1859   20.2160   20.2140   20.1137   19.6570   19.0894   18.6468 (93)


-------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------

              Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9965    0.9926    0.9807    0.9405    0.8366    0.6430    0.4522    0.5064    0.7915    0.9629    0.9928    0.9973 (94)
Useful gains 460.6766  525.1371  589.5397  635.7798  603.9055  454.8733  305.2198  319.3700  454.0709  481.7418  446.8777  436.8668 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
  1263.2167 1224.6992 1111.6570  929.3842  715.9624  475.5555  307.8456  324.0264  514.2107  779.7991 1037.2929 1256.2284 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
   597.0898  470.1057  388.4553  211.3952   83.3704    0.0000    0.0000    0.0000    0.0000  221.7546  425.0989  609.6051 (98)
Space heating                                                                                                   3006.8749 (98)
Space heating per m2                                                                                 (98) / (4) =    38.0136 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3219.3521	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	639.2824	503.3252	415.9050	226.3331	89.2616	0.0000	0.0000	0.0000	0.0000	237.4246	455.1380	652.6821	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6193	87.3971	86.8895	85.7060	83.5252	80.3000	80.3000	80.3000	80.3000	85.7072	87.1092	87.7083	(217)
Fuel for water heating, kWh/month													
	229.9673	202.1623	211.5657	190.2393	188.9942	173.1411	165.8823	184.9199	186.9622	199.4624	209.4952	224.3184	(219)
Water heating fuel used												2367.1103	(219)
Annual totals kWh/year													
Space heating fuel - main system												3219.3521	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6025.8707	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3219.3521	0.2160	695.3801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2367.1103	0.2160	511.2958	(264)
Space and water heating			1206.6759	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1434.7288	(272)
Emissions per m2 for space and water heating			15.2551	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2551 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.1400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 264 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 264	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.87	**TER**	18.14
Environmental	94 A	**% DER<TER**	51.10		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.00	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.14	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.87	$kgCO_2/m^2$	Pass
	-9.27 (-51.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.95	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.00	$kWh/m^2/yr$	
	-10.9 (-21.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.43 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.22 m², No overhang 0.96 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.43 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 264 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 264	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.87	**TER**	18.14
Environmental	94 A	**% DER<TER**	51.10		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.00	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.43	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 264 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 264	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.87	**TER**	18.14
Environmental	94 A	**% DER<TER**	51.10		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.00	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.87	$kgCO_2/yr/m^2$	
TER	18.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.87	$kgCO_2/yr/m^2$	
Reduction DER/TER	51.10	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.00	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.19	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.73	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.73	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.47	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.01	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.01	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 265 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 265	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.94	**TER**	18.31
Environmental	94 A	**% DER<TER**	51.17		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.49	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.94 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.27 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 4.22 m², No overhang
Windows facing West: 6.33 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2015	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.4150	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3527	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4497	0.4409	0.4321	0.3880	0.3792	0.3351	0.3351	0.3263	0.3527	0.3792	0.3968	0.4145	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6997	0.6909	0.6821	0.6380	0.6292	0.5851	0.5851	0.5763	0.6027	0.6292	0.6468	0.6645	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8404	(36)
Total fabric heat loss (33) + (36) =	43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.8449	45.2671	44.6894	41.8006	41.2229	38.3341	38.3341	37.7564	39.4896	41.2229	42.3784	43.5339	(38)
Heat transfer coeff	89.1204	88.5426	87.9649	85.0761	84.4984	81.6096	81.6096	81.0319	82.7651	84.4984	85.6539	86.8094	(39)
Average = Sum(39)m / 12 =												84.9317	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1267	1.1194	1.1121	1.0756	1.0682	1.0317	1.0317	1.0244	1.0463	1.0682	1.0829	1.0975	(40)
HLP (average)												1.0737	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
										Total per year (kWh/year) = Sum(64)m =		1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(76)
West	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(80)

Solar gains	61.7735	120.7111	199.0844	291.7449	359.3833	368.8476	350.7562	299.9579	231.9133	143.2549	76.9859	50.8323	(83)
Total gains	432.7140	489.5972	554.6195	625.7273	671.4776	659.8258	627.9960	583.1152	526.1204	459.2254	417.9747	410.5896	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.4058	42.6825	42.9629	44.4216	44.7254	46.3085	46.3085	46.6387	45.6620	44.7254	44.1220	43.5347	
alpha	3.8271	3.8455	3.8642	3.9614	3.9817	4.0872	4.0872	4.1092	4.0441	3.9817	3.9415	3.9023	
util living area													
	0.9937	0.9892	0.9770	0.9404	0.8568	0.7003	0.5453	0.5984	0.8332	0.9625	0.9895	0.9949	(86)
MIT	19.3226	19.5055	19.8331	20.2922	20.6615	20.9023	20.9730	20.9613	20.7854	20.2977	19.7552	19.3240	(87)
Th 2	19.9791	19.9850	19.9910	20.0208	20.0268	20.0570	20.0570	20.0630	20.0449	20.0268	20.0149	20.0029	(88)
util rest of house													
	0.9922	0.9865	0.9711	0.9245	0.8175	0.6241	0.4397	0.4929	0.7740	0.9495	0.9865	0.9937	(89)
MIT 2	17.7320	18.0021	18.4810	19.1566	19.6626	19.9772	20.0427	20.0407	19.8441	19.1779	18.3867	17.7494	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0572	18.3095	18.7574	19.3888	19.8668	20.1663	20.2329	20.2289	20.0366	19.4068	18.6665	18.0713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0572	18.3095	18.7574	19.3888	19.8668	20.1663	20.2329	20.2289	20.0366	19.4068	18.6665	18.0713	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9802	0.9613	0.9116	0.8100	0.6336	0.4602	0.5127	0.7734	0.9384	0.9805	0.9901	(94)
Useful gains	427.4778	479.9263	533.1357	570.3925	543.9209	418.0714	289.0333	298.9507	406.9155	430.9455	409.8079	406.5057	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1226.0427	1187.3090	1078.2221	892.3435	690.0819	454.2651	296.4789	310.2618	491.3395	744.1599	990.7115	1204.1572	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	594.1323	475.3612	405.5443	231.8047	108.7438	0.0000	0.0000	0.0000	0.0000	233.0315	418.2507	593.4528	(98)
Space heating												3060.3212	(98)
Space heating per m2											(98) / (4) =	38.6893	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3294.2101	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	594.1323	475.3612	405.5443	231.8047	108.7438	0.0000	0.0000	0.0000	0.0000	233.0315	418.2507	593.4528	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	639.5396	511.6913	436.5385	249.5207	117.0547	0.0000	0.0000	0.0000	0.0000	250.8413	450.2160	638.8081	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1935	89.1419	89.0231	88.7244	88.1575	86.7000	86.7000	86.7000	86.7000	88.7005	89.0510	89.2091	(217)
Fuel for water heating, kWh/month	182.0185	159.6537	165.8442	146.3189	142.2309	126.1921	118.3152	133.8039	134.8180	151.9120	163.5684	176.6541	(219)
Water heating fuel used												1801.3299	(219)
Annual totals kWh/year													
Space heating fuel - main system												3294.2101	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4337.6750	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3294.2101	0.2160	711.5494	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.3299	0.2160	389.0873	(264)
Space and water heating			1100.6366	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			707.3047	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.9400	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.4842	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4842	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3077	(36)
Total fabric heat loss	(33) + (36) = 48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

Water storage loss:

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
							Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(76)
West	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(80)

Solar gains 66.4442	129.8380	214.1371	313.8037	386.5562	396.7361	377.2768	322.6377	249.4483	154.0863	82.8067	54.6757	(83)
Total gains 451.7107	512.5498	582.6788	659.9636	710.0403	698.4046	665.2440	617.2778	555.9605	483.1911	437.7137	428.7941	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9984	0.9966	0.9903	0.9648	0.8860	0.7220	0.5511	0.6114	0.8647	0.9816	0.9968	0.9988	(86)
MIT	19.7842	19.9228	20.1735	20.5109	20.7939	20.9511	20.9904	20.9839	20.8686	20.4943	20.0808	19.7626	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9979	0.9955	0.9868	0.9513	0.8433	0.6338	0.4346	0.4922	0.7987	0.9722	0.9955	0.9984	(89)
MIT 2	18.3658	18.5700	18.9363	19.4265	19.8049	19.9871	20.0166	20.0153	19.9074	19.4115	18.8097	18.3411	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9829	0.9450	0.8431	0.6497	0.4585	0.5166	0.8055	0.9673	0.9936	0.9976	(94)
Useful gains	450.2709	509.2300	572.6984	623.6777	598.6560	453.7339	305.0170	318.8569	447.8421	467.3686	434.9105	427.7450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1261.7099	1222.3907	1109.1972	927.6278	715.2339	475.4111	307.8197	323.9617	513.3738	777.7182	1035.5745	1254.9203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating												3066.4845	(98)
Space heating per m2											(98) / (4) =	38.7672	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3283.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	646.3711	513.1092	427.3610	234.3084	92.8630	0.0000	0.0000	0.0000	0.0000	247.2164	463.0387	658.9062	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6415	87.4376	86.9514	85.7929	83.6126	80.3000	80.3000	80.3000	80.3000	85.8086	87.1473	87.7270	(217)
Fuel for water heating, kWh/month													
	229.9091	202.0688	211.4149	190.0466	188.7965	173.1411	165.8823	184.9199	186.9622	199.2267	209.4037	224.2706	(219)
Water heating fuel used												2366.0425	(219)
Annual totals kWh/year													
Space heating fuel - main system												3283.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6088.6247	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3283.1739	0.2160	709.1656	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2366.0425	0.2160	511.0652	(264)
Space and water heating			1220.2308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1448.2836	(272)
Emissions per m2 for space and water heating			15.4264	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4264 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 265 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 265	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.94	**TER**	18.31
Environmental	94 A	**% DER<TER**	51.17		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.49	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.94	$kgCO_2/m^2$	Pass
	-9.37 (-51.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.49	$kWh/m^2/yr$	
	-11.3 (-22.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 4.22 m², No overhang 6.33 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 265 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 265	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.94	**TER**	18.31
Environmental	94 A	**% DER<TER**	51.17		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.49	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	4.27	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 265 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 265	**Prop Type Ref**	
Property			

SAP Rating	92 A	**DER**	8.94	**TER**	18.31
Environmental	94 A	**% DER<TER**	51.17		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.49	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.94	$kgCO_2/yr/m^2$	
TER	18.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.94	$kgCO_2/yr/m^2$	
Reduction DER/TER	51.17	%	
CfSH ENE1 credits achieved	5.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.49	kWh/m^2/yr	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.26	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.80	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.80	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.54	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.08	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.08	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 266 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 266	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.72	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.46		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.15	**TFEE**	53.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.72 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.77 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 3.50 m², No overhang
Windows facing South West: 2.42 m², No overhang
Windows facing North West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3373	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2867	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3656	0.3584	0.3512	0.3154	0.3082	0.2724	0.2724	0.2652	0.2867	0.3082	0.3225	0.3369	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6156	0.6084	0.6012	0.5654	0.5582	0.5224	0.5224	0.5152	0.5367	0.5582	0.5725	0.5869	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7700	1.2357	17.0162			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1400	5.6224			(28a)
External Wall	89.8400	15.8900	73.9500	0.2100	15.5295			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.1593			(33)
Party Wall			46.3100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1865	(36)
Total fabric heat loss					(33) + (36) =		48.3458	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9524	40.4755	39.9987	37.6143	37.1375	34.7532	34.7532	34.2763	35.7069	37.1375	38.0912	39.0449	(38)
Heat transfer coeff	89.2982	88.8213	88.3445	85.9601	85.4833	83.0989	83.0989	82.6221	84.0527	85.4833	86.4370	87.3907	(39)
Average = Sum(39)m / 12 =												85.8409	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1118	1.1058	1.0999	1.0702	1.0643	1.0346	1.0346	1.0287	1.0465	1.0643	1.0762	1.0880	(40)
HLP (average)												1.0687	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689 (42)
Average daily hot water use (litres/day)		92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)

Total heat required for water heating calculated for each month

	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)

Heat gains from water heating, kWh/month

	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.6228	17.4288	14.1740	10.7307	8.0213	6.7719	7.3173	9.5113	12.7660	16.2094	18.9188	20.1682	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)

Water heating gains (Table 5)

	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)

Total internal gains

	374.4142	372.3562	358.8849	337.1254	315.0118	293.6834	279.8084	285.7533	296.9095	318.8810	344.1437	363.1099	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.5000	36.7938	0.4100	1.0000	0.7700	36.5898	(77)
Southwest	2.4200	36.7938	0.4100	1.0000	0.7700	25.2992	(79)
Northwest	7.8500	11.2829	0.4100	1.0000	0.7700	25.1657	(81)

Solar gains	87.0548	156.6455	236.5323	330.2907	403.9219	415.9427	394.7951	337.5786	268.6410	179.1131	105.7938	73.5157	(83)
Total gains	461.4690	529.0016	595.4172	667.4161	718.9338	709.6261	674.6035	623.3319	565.5504	497.9942	449.9375	436.6256	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.2204	49.4846	49.7517	51.1317	51.4169	52.8922	52.8922	53.1975	52.2921	51.4169	50.8496	50.2947	
alpha	4.2814	4.2990	4.3168	4.4088	4.4278	4.5261	4.5261	4.5465	4.4861	4.4278	4.3900	4.3530	
util living area													
	0.9954	0.9912	0.9801	0.9443	0.8543	0.6856	0.5259	0.5829	0.8279	0.9647	0.9916	0.9964	(86)
MIT	19.5383	19.7154	20.0094	20.4140	20.7412	20.9347	20.9844	20.9759	20.8394	20.4150	19.9216	19.5289	(87)
Th 2	19.9912	19.9961	20.0009	20.0252	20.0301	20.0546	20.0546	20.0595	20.0448	20.0301	20.0204	20.0106	(88)
util rest of house													
	0.9942	0.9888	0.9744	0.9278	0.8118	0.6056	0.4204	0.4756	0.7638	0.9511	0.9889	0.9954	(89)
MIT 2	18.0360	18.2972	18.7267	19.3194	19.7608	20.0050	20.0473	20.0470	19.9022	19.3330	18.6154	18.0354	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.4123	18.6524	19.0480	19.5936	20.0064	20.2379	20.2820	20.2797	20.1370	19.6041	18.9426	18.4095	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4123	18.6524	19.0480	19.5936	20.0064	20.2379	20.2820	20.2797	20.1370	19.6041	18.9426	18.4095	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9843	0.9672	0.9188	0.8107	0.6221	0.4465	0.5018	0.7708	0.9433	0.9846	0.9931	(94)
Useful gains	457.4850	520.6888	575.8604	613.2492	582.8114	441.4665	301.2432	312.7835	435.9282	469.7684	443.0239	433.6224	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1260.2039	1221.5104	1108.5480	919.2221	710.0584	468.5014	305.9705	320.5488	507.4239	769.6972	1023.6368	1241.7774	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	597.2229	470.9521	396.3195	220.3005	94.6718	0.0000	0.0000	0.0000	0.0000	223.1470	418.0413	601.2674	(98)
Space heating												3021.9224	(98)
Space heating per m2											(98) / (4) =	37.6235	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3252.8766	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.2229	470.9521	396.3195	220.3005	94.6718	0.0000	0.0000	0.0000	0.0000	223.1470	418.0413	601.2674	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	642.8664	506.9452	426.6087	237.1372	101.9072	0.0000	0.0000	0.0000	0.0000	240.2013	449.9906	647.2200	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1933	89.1333	89.0048	88.6822	88.0441	86.7000	86.7000	86.7000	86.7000	88.6637	89.0472	89.2132	(217)
Fuel for water heating, kWh/month													
	183.0343	160.5592	166.7979	147.1931	143.1916	126.8734	118.9465	134.5283	135.5512	152.8108	164.4836	177.6292	(219)
Water heating fuel used												1811.5992	(219)
Annual totals kWh/year													
Space heating fuel - main system												3252.8766	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												346.5446	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4152.1944	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3252.8766	0.2160	702.6213	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.5992	0.2160	391.3054	(264)
Space and water heating			1093.9268	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	346.5446	0.5190	179.8567	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			620.4527	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.7200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.7200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.1783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.1783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3988 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.7700	1.3258	18.2557			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.8900	73.9500	0.1800	13.3110			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5523			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7861	(36)
Total fabric heat loss					(33) + (36) =		54.3384	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8168	93.5755	93.3390	92.2281	92.0203	91.0527	91.0527	90.8735	91.4254	92.0203	92.4407	92.8803	(39)
Average = Sum(39)m / 12 =												92.2271	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1680	1.1650	1.1621	1.1483	1.1457	1.1336	1.1336	1.1314	1.1383	1.1457	1.1509	1.1564	(40)
HLP (average)												1.1482	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689 (42)
Average daily hot water use (litres/day)		92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2077	17.9483	14.5966	11.0505	8.2604	6.9738	7.5354	9.7948	13.1466	16.6926	19.4827	20.7694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1530	385.7603	371.5637	349.0744	326.2504	304.2562	290.4019	297.0404	308.9253	331.6266	357.5957	376.8673	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	3.5000	36.7938	0.6300	0.7000	0.7700	39.3564	(77)
Southwest	2.4200	36.7938	0.6300	0.7000	0.7700	27.2121	(79)
Northwest	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(81)

Solar gains	93.6369	168.4894	254.4164	355.2639	434.4624	447.3920	424.6454	363.1028	288.9528	192.6558	113.7928	79.0742	(83)
Total gains	481.7899	554.2497	625.9801	704.3383	760.7127	751.6482	715.0473	660.1432	597.8781	524.2825	471.3886	455.9416	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4539	59.6072	59.7583	60.4781	60.6147	61.2588	61.2588	61.3796	61.0091	60.6147	60.3390	60.0534	
alpha	4.9636	4.9738	4.9839	5.0319	5.0410	5.0839	5.0839	5.0920	5.0673	5.0410	5.0226	5.0036	
util living area													
	0.9980	0.9956	0.9884	0.9612	0.8795	0.7146	0.5469	0.6091	0.8567	0.9776	0.9959	0.9985	(86)
MIT	19.7344	19.8867	20.1428	20.4866	20.7814	20.9465	20.9888	20.9813	20.8610	20.4799	20.0466	19.7093	(87)
Th 2	19.9457	19.9481	19.9504	19.9616	19.9637	19.9735	19.9735	19.9753	19.9697	19.9637	19.9595	19.9551	(88)
util rest of house													
	0.9973	0.9941	0.9841	0.9463	0.8343	0.6233	0.4262	0.4853	0.7870	0.9663	0.9942	0.9980	(89)
MIT 2	18.2603	18.4842	18.8578	19.3557	19.7482	19.9378	19.9693	19.9675	19.8563	19.3552	18.7265	18.2303	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6296	18.8355	19.1797	19.6390	20.0070	20.1905	20.2247	20.2215	20.1079	19.6370	19.0572	18.6008	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6296	18.8355	19.1797	19.6390	20.0070	20.1905	20.2247	20.2215	20.1079	19.6370	19.0572	18.6008	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9918	0.9799	0.9404	0.8365	0.6440	0.4566	0.5164	0.7979	0.9615	0.9920	0.9970	(94)
Useful gains	479.8887	549.7018	613.3685	662.3641	636.3221	484.0442	326.5194	340.8915	477.0244	504.1018	467.6252	454.5615	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1344.3569	1304.0207	1183.5114	990.4340	764.4124	509.0273	330.0401	347.2689	549.2786	831.5833	1105.3294	1337.5464	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	643.1643	506.9023	424.1863	236.2104	95.2992	0.0000	0.0000	0.0000	0.0000	243.6462	459.1471	656.9407	(98)
Space heating												3265.4965	(98)
Space heating per m2											(98) / (4) =	40.6561	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3496.2489	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	643.1643	506.9023	424.1863	236.2104	95.2992	0.0000	0.0000	0.0000	0.0000	243.6462	459.1471	656.9407	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	688.6127	542.7220	454.1610	252.9019	102.0334	0.0000	0.0000	0.0000	0.0000	260.8632	491.5922	703.3627	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7579	87.5414	87.0749	85.9686	83.8118	80.3000	80.3000	80.3000	80.3000	85.9279	87.2649	87.8449	(217)
Fuel for water heating, kWh/month													
	230.6347	203.0416	212.3835	190.7975	189.4793	174.1812	166.8789	186.0308	188.0853	200.1454	210.3778	224.9666	(219)
Water heating fuel used												2377.0027	(219)
Annual totals kWh/year													
Space heating fuel - main system												3496.2489	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8746	(232)
Total delivered energy for all uses												6305.1262	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3496.2489	0.2160	755.1898	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2377.0027	0.2160	513.4326	(264)
Space and water heating			1268.6223	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8746	0.5190	185.2179	(268)
Total CO2, kg/m2/year			1492.7653	(272)
Emissions per m2 for space and water heating			15.7946	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3060	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7946 * 1.00) + 2.3060 + 0.4846, rounded to 2 d.p.			18.5900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 266 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 266	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.72	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.46		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.15	**TFEE**	53.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.72	$kgCO_2/m^2$	Pass
	-10.87 (-58.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.07	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.15	$kWh/m^2/yr$	
	-12.0 (-22.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.77 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	3.50 m², No overhang 2.42 m², No overhang 7.85 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.77 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.025	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 266 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 266	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.72	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.46		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.15	**TFEE**	53.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.95

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.82	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South East							2.12	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.77	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.052	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.77	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 266 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 266	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.72	**TER**	18.59
Environmental	95 A	**% DER<TER**	58.46		
CO_2 Emissions (t/year)	0.27	**DFEE**	41.15	**TFEE**	53.07
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.72	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.72	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.46	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.15	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.24	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 267 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 267	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.88	**TER**	18.89
Environmental	95 A	**% DER<TER**	58.27		
CO_2 Emissions (t/year)	0.28	**DFEE**	42.11	**TFEE**	54.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.88 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.55 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 2.42 m², No overhang
Windows facing South East: 3.50 m², No overhang
Windows facing North West: 7.85 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Air permeability 3.6 m³/m²h
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		3.5500	
Infiltration rate		0.3263	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2774	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3536	0.3467	0.3398	0.3051	0.2982	0.2635	0.2635	0.2566	0.2774	0.2982	0.3120	0.3259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6036	0.5967	0.5898	0.5551	0.5482	0.5135	0.5135	0.5066	0.5274	0.5482	0.5620	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.7700	1.2357	17.0162			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1400	5.6224			(28a)
External Wall	89.8400	15.8900	73.9500	0.2100	15.5295			(29a)
Main Roof	40.1600		40.1600	0.0700	2.8112			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.1593			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1865	(36)
Total fabric heat loss (33) + (36) =	48.3458	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.1593	39.6980	39.2367	36.9301	36.4688	34.1622	34.1622	33.7009	35.0848	36.4688	37.3914	38.3140	(38)
Heat transfer coeff	88.5051	88.0438	87.5825	85.2759	84.8146	82.5080	82.5080	82.0467	83.4306	84.8146	85.7372	86.6598	(39)
Average = Sum(39)m / 12 =												85.1606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1019	1.0962	1.0904	1.0617	1.0560	1.0272	1.0272	1.0215	1.0387	1.0560	1.0674	1.0789	(40)
HLP (average)												1.0603	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8131   10.6602   11.7801   11.3748   11.7356   11.3359   11.7005   11.7233   11.3571   11.7617   11.4116   11.8059 (61)
Total heat required for water heating calculated for each month
              163.2543  143.1117  148.4581  130.5340  126.0717  109.9992  103.1266  116.6361  117.5229  135.4877  146.4682  158.4687 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              163.2543  143.1117  148.4581  130.5340  126.0717  109.9992  103.1266  116.6361  117.5229  135.4877  146.4682  158.4687 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1599.1392 (64)
Heat gains from water heating, kWh/month
               53.3075   46.7052   48.3905   42.4641   40.9507   35.6395   33.3243   37.8143   38.1394   44.0793   47.7592   51.7168 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452  123.4452 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.6228   17.4288   14.1740   10.7307    8.0213    6.7719    7.3173    9.5113   12.7660   16.2094   18.9188   20.1682 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              220.1080  222.3921  216.6364  204.3832  188.9158  174.3786  164.6668  162.3828  168.1385  180.3916  195.8591  210.3963 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445   35.3445 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
               71.6498   69.5017   65.0409   58.9780   55.0412   49.4994   44.7907   50.8257   52.9714   59.2464   66.3322   69.5119 (72)
Total internal gains
              374.4142  372.3562  358.8849  337.1254  315.0118  293.6834  279.8084  285.7533  296.9095  318.8810  344.1437  363.1099 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data      factor                W
                                                      W/m2       or Table 6b      or Table 6c        Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                          2.4200           11.2829            0.4100           1.0000          0.7700            7.7581 (75)
Southeast                          3.5000           36.7938            0.4100           1.0000          0.7700           36.5898 (77)
Northwest                          7.8500           11.2829            0.4100           1.0000          0.7700           25.1657 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains    69.5136  129.3433  206.0210  303.9587  384.8998  401.6644  379.1124  315.7381  239.4655  150.7840   85.2528   58.2005 (83)
Total gains   443.9278  501.6995  564.9060  641.0841  699.9116  695.3478  658.9208  601.4915  536.3749  469.6650  429.3965  421.3104 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.6614   49.9216   50.1846   51.5420   51.8223   53.2711   53.2711   53.5706   52.6820   51.8223   51.2647   50.7189
alpha          4.3108    4.3281    4.3456    4.4361    4.4548    4.5514    4.5514    4.5714    4.5121    4.4548    4.4176    4.3813
util living area
               0.9961    0.9928    0.9834    0.9504    0.8619    0.6927    0.5339    0.5975    0.8463    0.9708    0.9929    0.9969 (86)

MIT           19.5295   19.6931   19.9832   20.3948   20.7339   20.9331   20.9838   20.9739   20.8247   20.3889   19.9051   19.5219 (87)
Th 2          19.9993   20.0040   20.0087   20.0322   20.0370   20.0607   20.0607   20.0655   20.0512   20.0370   20.0275   20.0181 (88)
util rest of house
               0.9950    0.9908    0.9786    0.9355    0.8208    0.6132    0.4278    0.4892    0.7856    0.9593    0.9907    0.9961 (89)
MIT 2         18.0287   18.2703   18.6947   19.2988   19.7584   20.0096   20.0530   20.0518   19.8928   19.3021   18.5965   18.0303 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2505 (91)
MIT           18.4046   18.6267   19.0175   19.5733   20.0028   20.2409   20.2862   20.2828   20.1262   19.5744   18.9243   18.4039 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.4046   18.6267   19.0175   19.5733   20.0028   20.2409   20.2862   20.2828   20.1262   19.5744   18.9243   18.4039 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9925    0.9869    0.9720    0.9266    0.8192    0.6294    0.4541    0.5156    0.7911    0.9520    0.9869    0.9940 (94)
Useful gains  440.5963  495.1081  549.0994  594.0489  573.3398  437.6778  299.2185  310.1239  424.3495  447.1126  423.7782  418.7754 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1248.3297 1208.5507 1096.3102  910.1781  704.1979  465.4197  304.1388  318.5689  502.7712  761.1560 1013.7827 1230.9117 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              600.9537  479.4334  407.1249  227.6131   97.3585    0.0000    0.0000    0.0000    0.0000  233.6483  424.8032  604.2294 (98)
Space heating                                                                                                          3075.1644 (98)
Space heating per m2                                                                                  (98) / (4) =     38.2864 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3310.1877	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.9537	479.4334	407.1249	227.6131	97.3585	0.0000	0.0000	0.0000	0.0000	233.6483	424.8032	604.2294	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	646.8823	516.0747	438.2399	245.0087	104.7992	0.0000	0.0000	0.0000	0.0000	251.5051	457.2693	650.4084	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1967	89.1436	89.0220	88.7067	88.0659	86.7000	86.7000	86.7000	86.7000	88.6984	89.0572	89.2158	(217)
Fuel for water heating, kWh/month													
	183.0273	160.5405	166.7656	147.1524	143.1561	126.8734	118.9465	134.5283	135.5512	152.7510	164.4652	177.6239	(219)
Water heating fuel used												1811.3814	(219)
Annual totals kWh/year													
Space heating fuel - main system												3310.1877	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												346.5446	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =										-1333.8260		-1333.8260	(233)
Total delivered energy for all uses												4209.2878	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3310.1877	0.2160	715.0005	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.3814	0.2160	391.2584	(264)
Space and water heating			1106.2589	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	346.5446	0.5190	179.8567	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			632.7849	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.8800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.8800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		26.3383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.3383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.3900 (2b)	=	95.9824	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.6032	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1488 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3988 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3390 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4322	0.4237	0.4153	0.3729	0.3644	0.3220	0.3220	0.3136	0.3390	0.3644	0.3814	0.3983	(22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5727	0.5793	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.7700	1.3258	18.2557			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	89.8400	15.8900	73.9500	0.1800	13.3110			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			170.1600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.5523			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7861	(36)
Total fabric heat loss					(33) + (36) =		54.3384	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4784	39.2372	39.0006	37.8897	37.6819	36.7143	36.7143	36.5351	37.0870	37.6819	38.1024	38.5419	(38)
Heat transfer coeff	93.8168	93.5755	93.3390	92.2281	92.0203	91.0527	91.0527	90.8735	91.4254	92.0203	92.4407	92.8803	(39)
Average = Sum(39)m / 12 =												92.2271	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1680	1.1650	1.1621	1.1483	1.1457	1.1336	1.1336	1.1314	1.1383	1.1457	1.1509	1.1564	(40)
HLP (average)												1.1482	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689 (42)
Average daily hot water use (litres/day)		92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.2077	17.9483	14.5966	11.0505	8.2604	6.9738	7.5354	9.7948	13.1466	16.6926	19.4827	20.7694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.1530	385.7603	371.5637	349.0744	326.2504	304.2562	290.4019	297.0404	308.9253	331.6266	357.5957	376.8673	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.4200	11.2829	0.6300	0.7000	0.7700	8.3447	(75)
Southeast	3.5000	36.7938	0.6300	0.7000	0.7700	39.3564	(77)
Northwest	7.8500	11.2829	0.6300	0.7000	0.7700	27.0685	(81)

Solar gains	74.7695	139.1229	221.5983	326.9409	414.0020	432.0341	407.7770	339.6110	257.5714	162.1847	91.6988	62.6010	(83)
Total gains	462.9225	524.8832	593.1619	676.0154	740.2524	736.2903	698.1789	636.6515	566.4967	493.8113	449.2945	439.4683	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4539	59.6072	59.7583	60.4781	60.6147	61.2588	61.2588	61.3796	61.0091	60.6147	60.3390	60.0534	
alpha	4.9636	4.9738	4.9839	5.0319	5.0410	5.0839	5.0839	5.0920	5.0673	5.0410	5.0226	5.0036	
util living area													
	0.9983	0.9966	0.9907	0.9667	0.8886	0.7252	0.5588	0.6279	0.8766	0.9824	0.9967	0.9987	(86)
MIT	19.7127	19.8532	20.1066	20.4591	20.7683	20.9428	20.9877	20.9786	20.8427	20.4478	20.0213	19.6902	(87)
Th 2	19.9457	19.9481	19.9504	19.9616	19.9637	19.9735	19.9735	19.9753	19.9697	19.9637	19.9595	19.9551	(88)
util rest of house													
	0.9978	0.9954	0.9873	0.9536	0.8455	0.6341	0.4361	0.5021	0.8118	0.9733	0.9953	0.9983	(89)
MIT 2	18.2286	18.4354	18.8058	19.3182	19.7331	19.9350	19.9689	19.9662	19.8379	19.3106	18.6897	18.2024	(90)
Living area fraction									fLA = Living area / (4) =			0.2505	(91)
MIT	18.6003	18.7906	19.1317	19.6040	19.9924	20.1874	20.2241	20.2198	20.0896	19.5955	19.0233	18.5751	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6003	18.7906	19.1317	19.6040	19.9924	20.1874	20.2241	20.2198	20.0896	19.5955	19.0233	18.5751	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9835	0.9478	0.8469	0.6545	0.4671	0.5336	0.8207	0.9688	0.9934	0.9974	(94)
Useful gains	461.3783	521.4271	583.3967	640.7191	626.8951	481.9132	326.0890	339.7439	464.9235	478.3940	446.3458	438.3324	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.6111	1299.8166	1179.0279	987.2128	763.0698	508.7506	329.9839	347.1207	547.6050	827.7687	1102.1968	1335.1608	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.8932	523.0778	443.1496	249.4755	101.3140	0.0000	0.0000	0.0000	0.0000	259.9348	472.2127	667.2404	(98)
Space heating												3371.2979	(98)
Space heating per m2											(98) / (4) =	41.9733	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3609.5267	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	654.8932	523.0778	443.1496	249.4755	101.3140	0.0000	0.0000	0.0000	0.0000	259.9348	472.2127	667.2404	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	701.1705	560.0404	474.4642	267.1044	108.4732	0.0000	0.0000	0.0000	0.0000	278.3028	505.5811	714.3901	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7930	87.6054	87.1717	86.1040	83.9533	80.3000	80.3000	80.3000	80.3000	86.0885	87.3252	87.8744	(217)
Fuel for water heating, kWh/month													
	230.5425	202.8934	212.1477	190.4975	189.1600	174.1812	166.8789	186.0308	188.0853	199.7720	210.2324	224.8909	(219)
Water heating fuel used												2375.3126	(219)
Annual totals kWh/year													
Space heating fuel - main system												3609.5267	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.8746	(232)
Total delivered energy for all uses												6416.7138	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3609.5267	0.2160	779.6578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.3126	0.2160	513.0675	(264)
Space and water heating			1292.7253	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.8746	0.5190	185.2179	(268)
Total CO2, kg/m2/year			1516.8682	(272)
Emissions per m2 for space and water heating			16.0947	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3060	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0947 * 1.00) + 2.3060 + 0.4846, rounded to 2 d.p.			18.8900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 267 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 267	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.88	**TER**	18.89
Environmental	95 A	**% DER<TER**	58.27		
CO_2 Emissions (t/year)	0.28	**DFEE**	42.11	**TFEE**	54.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.89	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.88	$kgCO_2/m^2$	Pass
	-11.01 (-58.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.57	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	42.11	$kWh/m^2/yr$	
	-12.5 (-22.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.55 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	2.42 m², No overhang 3.50 m², No overhang 7.85 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.55 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.025	W/m²K
Air permeability	3.6	m³/m²h
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 267 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 267	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.88	**TER**	18.89
Environmental	95 A	**% DER<TER**	58.27		
CO_2 Emissions (t/year)	0.28	**DFEE**	42.11	**TFEE**	54.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.93 m	40.16 m²	2.39 m
1st Storey:	17.93 m	40.16 m²	2.63 m

7.0 Living Area	20.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.84	73.95

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	40.16	40.16

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	40.16

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.82	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
D2 (W10)	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South East							2.12	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.77	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Built)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.58	0.052	No
Independently assessed	E3 Sill	8.98	0.004	No
Independently assessed	E4 Jamb	29.25	0.005	No
Independently assessed	E5 Ground floor (normal)	17.93	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.93	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.69	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.55	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 267 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 267	**Prop Type Ref**	
Property			

SAP Rating	93 A	**DER**	7.88	**TER**	18.89
Environmental	95 A	**% DER<TER**	58.27		
CO_2 Emissions (t/year)	0.28	**DFEE**	42.11	**TFEE**	54.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.83		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	80.32	m^2	
DER	7.88	$kgCO_2/yr/m^2$	
TER	18.89	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.88	$kgCO_2/yr/m^2$	
Reduction DER/TER	58.27	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	42.11	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	80.32	m^2	
DER	18.93	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.39	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.39	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.31	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.24	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.22	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.77	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.77	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 268 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 268	**Prop Type Ref**	
Property	1BMW GF , Plot 268, Boorley Gardens, Southampton, SO32		

SAP Rating	90 B	**DER**	11.77	**TER**	20.76
Environmental	93 A	**% DER<TER**	43.31		
CO_2 Emissions (t/year)	0.43	**DFEE**	47.37	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 64 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.4 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.55 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing North West: 3.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.033 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1200 (1b)	x	2.3100 (2b)	=	148.1172	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.1172	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2025	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4275	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3634	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4633	0.4543	0.4452	0.3998	0.3907	0.3452	0.3452	0.3362	0.3634	0.3907	0.4088	0.4270	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7133	0.7043	0.6952	0.6498	0.6407	0.5952	0.5952	0.5862	0.6134	0.6407	0.6588	0.6770	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.6000	1.2357	9.3916			(27)
Opening Type 8			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1200	0.1400	8.9768			(28a)
External Wall	63.7900	11.8400	51.9500	0.2100	10.9095			(29a)
Low Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			144.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.2587			(33)
Party Wall			13.5900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		248.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.8123 (36)
Total fabric heat loss	(33) + (36) =	43.0711 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.8676	34.4235	33.9794	31.7590	31.3149	29.0946	29.0946	28.6505	29.9827	31.3149	32.2031	33.0912	(38)
Heat transfer coeff	77.9386	77.4945	77.0505	74.8301	74.3860	72.1656	72.1656	71.7216	73.0538	74.3860	75.2742	76.1623	(39)
Average = Sum(39)m / 12 =												74.7191	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2155	1.2086	1.2017	1.1670	1.1601	1.1255	1.1255	1.1186	1.1393	1.1601	1.1740	1.1878	(40)
HLP (average)												1.1653	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0954 (42)
Average daily hot water use (litres/day)	83.9660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3626	89.0040	85.6453	82.2867	78.9280	75.5694	75.5694	78.9280	82.2867	85.6453	89.0040	92.3626	(44)
Energy conte	136.9711	119.7958	123.6185	107.7736	103.4113	89.2361	82.6904	94.8884	96.0217	111.9040	122.1520	132.6492	(45)
Energy content (annual)										Total = Sum(45)m =		1321.1121	(45)

Distribution loss (46)m = 0.15 x (45)m

	20.5457	17.9694	18.5428	16.1660	15.5117	13.3854	12.4036	14.2333	14.4033	16.7856	18.3228	19.8974	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.7757 10.6247 11.7448 11.3452 11.7084 11.3134 11.6797 11.6983 11.3307 11.7297 11.3753 11.7697 (61)
Total heat required for water heating calculated for each month
148.7468 130.4204 135.3632 119.1188 115.1197 100.5495 94.3701 106.5867 107.3524 123.6337 133.5273 144.4189 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
148.7468 130.4204 135.3632 119.1188 115.1197 100.5495 94.3701 106.5867 107.3524 123.6337 133.5273 144.4189 (64)
Total per year (kWh/year) = Sum(64)m = 1459.2075 (64)
Heat gains from water heating, kWh/month
48.4868 42.4883 44.0393 38.6710 37.3114 32.4993 30.4145 34.4750 34.7599 40.1405 43.4594 47.0483 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
16.8574 14.9726 12.1765 9.2184 6.8909 5.8176 6.2861 8.1709 10.9669 13.9250 16.2526 17.3259 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
183.2055 185.1066 180.3159 170.1170 157.2428 145.1428 137.0593 135.1582 139.9489 150.1478 163.0220 175.1220 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 33.4771 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 -83.8164 (71)
Water heating gains (Table 5)
65.1704 63.2266 59.1927 53.7098 50.1497 45.1380 40.8797 46.3373 48.2776 53.9523 60.3602 63.2369 (72)
Total internal gains
322.6644 320.7369 309.1162 290.4763 271.7145 253.5295 241.6562 247.0976 256.6247 275.4563 297.0660 313.1159 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5500	11.2829	0.4100	1.0000	0.7700	4.9690	(75)
Southeast	2.4400	36.7938	0.4100	1.0000	0.7700	25.5083	(77)
Northwest	3.6100	11.2829	0.4100	1.0000	0.7700	11.5730	(81)

Solar gains	42.0504	77.1219	120.1162	173.2927	216.4308	224.6872	212.5352	178.8507	138.2945	89.1712	51.3673	35.3389	(83)
Total gains	364.7148	397.8588	429.2324	463.7690	488.1453	478.2168	454.1914	425.9483	394.9191	364.6275	348.4332	348.4548	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6748	56.9996	57.3281	59.0291	59.3815	61.2086	61.2086	61.5876	60.4644	59.3815	58.6809	57.9966	
alpha	4.7783	4.8000	4.8219	4.9353	4.9588	5.0806	5.0806	5.1058	5.0310	4.9588	4.9121	4.8664	
util living area	0.9984	0.9972	0.9939	0.9817	0.9403	0.8207	0.6606	0.7146	0.9177	0.9872	0.9970	0.9987	(86)
MIT	19.6346	19.7590	19.9915	20.3385	20.6575	20.8972	20.9741	20.9621	20.7908	20.3914	19.9743	19.6364	(87)
Th 2	19.9076	19.9131	19.9187	19.9465	19.9520	19.9801	19.9801	19.9857	19.9688	19.9520	19.9409	19.9298	(88)
util rest of house	0.9978	0.9962	0.9915	0.9738	0.9117	0.7381	0.5262	0.5847	0.8665	0.9802	0.9957	0.9983	(89)
MIT 2	18.0889	18.2746	18.6177	19.1394	19.5883	19.9036	19.9694	19.9681	19.7816	19.2232	18.6090	18.1070	(90)
Living area fraction									fLA = Living area / (4) =			0.5694	(91)
MIT	18.9690	19.1199	19.4000	19.8222	20.1971	20.4694	20.5415	20.5341	20.3562	19.8884	19.3864	18.9778	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9690	19.1199	19.4000	19.8222	20.1971	20.4694	20.5415	20.5341	20.3562	19.8884	19.3864	18.9778	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9952	0.9900	0.9727	0.9195	0.7810	0.6032	0.6587	0.8887	0.9797	0.9948	0.9977	(94)
Useful gains	363.6563	395.9415	424.9465	451.0877	448.8535	373.4996	273.9706	280.5870	350.9702	357.2261	346.6316	347.6537	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1143.2824	1101.9617	993.9478	817.3088	632.0661	423.5672	284.4405	296.5028	457.0415	690.9235	924.8474	1125.5122	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	580.0418	474.4456	423.3370	263.6792	136.3102	0.0000	0.0000	0.0000	0.0000	248.2708	416.3154	578.7267	(98)
Space heating												3121.1267	(98)
Space heating per m2											(98) / (4) =	48.6763	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3359.6628	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	580.0418	474.4456	423.3370	263.6792	136.3102	0.0000	0.0000	0.0000	0.0000	248.2708	416.3154	578.7267	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	624.3723	510.7057	455.6911	283.8312	146.7279	0.0000	0.0000	0.0000	0.0000	267.2452	448.1328	622.9567	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.7468	130.4204	135.3632	119.1188	115.1197	100.5495	94.3701	106.5867	107.3524	123.6337	133.5273	144.4189	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2278	89.1902	89.1032	88.8792	88.4060	86.7000	86.7000	86.7000	86.7000	88.8103	89.1014	89.2422	(217)
Fuel for water heating, kWh/month													
	166.7044	146.2273	151.9174	134.0233	130.2170	115.9740	108.8467	122.9374	123.8205	139.2110	149.8600	161.8280	(219)
Water heating fuel used												1651.5670	(219)
Annual totals kWh/year													
Space heating fuel - main system												3359.6628	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												297.7062	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												4379.4497	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3359.6628	0.2160	725.6872	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1651.5670	0.2160	356.7385	(264)
Space and water heating			1082.4256	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	297.7062	0.5190	154.5095	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			754.5318	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.7700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.7700	ZC1
Total Floor Area	TFA	64.1200	
Assumed number of occupants	N	2.0954	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9313	ZC2
CO2 emissions from cooking, equation (L16)		2.6402	ZC3
Total CO2 emissions		31.3415	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.3415	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1200 (1b)	x	2.3100 (2b)	=	148.1172	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.1172	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3850	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3845	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			7.6000	1.3258	10.0758			(27)
Ground floor			64.1200	0.1300	8.3356			(28a)
External Wall	63.7900	11.8400	51.9500	0.1800	9.3510			(29a)
Low Roof	16.3800		16.3800	0.1300	2.1294			(30)
Total net area of external elements Aum(A, m2)			144.2900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.9798			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1708	(36)
Total fabric heat loss						(33) + (36) =	45.1506	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.6947	28.5294	28.3675	27.6067	27.4644	26.8018	26.8018	26.6791	27.0570	27.4644	27.7523	28.0533	(38)
Heat transfer coeff	73.8452	73.6800	73.5180	72.7573	72.6149	71.9523	71.9523	71.8296	72.2076	72.6149	72.9029	73.2039	(39)
Average = Sum(39)m / 12 =												72.7566	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1517	1.1491	1.1466	1.1347	1.1325	1.1222	1.1222	1.1202	1.1261	1.1325	1.1370	1.1417	(40)
HLP (average)												1.1347	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0954 (42)
Average daily hot water use (litres/day)		83.9660 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3626	89.0040	85.6453	82.2867	78.9280	75.5694	75.5694	78.9280	82.2867	85.6453	89.0040	92.3626	(44)
Energy conte	136.9711	119.7958	123.6185	107.7736	103.4113	89.2361	82.6904	94.8884	96.0217	111.9040	122.1520	132.6492	(45)
Energy content (annual)										Total = Sum(45)m =		1321.1121	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5457	17.9694	18.5428	16.1660	15.5117	13.3854	12.4036	14.2333	14.4033	16.7856	18.3228	19.8974	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	47.0670	40.9662	43.6439	40.5797	40.2209	37.2671	38.5093	40.2209	40.5797	43.6439	43.8924	47.0670	(61)
Total heat required for water heating calculated for each month													
	184.0380	160.7620	167.2624	148.3533	143.6322	126.5032	121.1997	135.1093	136.6014	155.5479	166.0444	179.7161	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	184.0380	160.7620	167.2624	148.3533	143.6322	126.5032	121.1997	135.1093	136.6014	155.5479	166.0444	179.7161	(64)
									Total per year (kWh/year) = Sum(64)m =			1824.7700	(64)
Heat gains from water heating, kWh/month													
	57.3096	50.0736	52.0141	45.9797	44.4395	38.9878	37.1219	41.6056	42.0721	48.1191	51.5886	55.8726	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	104.7705	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.1785	16.1460	13.1308	9.9409	7.4309	6.2735	6.7787	8.8112	11.8264	15.0164	17.5263	18.6837	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	183.2055	185.1066	180.3159	170.1170	157.2428	145.1428	137.0593	135.1582	139.9489	150.1478	163.0220	175.1220	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	33.4771	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	-83.8164	(71)
Water heating gains (Table 5)													
	77.0291	74.5143	69.9115	63.8606	59.7305	54.1497	49.8950	55.9215	58.4335	64.6762	71.6509	75.0976	(72)
Total internal gains													
	335.8442	333.1981	320.7893	301.3497	281.8354	262.9972	251.1642	257.3222	267.6401	287.2715	309.6304	326.3344	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5500	11.2829	0.6300	0.7000	0.7700	5.3447	(75)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
Northwest	3.6100	11.2829	0.6300	0.7000	0.7700	12.4481	(81)

Solar gains	45.2298	82.9531	129.1982	186.3953	232.7950	241.6758	228.6049	192.3735	148.7509	95.9135	55.2511	38.0108	(83)
Total gains	381.0740	416.1512	449.9875	487.7449	514.6304	504.6730	479.7691	449.6957	416.3910	383.1850	364.8815	364.3453	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2988	60.4340	60.5672	61.2005	61.3204	61.8851	61.8851	61.9908	61.6664	61.3204	61.0782	60.8271	
alpha	5.0199	5.0289	5.0378	5.0800	5.0880	5.1257	5.1257	5.1327	5.1111	5.0880	5.0719	5.0551	
util living area													
	0.9981	0.9966	0.9925	0.9772	0.9262	0.7962	0.6310	0.6876	0.9014	0.9841	0.9964	0.9985	(86)
MIT	19.7512	19.8698	20.0922	20.4070	20.7081	20.9136	20.9796	20.9687	20.8192	20.4444	20.0460	19.7296	(87)
Th 2	19.9589	19.9609	19.9630	19.9726	19.9744	19.9828	19.9828	19.9843	19.9795	19.9744	19.9708	19.9669	(88)
util rest of house													
	0.9974	0.9955	0.9896	0.9676	0.8931	0.7102	0.4995	0.5581	0.8444	0.9758	0.9949	0.9980	(89)
MIT 2	18.2942	18.4688	18.7943	19.2548	19.6705	19.9205	19.9747	19.9703	19.8223	19.3141	18.7337	18.2684	(90)
Living area fraction									fLA = Living area / (4) =			0.5694	(91)
MIT	19.1238	19.2666	19.5333	19.9109	20.2613	20.4860	20.5469	20.5388	20.3900	19.9577	19.4809	19.1004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1238	19.2666	19.5333	19.9109	20.2613	20.4860	20.5469	20.5388	20.3900	19.9577	19.4809	19.1004	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9944	0.9881	0.9669	0.9037	0.7557	0.5748	0.6320	0.8704	0.9756	0.9939	0.9974	(94)
Useful gains	379.8282	413.8342	444.6334	471.6168	465.0640	381.3937	275.7715	284.2146	362.4386	373.8389	362.6735	363.3943	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1094.6663	1058.5278	958.1823	801.1198	621.6770	423.5080	283.9863	297.2904	454.1832	679.5097	902.6041	1090.7668	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	531.8395	433.2341	382.0804	237.2422	116.5200	0.0000	0.0000	0.0000	0.0000	227.4191	388.7500	541.1652	(98)
Space heating												2858.2505	(98)
Space heating per m2											(98) / (4) =	44.5766	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3060.2253	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	531.8395	433.2341	382.0804	237.2422	116.5200	0.0000	0.0000	0.0000	0.0000	227.4191	388.7500	541.1652	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	569.4213	463.8480	409.0796	254.0066	124.7538	0.0000	0.0000	0.0000	0.0000	243.4894	416.2205	579.4060	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	184.0380	160.7620	167.2624	148.3533	143.6322	126.5032	121.1997	135.1093	136.6014	155.5479	166.0444	179.7161	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5685	87.4240	87.0657	86.2273	84.5300	80.3000	80.3000	80.3000	80.3000	86.0062	87.1204	87.6515	(217)
Fuel for water heating, kWh/month													
	210.1647	183.8877	192.1106	172.0491	169.9187	157.5383	150.9336	168.2556	170.1139	180.8566	190.5918	205.0347	(219)
Water heating fuel used												2151.4554	(219)
Annual totals kWh/year													
Space heating fuel - main system												3060.2253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												321.0382	(232)
Total delivered energy for all uses												5607.7190	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3060.2253	0.2160	661.0087	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2151.4554	0.2160	464.7144	(264)
Space and water heating			1125.7230	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	321.0382	0.5190	166.6188	(268)
Total CO2, kg/m2/year			1331.2669	(272)
Emissions per m2 for space and water heating			17.5565	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5985	(272b)
Emissions per m2 for pumps and fans			0.6071	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.5565 * 1.00) + 2.5985 + 0.6071, rounded to 2 d.p.			20.7600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 268 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 268	**Prop Type Ref**	
Property	1BMW GF , Plot 268, Boorley Gardens, Southampton, SO32		

SAP Rating	90 B	**DER**	11.77	**TER**	20.76
Environmental	93 A	**% DER<TER**	43.31		
CO_2 Emissions (t/year)	0.43	**DFEE**	47.37	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.76	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.77	$kgCO_2/m^2$	Pass
	-8.99 (-43.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.69	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.37	$kWh/m^2/yr$	
	-9.3 (-16.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	1.55 m², No overhang 2.44 m², No overhang 3.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.033	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

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General Requirements Compliance	Pass	**% DFEE<TFEE**	16.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	27.62 m	64.12 m²	2.31 m

7.0 Living Area	36.51	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	248.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	63.79	51.95

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	13.59

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Low Roof	External Plane Roof	0.16	16.38	16.38

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	64.12

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.44	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W3	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	South East							2.12	100
D2	Half Glazed Door	[1] External Wall	North West							2.12	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.39	0.052	No
Independently assessed	E3 Sill	6.36	0.004	No
Independently assessed	E4 Jamb	22.20	0.005	No
Independently assessed	E5 Ground floor (normal)	27.62	0.061	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	27.62	0.043	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.40	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	3.90	0.051	No
Independently assessed	E16 Corner (normal)	6.93	0.037	No
Independently assessed	E18 Party wall between dwellings	2.31	0.030	No
Independently assessed	P1 Party wall - Ground floor	5.88	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.88	0.000	No

Y-value 0.033 W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	7	
Total number of L.E.L. fittings	7	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	

Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 268 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 268	**Prop Type Ref**	
Property	1BMW GF , Plot 268, Boorley Gardens, Southampton, SO32		

SAP Rating	90 B	**DER**	11.77	**TER**	20.76
Environmental	93 A	**% DER<TER**	43.31		
CO_2 Emissions (t/year)	0.43	**DFEE**	47.37	**TFEE**	56.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	64.12	m^2	
DER	11.77	$kgCO_2/yr/m^2$	
TER	20.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.77	$kgCO_2/yr/m^2$	
Reduction DER/TER	43.31	%	
CfSH ENE1 credits achieved	4.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	47.37	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	3.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	64.12	m^2	
DER	22.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.93	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.64	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	42.08	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	42.08	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	14.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.93	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.64	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	33.95	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	33.95	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 269 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 269	**Prop Type Ref**	
Property	1BMW FF, Plot 269, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	11.93	**TER**	20.31
Environmental	92 A	**% DER<TER**	41.27		
CO_2 Emissions (t/year)	0.47	**DFEE**	41.79	**TFEE**	53.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.94		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 58 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.93 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 3.61 m², No overhang
Windows facing North West: 4.52 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0900	(1b)	x 2.8300	(2b) =	11.5747	(1b) - (3b)
First floor	53.7600	(1c)	x 2.3400	(2c) =	125.7984	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.8500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	137.3731	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1456	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3706	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3150	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4016	0.3938	0.3859	0.3465	0.3386	0.2993	0.2993	0.2914	0.3150	0.3386	0.3544	0.3701	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6516	0.6438	0.6359	0.5965	0.5886	0.5493	0.5493	0.5414	0.5650	0.5886	0.6044	0.6201	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.1300	1.2357	10.0466			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			4.0900	0.1500	0.6135			(28a)
External Wall	83.7600	10.2500	73.5100	0.2100	15.4371			(29a)
Main Roof	53.7600		53.7600	0.0700	3.7632			(30)
Total net area of external elements Aum(A, m2)			141.6100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0404			(33)
Party Wall			14.6400	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8453	(36)
Total fabric heat loss					(33) + (36) =		36.8857	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.5402	29.1832	28.8262	27.0412	26.6842	24.8992	24.8992	24.5422	25.6132	26.6842	27.3982	28.1122	(38)
Heat transfer coeff	66.4259	66.0689	65.7119	63.9269	63.5699	61.7849	61.7849	61.4279	62.4989	63.5699	64.2839	64.9979	(39)
Average = Sum(39)m / 12 =												63.8377	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1482	1.1421	1.1359	1.1050	1.0989	1.0680	1.0680	1.0618	1.0804	1.0989	1.1112	1.1236	(40)
HLP (average)												1.1035	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9202	(42)
Average daily hot water use (litres/day)	79.8057	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7862	84.5940	81.4018	78.2096	75.0173	71.8251	71.8251	75.0173	78.2096	81.4018	84.5940	87.7862	(44)
Energy conte	130.1845	113.8602	117.4935	102.4337	98.2875	84.8147	78.5933	90.1869	91.2640	106.3594	116.0997	126.0767	(45)
Energy content (annual)										Total = Sum(45)m =		1255.6541	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5277	17.0790	17.6240	15.3651	14.7431	12.7222	11.7890	13.5280	13.6896	15.9539	17.4149	18.9115	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.7574    10.6092    11.7294    11.3324    11.6965    11.3036    11.6706    11.6874    11.3193    11.7158    11.3595    11.7520 (61)
Total heat required for water heating calculated for each month
               141.9418   124.4694   129.2229   113.7660   109.9841    96.1183    90.2639   101.8744   102.5833   118.0753   127.4592   137.8287 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
               141.9418   124.4694   129.2229   113.7660   109.9841    96.1183    90.2639   101.8744   102.5833   118.0753   127.4592   137.8287 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1393.5871 (64)
Heat gains from water heating, kWh/month
                46.2257    40.5108    41.9989    36.8923    35.6047    31.0268    29.0499    32.9090    33.1751    38.2935    41.4430    44.8585 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120    96.0120 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                15.0315    13.3508    10.8576     8.2199     6.1445     5.1874     5.6052     7.2859     9.7791    12.4168    14.4922    15.4492 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               167.4939   169.2320   164.8521   155.5279   143.7577   132.6955   125.3052   123.5671   127.9470   137.2712   149.0413   160.1036 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012    32.6012 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
               -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096   -76.8096 (71)
Water heating gains (Table 5)
                62.1313    60.2839    56.4502    51.2393    47.8558    43.0927    39.0456    44.2325    46.0765    51.4697    57.5597    60.2937 (72)
Total internal gains
               299.4602   297.6703   286.9635   269.7907   252.5617   235.7792   224.7596   229.8891   238.6062   255.9613   275.8969   290.6501 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux                 g                FF            Access            Gains
                                           m2           Table 6a       Specific data       Specific data        factor                W
                                                           W/m2       or Table 6b         or Table 6c          Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Southeast                                3.6100           36.7938            0.4100            1.0000            0.7700           37.7398 (77)
Northwest                                4.5200           11.2829            0.4100            1.0000            0.7700           14.4903 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    52.2301    93.7803   141.0987   196.2568   239.3831   246.2554   233.8362   200.3467   159.9928   107.0942    63.4361    44.1309 (83)
Total gains   351.6903   391.4505   428.0622   466.0475   491.9448   482.0347   458.5957   430.2358   398.5990   363.0555   339.3330   334.7810 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau            37.9807    38.1859    38.3934    39.4654    39.6870    40.8336    40.8336    41.0709    40.3671    39.6870    39.2462    38.8151
alpha           3.5320     3.5457     3.5596     3.6310     3.6458     3.7222     3.7222     3.7381     3.6911     3.6458     3.6164     3.5877
util living area
                0.9881     0.9816     0.9672     0.9302     0.8504     0.7042     0.5551     0.6026     0.8167     0.9460     0.9811     0.9900 (86)

MIT            19.2473    19.4342    19.7564    20.2089    20.5972    20.8685    20.9594    20.9451    20.7524    20.2596    19.6977    19.2389 (87)
Th 2           19.9616    19.9666    19.9716    19.9967    20.0018    20.0270    20.0270    20.0321    20.0169    20.0018    19.9917    19.9816 (88)
util rest of house
                0.9855     0.9775     0.9596     0.9129     0.8114     0.6287     0.4473     0.4961     0.7564     0.9292     0.9762     0.9878 (89)
MIT 2          17.6238    17.8983    18.3677    19.0292    19.5629    19.9161    20.0044    19.9988    19.7826    19.1133    18.2991    17.6243 (90)
Living area fraction                                                                                    fLA = Living area / (4) =     0.2778 (91)
MIT            18.0748    18.3250    18.7534    19.3569    19.8502    20.1807    20.2697    20.2617    20.0520    19.4317    18.6876    18.0728 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT   18.0748    18.3250    18.7534    19.3569    19.8502    20.1807    20.2697    20.2617    20.0520    19.4317    18.6876    18.0728 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9787     0.9685     0.9476     0.8993     0.8046     0.6417     0.4756     0.5230     0.7589     0.9169     0.9674     0.9818 (94)
Useful gains  344.2001   379.1211   405.6520   419.1315   395.8205   309.2997   218.0903   224.9926   302.4795   332.8984   328.2830   328.6988 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
               915.0042   886.9721   805.1966   668.4777   518.1083   344.8015   226.7298   237.2157   371.9948   561.4307   744.8983   901.7055 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
               424.6783   341.2758   297.2612   179.5293    90.9821     0.0000     0.0000     0.0000     0.0000   170.0281   299.9630   426.3170 (98)
Space heating                                                                                                                2230.0347 (98)
Space heating per m2                                                                                                 (98) / (4) =    38.5486 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2400.4679	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	424.6783	341.2758	297.2612	179.5293	90.9821	0.0000	0.0000	0.0000	0.0000	170.0281	299.9630	426.3170	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	457.1348	367.3583	319.9797	193.2500	97.9355	0.0000	0.0000	0.0000	0.0000	183.0227	322.8881	458.8988	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.9418	124.4694	129.2229	113.7660	109.9841	96.1183	90.2639	101.8744	102.5833	118.0753	127.4592	137.8287	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0764	89.0219	88.9057	88.6311	88.1200	86.7000	86.7000	86.7000	86.7000	88.5604	88.9213	89.0966	(217)
Fuel for water heating, kWh/month													
	159.3484	139.8188	145.3482	128.3590	124.8117	110.8630	104.1106	117.5021	118.3199	133.3274	143.3393	154.6958	(219)
Water heating fuel used												1579.8442	(219)
Annual totals kWh/year													
Space heating fuel - main system												2400.4679	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												265.4604	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												3653.8596	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2400.4679	0.2160	518.5011	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1579.8442	0.2160	341.2464	(264)
Space and water heating			859.7474	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	265.4604	0.5190	137.7739	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total CO2, kg/year			690.3185	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.9300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.9300	ZC1
Total Floor Area	TFA	57.8500	
Assumed number of occupants	N	1.9202	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1570	ZC2
CO2 emissions from cooking, equation (L16)		2.8537	ZC3
Total CO2 emissions		31.9407	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9407	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0900 (1b)	x	2.8300 (2b)	=	11.5747	(1b) - (3b)
First floor	53.7600 (1c)	x	2.3400 (2c)	=	125.7984	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.8500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.3731	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1456	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3956	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3363	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4287	0.4203	0.4119	0.3699	0.3615	0.3194	0.3194	0.3110	0.3363	0.3615	0.3783	0.3951	(22b)
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5715	0.5780	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			8.1300	1.3258	10.7784			(27)
Ground floor			4.0900	0.1300	0.5317			(28a)
External Wall	83.7600	10.2500	73.5100	0.1800	13.2318			(29a)
Main Roof	53.7600		53.7600	0.1300	6.9888			(30)
Total net area of external elements Aum(A, m2)			141.6100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.0747			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.0764	(36)
Total fabric heat loss (33) + (36) =	41.1511	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8327	26.6709	26.5123	25.7675	25.6282	24.9795	24.9795	24.8593	25.2293	25.6282	25.9101	26.2048	(38)
Heat transfer coeff	67.9838	67.8220	67.6634	66.9186	66.7793	66.1306	66.1306	66.0105	66.3805	66.7793	67.0612	67.3559	(39)
Average = Sum(39)m / 12 =												66.9180	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1752	1.1724	1.1696	1.1568	1.1544	1.1431	1.1431	1.1411	1.1475	1.1544	1.1592	1.1643	(40)
HLP (average)												1.1567	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9202 (42)
Average daily hot water use (litres/day)	79.8057 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7862	84.5940	81.4018	78.2096	75.0173	71.8251	71.8251	75.0173	78.2096	81.4018	84.5940	87.7862	(44)
Energy conte	130.1845	113.8602	117.4935	102.4337	98.2875	84.8147	78.5933	90.1869	91.2640	106.3594	116.0997	126.0767	(45)
Energy content (annual)										Total = Sum(45)m =		1255.6541	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5277	17.0790	17.6240	15.3651	14.7431	12.7222	11.7890	13.5280	13.6896	15.9539	17.4149	18.9115	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.7349	38.9364	41.4815	38.5691	38.2280	35.4206	36.6013	38.2280	38.5691	41.4815	41.7176	44.7349	(61)
Total heat required for water heating calculated for each month													
	174.9194	152.7966	158.9750	141.0028	136.5156	120.2353	115.1946	128.4149	129.8331	147.8409	157.8172	170.8116	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.9194	152.7966	158.9750	141.0028	136.5156	120.2353	115.1946	128.4149	129.8331	147.8409	157.8172	170.8116	(64)
								Total per year (kWh/year) = Sum(64)m =				1734.3570	(64)
Heat gains from water heating, kWh/month													
	54.4701	47.5926	49.4370	43.7015	42.2376	37.0560	35.2826	39.5442	39.9876	45.7349	49.0325	53.1042	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	96.0120	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.0062	14.2166	11.5617	8.7529	6.5429	5.5238	5.9687	7.7583	10.4132	13.2219	15.4320	16.4511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.4939	169.2320	164.8521	155.5279	143.7577	132.6955	125.3052	123.5671	127.9470	137.2712	149.0413	160.1036	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	32.6012	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	-76.8096	(71)
Water heating gains (Table 5)													
	73.2124	70.8223	66.4475	60.6965	56.7710	51.4667	47.4228	53.1507	55.5383	61.4716	68.1007	71.3767	(72)
Total internal gains													
	311.5161	309.0744	297.6649	279.7809	261.8752	244.4896	233.5003	239.2798	248.7021	266.7684	287.3776	302.7349	(73)

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6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast		3.6100	36.7938	0.6300	0.7000	0.7700	40.5933	(77)
Northwest		4.5200	11.2829	0.6300	0.7000	0.7700	15.5859	(81)

Solar gains	56.1792	100.8710	151.7671	211.0957	257.4828	264.8747	251.5164	215.4949	172.0898	115.1916	68.2325	47.4676	(83)
Total gains	367.6953	409.9454	449.4320	490.8767	519.3581	509.3643	485.0167	454.7747	420.7919	381.9599	355.6101	350.2026	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0929	59.2339	59.3727	60.0335	60.1588	60.7489	60.7489	60.8595	60.5202	60.1588	59.9059	59.6438	
alpha	4.9395	4.9489	4.9582	5.0022	5.0106	5.0499	5.0499	5.0573	5.0347	5.0106	4.9937	4.9763	
util living area													
	0.9974	0.9951	0.9886	0.9661	0.8985	0.7491	0.5809	0.6362	0.8675	0.9769	0.9950	0.9980	(86)
MIT	19.7579	19.8941	20.1316	20.4560	20.7495	20.9323	20.9850	20.9767	20.8490	20.4787	20.0627	19.7336	(87)
Th 2	19.9399	19.9422	19.9444	19.9547	19.9567	19.9658	19.9658	19.9674	19.9623	19.9567	19.9528	19.9487	(88)
util rest of house													
	0.9965	0.9934	0.9844	0.9527	0.8575	0.6583	0.4540	0.5087	0.8000	0.9652	0.9929	0.9973	(89)
MIT 2	18.2906	18.4906	18.8373	19.3086	19.7048	19.9192	19.9601	19.9576	19.8374	19.3481	18.7449	18.2613	(90)
Living area fraction									fLA = Living area / (4) =			0.2778	(91)
MIT	18.6982	18.8805	19.1968	19.6273	19.9950	20.2006	20.2448	20.2407	20.1184	19.6621	19.1110	18.6703	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6982	18.8805	19.1968	19.6273	19.9950	20.2006	20.2448	20.2407	20.1184	19.6621	19.1110	18.6703	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9910	0.9804	0.9474	0.8593	0.6807	0.4895	0.5442	0.8119	0.9608	0.9905	0.9961	(94)
Useful gains	365.8680	406.2510	440.6187	465.0528	446.2809	346.7138	237.4310	247.5079	341.6437	366.9741	352.2365	348.8227	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	978.8431	948.1850	859.1122	717.8575	553.9364	370.3740	241.0324	253.5242	399.5051	605.1624	805.4694	974.6577	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	456.0534	364.1796	311.3592	182.0194	80.0957	0.0000	0.0000	0.0000	0.0000	177.2121	326.3277	465.6212	(98)
Space heating												2362.8684	(98)
Space heating per m2											(98) / (4) =	40.8447	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2529.8377	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	456.0534	364.1796	311.3592	182.0194	80.0957	0.0000	0.0000	0.0000	0.0000	177.2121	326.3277	465.6212	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	488.2799	389.9140	333.3610	194.8815	85.7556	0.0000	0.0000	0.0000	0.0000	189.7346	349.3873	498.5238	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.9194	152.7966	158.9750	141.0028	136.5156	120.2353	115.1946	128.4149	129.8331	147.8409	157.8172	170.8116	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3541	87.1598	86.7135	85.6950	83.7603	80.3000	80.3000	80.3000	80.3000	85.5084	86.8396	87.4480	(217)
Fuel for water heating, kWh/month													
	200.2418	175.3062	183.3336	164.5402	162.9835	149.7326	143.4552	159.9190	161.6851	172.8964	181.7343	195.3294	(219)
Water heating fuel used												2051.1573	(219)
Annual totals kWh/year													
Space heating fuel - main system												2529.8377	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												282.6746	(232)
Total delivered energy for all uses												4938.6695	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2529.8377	0.2160	546.4449	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2051.1573	0.2160	443.0500	(264)
Space and water heating			989.4949	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	282.6746	0.5190	146.7081	(268)
Total CO2, kg/m2/year			1175.1280	(272)
Emissions per m2 for space and water heating			17.1045	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5360	(272b)
Emissions per m2 for pumps and fans			0.6729	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1045 * 1.00) + 2.5360 + 0.6729, rounded to 2 d.p.			20.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 269 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 269	**Prop Type Ref**	
Property	1BMW FF, Plot 269, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	11.93	**TER**	20.31
Environmental	92 A	**% DER<TER**	41.27		
CO_2 Emissions (t/year)	0.47	**DFEE**	41.79	**TFEE**	53.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.94		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.93	$kgCO_2/m^2$	Pass
	-8.38 (-41.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.54	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.79	$kWh/m^2/yr$	
	-11.7 (-21.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	3.61 m², No overhang 4.52 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 269 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 269	**Prop Type Ref**	
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CO_2 Emissions (t/year)	0.47	**DFEE**	41.79	**TFEE**	53.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.94		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	5.18 m	4.09 m²	2.83 m
1st Storey:	29.60 m	53.76 m²	2.34 m

7.0 Living Area	16.07	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	157.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	83.76	73.51

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	14.64

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	53.76	53.76

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.15	4.09

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.78	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
D1	Half Glazed Door	[1] External Wall	South East							2.12	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.90	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.50	0.052	No
Independently assessed	E3 Sill	7.49	0.004	No
Independently assessed	E4 Jamb	17.25	0.005	No
Independently assessed	E5 Ground floor (normal)	5.18	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	29.60	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.80	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	12.80	0.051	No
Independently assessed	E16 Corner (normal)	17.82	0.037	No
Independently assessed	E18 Party wall between dwellings	2.83	0.030	No
Independently assessed	P1 Party wall - Ground floor	5.18	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.18	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	5.18	0.037	No

Y-value	0.027	W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	6	
Total number of L.E.L. fittings	6	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	

Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 269 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 269	**Prop Type Ref**	
Property	1BMW FF, Plot 269, Boorley Gardens, Southampton, SO32		

SAP Rating	89 B	**DER**	11.93	**TER**	20.31
Environmental	92 A	**% DER<TER**	41.27		
CO_2 Emissions (t/year)	0.47	**DFEE**	41.79	**TFEE**	53.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.94		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	57.85	m^2	
DER	11.93	$kgCO_2/yr/m^2$	
TER	20.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	11.93	$kgCO_2/yr/m^2$	
Reduction DER/TER	41.27	%	
CfSH ENE1 credits achieved	4.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.79	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	57.85	m^2	
DER	21.15	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.16	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.85	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	41.16	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	41.16	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.17	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.16	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.85	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	35.18	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	35.18	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	15	%	

ENE7 credits achieved	1

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 270 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 270	**Prop Type Ref**	
Property	1BM GF , Plot 270, Boorley Gardens, Southampton, SO32		

SAP Rating	88 B	**DER**	12.47	**TER**	20.98
Environmental	93 A	**% DER<TER**	40.57		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.57	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.98 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.50 m², No overhang
Windows facing South East: 4.07 m², No overhang
Windows facing South West: 1.50 m², No overhang
Windows facing North West: 4.52 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.034 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000	(1b)	x 2.3100	(2b) =	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3938	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3347	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4268	0.4184	0.4100	0.3682	0.3598	0.3180	0.3180	0.3096	0.3347	0.3598	0.3765	0.3933	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6768	0.6684	0.6600	0.6182	0.6098	0.5680	0.5680	0.5596	0.5847	0.6098	0.6265	0.6433	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1400	7.1820			(28a)
External Wall	59.5700	13.7100	45.8600	0.2100	9.6306			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.3148			(33)
Party Wall			12.7000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	254.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.7388	(36)
Total fabric heat loss (33) + (36) =	38.0537	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.4650	26.1378	25.8105	24.1744	23.8472	22.2111	22.2111	21.8838	22.8655	23.8472	24.5016	25.1561	(38)
Heat transfer coeff	64.5187	64.1914	63.8642	62.2281	61.9008	60.2647	60.2647	59.9375	60.9192	61.9008	62.5553	63.2098	(39)
Average = Sum(39)m / 12 =												62.1463	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2577	1.2513	1.2449	1.2130	1.2066	1.1748	1.1748	1.1684	1.1875	1.2066	1.2194	1.2322	(40)
HLP (average)												1.2114	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284 (42)
Average daily hot water use (litres/day)	75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)
Total heat required for water heating calculated for each month													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.4270	11.9257	9.6986	7.3425	5.4886	4.6337	5.0069	6.5081	8.7352	11.0913	12.9452	13.8001	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	274.7665	273.0864	263.3064	247.6529	232.0253	216.7324	206.6443	211.4733	219.3772	235.2026	253.3821	266.7618	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5000	11.2829	0.4100	1.0000	0.7700	4.8087	(75)
Southeast	4.0700	36.7938	0.4100	1.0000	0.7700	42.5487	(77)
Southwest	1.5000	36.7938	0.4100	1.0000	0.7700	15.6813	(79)
Northwest	4.5200	11.2829	0.4100	1.0000	0.7700	14.4903	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	77.5291	138.4711	206.4893	284.3903	344.5908	353.5574	336.0985	289.4345	233.1906	157.6310	94.0294	65.5934	(83)
Total gains	352.2956	411.5575	469.7957	532.0432	576.6161	570.2897	542.7428	500.9077	452.5679	392.8337	347.4115	332.3551	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1001	56.3860	56.6749	58.1651	58.4725	60.0600	60.0600	60.3879	59.4148	58.4725	57.8608	57.2617	
alpha	4.7400	4.7591	4.7783	4.8777	4.8982	5.0040	5.0040	5.0259	4.9610	4.8982	4.8574	4.8174	
util living area													
	0.9966	0.9924	0.9804	0.9380	0.8298	0.6421	0.4815	0.5378	0.8001	0.9633	0.9930	0.9974	(86)
MIT	19.7118	19.8902	20.1726	20.5462	20.8260	20.9649	20.9931	20.9886	20.8954	20.5251	20.0634	19.6987	(87)
Th 2	19.8741	19.8792	19.8842	19.9096	19.9147	19.9403	19.9403	19.9454	19.9300	19.9147	19.9045	19.8944	(88)
util rest of house													
	0.9955	0.9898	0.9734	0.9159	0.7744	0.5498	0.3693	0.4209	0.7184	0.9457	0.9901	0.9966	(89)
MIT 2	18.1750	18.4381	18.8494	19.3917	19.7522	19.9184	19.9379	19.9410	19.8510	19.3771	18.7093	18.1701	(90)
Living area fraction										fLA = Living area / (4) =		0.4571	(91)
MIT	18.8775	19.1019	19.4543	19.9194	20.2431	20.3968	20.4203	20.4199	20.3284	19.9019	19.3283	18.8688	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8775	19.1019	19.4543	19.9194	20.2431	20.3968	20.4203	20.4199	20.3284	19.9019	19.3283	18.8688	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9874	0.9699	0.9161	0.7926	0.5910	0.4208	0.4746	0.7515	0.9454	0.9881	0.9954	(94)
Useful gains	350.1908	406.3770	455.6691	487.4135	457.0443	337.0425	228.4023	237.7428	340.1018	371.4040	343.2701	330.8297	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	940.5210	911.6401	827.3145	685.7162	528.8239	349.3423	230.2275	240.9412	379.4280	575.7959	764.9450	927.2142	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	439.2057	339.5368	276.5042	142.7780	53.4040	0.0000	0.0000	0.0000	0.0000	152.0675	303.6059	443.7101	(98)
Space heating												2150.8122	(98)
Space heating per m2											(98) / (4) =	41.9262	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2315.1907	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	439.2057	339.5368	276.5042	142.7780	53.4040	0.0000	0.0000	0.0000	0.0000	152.0675	303.6059	443.7101	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	472.7725	365.4863	297.6363	153.6900	57.4855	0.0000	0.0000	0.0000	0.0000	163.6895	326.8094	477.6212	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1288	89.0526	88.8927	88.4941	87.7574	86.7000	86.7000	86.7000	86.7000	88.5144	88.9653	89.1517	(217)
Fuel for water heating, kWh/month													
	150.8953	132.4539	137.8064	121.9350	118.9200	105.2670	98.9250	111.5511	112.2971	126.5209	135.8005	146.5067	(219)
Water heating fuel used												1498.8790	(219)
Annual totals kWh/year													
Space heating fuel - main system												2315.1907	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												237.1242	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												3459.2809	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2315.1907	0.2160	500.0812	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1498.8790	0.2160	323.7579	(264)
Space and water heating			823.8391	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	237.1242	0.5190	123.0675	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total CO2, kg/year			639.7037	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.4700	ZC1
Total Floor Area	TFA	51.3000	
Assumed number of occupants	N	1.7284	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3973	ZC2
CO2 emissions from cooking, equation (L16)		3.1283	ZC3
Total CO2 emissions		32.9956	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.9956	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.7100	1.3258	14.1989			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.8300	46.7400	0.1800	8.4132			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.8251			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9450	(36)
Total fabric heat loss					(33) + (36) =		40.7701	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	64.3505	64.1941	64.0408	63.3208	63.1861	62.5590	62.5590	62.4428	62.8005	63.1861	63.4586	63.7435	(39)
Average = Sum(39)m / 12 =												63.3201	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2544	1.2513	1.2484	1.2343	1.2317	1.2195	1.2195	1.2172	1.2242	1.2317	1.2370	1.2426	(40)
HLP (average)												1.2343	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	42.1812	36.7137	39.1135	36.3674	36.0458	33.3986	34.5119	36.0458	36.3674	39.1135	39.3361	42.1812	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (64)
								Total per year (kWh/year) = Sum(64)m =				1635.3511 (64)
Heat gains from water heating, kWh/month												
	51.3606	44.8758	46.6148	41.2068	39.8265	34.9407	33.2685	37.2868	37.7049	43.1241	46.2335	50.0728 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.4695	11.9635	9.7294	7.3658	5.5060	4.6484	5.0227	6.5288	8.7629	11.1265	12.9863	13.8439	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	69.0331	66.7794	62.6544	57.2316	53.5302	48.5287	44.7157	50.1166	52.3679	57.9625	64.2132	67.3021	(72)
Total internal gains													
	285.0385	282.8417	272.5441	256.3735	240.2287	224.4225	214.3385	219.6826	228.1063	244.4488	263.1429	277.0366	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.6300	0.7000	0.7700	4.7930	(75)
Southeast	3.7500	36.7938	0.6300	0.7000	0.7700	42.1675	(77)
Southwest	1.3900	36.7938	0.6300	0.7000	0.7700	15.6301	(79)
Northwest	4.1800	11.2829	0.6300	0.7000	0.7700	14.4135	(81)

Solar gains	77.0042	137.5462	205.1422	282.5843	342.4431	351.3703	334.0129	287.6121	231.6859	156.5868	93.3950	65.1478	(83)
Total gains	362.0427	420.3879	477.6863	538.9578	582.6718	575.7928	548.3513	507.2947	459.7922	401.0356	356.5380	342.1843	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3609	55.4958	55.6286	56.2611	56.3811	56.9463	56.9463	57.0522	56.7272	56.3811	56.1390	55.8880	
alpha	4.6907	4.6997	4.7086	4.7507	4.7587	4.7964	4.7964	4.8035	4.7818	4.7587	4.7426	4.7259	
util living area													
	0.9960	0.9913	0.9783	0.9357	0.8298	0.6531	0.4926	0.5496	0.8016	0.9605	0.9918	0.9969	(86)
MIT	19.7171	19.8913	20.1704	20.5279	20.8122	20.9561	20.9907	20.9848	20.8831	20.5095	20.0477	19.6861	(87)
Th 2	19.8767	19.8791	19.8815	19.8926	19.8947	19.9045	19.9045	19.9063	19.9007	19.8947	19.8905	19.8861	(88)
util rest of house													
	0.9946	0.9884	0.9707	0.9131	0.7743	0.5582	0.3748	0.4272	0.7192	0.9419	0.9886	0.9958	(89)
MIT 2	18.1867	18.4415	18.8456	19.3541	19.7186	19.8768	19.9013	19.9004	19.8118	19.3411	18.6784	18.1481	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.8863	19.1042	19.4512	19.8906	20.2185	20.3702	20.3993	20.3961	20.3015	19.8752	19.3043	18.8511	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8863	19.1042	19.4512	19.8906	20.2185	20.3702	20.3993	20.3961	20.3015	19.8752	19.3043	18.8511	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9857	0.9670	0.9130	0.7920	0.6002	0.4290	0.4835	0.7521	0.9415	0.9862	0.9945	(94)
Useful gains	359.4821	414.3600	461.9351	492.0881	461.5048	345.6071	235.2177	245.2601	345.8102	377.5795	351.6231	340.2930	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	938.6334	911.8255	829.4034	695.9347	538.2522	360.9756	237.6794	249.5264	389.4578	586.0616	774.4688	933.9150	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	430.8886	334.2969	273.3964	146.7695	57.1001	0.0000	0.0000	0.0000	0.0000	155.1107	304.4489	441.6548	(98)
Space heating												2143.6658	(98)
Space heating per m2											(98) / (4) =	41.7869	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2295.1454	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	430.8886	334.2969	273.3964	146.7695	57.1001	0.0000	0.0000	0.0000	0.0000	155.1107	304.4489	441.6548	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	461.3368	357.9196	292.7156	157.1408	61.1350	0.0000	0.0000	0.0000	0.0000	166.0714	325.9624	472.8638	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3584	87.1005	86.5452	85.3005	83.1548	80.3000	80.3000	80.3000	80.3000	85.3205	86.8150	87.4604	(217)
Fuel for water heating, kWh/month													
	188.8017	165.4114	173.2042	155.8650	154.7987	141.1851	135.2661	150.7900	152.4553	163.3856	171.4083	184.1529	(219)
Water heating fuel used												1936.7244	(219)
Annual totals kWh/year													
Space heating fuel - main system												2295.1454	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												237.8755	(232)
Total delivered energy for all uses												4544.7454	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2295.1454	0.2160	495.7514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1936.7244	0.2160	418.3325	(264)
Space and water heating			914.0839	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	237.8755	0.5190	123.4574	(268)
Total CO2, kg/m2/year			1076.4663	(272)
Emissions per m2 for space and water heating			17.8184	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4066	(272b)
Emissions per m2 for pumps and fans			0.7588	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.8184 * 1.00) + 2.4066 + 0.7588, rounded to 2 d.p.			20.9800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 270 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 270	**Prop Type Ref**	
Property	1BM GF , Plot 270, Boorley Gardens, Southampton, SO32		

SAP Rating	88 B	**DER**	12.47	**TER**	20.98
Environmental	93 A	**% DER<TER**	40.57		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.57	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.98	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.47	$kgCO_2/m^2$	Pass
	-8.51 (-40.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.26	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.57	$kWh/m^2/yr$	
	-10.7 (-19.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	1.50 m², No overhang
Windows facing South East	4.07 m², No overhang
Windows facing South West	1.50 m², No overhang
Windows facing North West	4.52 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.034	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 270 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 270	**Prop Type Ref**	
Property	1BM GF , Plot 270, Boorley Gardens, Southampton, SO32		

SAP Rating	88 B	**DER**	12.47	**TER**	20.98
Environmental	93 A	**% DER<TER**	40.57		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.57	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	25.79 m	51.30 m²	2.31 m

7.0 Living Area	23.45	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	254.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	59.57	45.86

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	12.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	51.30

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South East							2.12	100
D2 w6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.80	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.62	0.052	No
Independently assessed	E3 Sill	6.80	0.004	No
Independently assessed	E4 Jamb	19.80	0.005	No
Independently assessed	E5 Ground floor (normal)	25.79	0.061	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	25.79	0.043	No
Independently assessed	E16 Corner (normal)	6.93	0.037	No
Independently assessed	E18 Party wall between dwellings	2.31	0.030	No
Independently assessed	P1 Party wall - Ground floor	5.50	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.50	0.000	No

Y-value	0.034	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal

Total number of light fittings	6	
Total number of L.E.L. fittings	6	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff	Standard

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	

Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.81	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 270 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 270	**Prop Type Ref**	
Property	1BM GF , Plot 270, Boorley Gardens, Southampton, SO32		

SAP Rating	88 B	**DER**	12.47	**TER**	20.98
Environmental	93 A	**% DER<TER**	40.57		
CO_2 Emissions (t/year)	0.41	**DFEE**	44.57	**TFEE**	55.26
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.35		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	51.3	m^2	
DER	12.47	$kgCO_2/yr/m^2$	
TER	20.98	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	12.47	$kgCO_2/yr/m^2$	
Reduction DER/TER	40.57	%	
CfSH ENE1 credits achieved	4.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	44.57	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	51.3	m^2	
DER	22.46	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.40	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	3.13	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	42.99	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	42.99	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	15.71	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.40	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	3.13	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	36.24	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	36.24	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	16	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 271 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 271	**Prop Type Ref**	
Property	1BM FF, Plot 271, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.01	**TER**	20.01
Environmental	94 A	**% DER<TER**	54.96		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.12	**TFEE**	52.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 60 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.01 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.41 m², No overhang
Windows facing South East: 4.23 m², No overhang
Windows facing South West: 1.31 m², No overhang
Windows facing North West: 1.44 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800	(1b)	x 2.8300	(2b) =	10.1314	(1b) - (3b)
First floor	56.6800	(1c)	x 2.3400	(2c) =	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3651	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3103	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3957	0.3879	0.3802	0.3414	0.3336	0.2948	0.2948	0.2871	0.3103	0.3336	0.3491	0.3646	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6457	0.6379	0.6302	0.5914	0.5836	0.5448	0.5448	0.5371	0.5603	0.5836	0.5991	0.6146	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.3900	1.2357	10.3679			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.1600	0.5728			(28a)
External Wall	86.6200	10.5100	76.1100	0.2100	15.9831			(29a)
Main Roof	56.6800		56.6800	0.0700	3.9676			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.0714			(33)
Party Wall			13.5600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	149.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0061	(36)
Total fabric heat loss (33) + (36) =	38.0775	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4185	30.0530	29.6875	27.8600	27.4945	25.6670	25.6670	25.3015	26.3980	27.4945	28.2255	28.9565	(38)
Heat transfer coeff	68.4960	68.1305	67.7650	65.9375	65.5720	63.7445	63.7445	63.3790	64.4755	65.5720	66.3030	67.0340	(39)
Average = Sum(39)m / 12 =												65.8461	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1367	1.1306	1.1245	1.0942	1.0882	1.0578	1.0578	1.0518	1.0700	1.0882	1.1003	1.1124	(40)
HLP (average)												1.0927	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890 (42)
Average daily hot water use (litres/day)	81.4382 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588 (61)

Total heat required for water heating calculated for each month

	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145 (64)

Total per year (kWh/year) = Sum(64)m = 1419.3355 (64)

Heat gains from water heating, kWh/month

	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	15.5949	13.8513	11.2646	8.5280	6.3748	5.3819	5.8153	7.5590	10.1456	12.8822	15.0354	16.0283	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)

Water heating gains (Table 5)

	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)

Total internal gains

	308.3555	306.5281	295.4896	277.7711	259.9658	242.6465	231.2901	236.5255	245.5335	263.4380	284.0054	299.2539	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.4100	11.2829	0.4100	1.0000	0.7700	4.5202	(75)
Southeast	4.2300	36.7938	0.4100	1.0000	0.7700	44.2214	(77)
Southwest	1.3100	36.7938	0.4100	1.0000	0.7700	13.6950	(79)
Northwest	1.4400	11.2829	0.4100	1.0000	0.7700	4.6164	(81)

Solar gains	67.0530	117.2509	168.4888	222.2773	261.3017	264.8368	253.0734	223.1301	186.9856	131.7607	80.8667	57.0258	(83)
Total gains	375.4086	423.7790	463.9784	500.0484	521.2675	507.4833	484.3636	459.6556	432.5192	395.1987	364.8721	356.2797	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.4122	36.6076	36.8050	37.8251	38.0360	39.1264	39.1264	39.3521	38.6828	38.0360	37.6166	37.2064	
alpha	3.4275	3.4405	3.4537	3.5217	3.5357	3.6084	3.6084	3.6235	3.5789	3.5357	3.5078	3.4804	
util living area													
	0.9851	0.9764	0.9590	0.9181	0.8362	0.6908	0.5421	0.5835	0.7925	0.9333	0.9762	0.9875	(86)
MIT	19.2212	19.4276	19.7605	20.2125	20.5951	20.8653	20.9580	20.9451	20.7610	20.2710	19.6878	19.2088	(87)
Th 2	19.9710	19.9759	19.9808	20.0056	20.0105	20.0354	20.0354	20.0404	20.0254	20.0105	20.0006	19.9907	(88)
util rest of house													
	0.9821	0.9715	0.9501	0.8993	0.7965	0.6167	0.4376	0.4805	0.7308	0.9142	0.9705	0.9849	(89)
MIT 2	17.5990	17.9011	18.3847	19.0435	19.5681	19.9202	20.0113	20.0064	19.7993	19.1383	18.2969	17.5934	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.2750	18.5372	18.9580	19.5306	19.9960	20.3140	20.4058	20.3976	20.2001	19.6103	18.8765	18.2665	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2750	18.5372	18.9580	19.5306	19.9960	20.3140	20.4058	20.3976	20.2001	19.6103	18.8765	18.2665	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9623	0.9388	0.8886	0.7958	0.6396	0.4793	0.5207	0.7431	0.9047	0.9618	0.9787	(94)
Useful gains	366.0350	407.8131	435.5598	444.3188	414.8492	324.5670	232.1772	239.3351	321.3844	357.5513	350.9426	348.6917	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	957.2312	929.1093	844.2144	700.9561	543.9855	364.2375	242.5975	253.3638	393.3054	590.8222	780.8153	942.9365	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	439.8499	350.3110	304.0390	184.7788	96.0774	0.0000	0.0000	0.0000	0.0000	173.5535	309.5084	442.1181	(98)
Space heating												2300.2362	(98)
Space heating per m2											(98) / (4) =	38.1719	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2476.0347	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	439.8499	350.3110	304.0390	184.7788	96.0774	0.0000	0.0000	0.0000	0.0000	173.5535	309.5084	442.1181	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	473.4660	377.0840	327.2756	198.9008	103.4203	0.0000	0.0000	0.0000	0.0000	186.8175	333.1629	475.9076	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0864	89.0267	88.9085	88.6392	88.1488	86.7000	86.7000	86.7000	86.7000	88.5621	88.9300	89.1073	(217)
Fuel for water heating, kWh/month													
	162.3277	142.4342	148.0536	130.7169	127.0570	112.8685	105.9690	119.6348	120.4782	135.7875	146.0027	157.5793	(219)
Water heating fuel used												1608.9095	(219)
Annual totals kWh/year													
Space heating fuel - main system												2476.0347	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												275.4108	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1029 * 1.00) =										-1004.4862		-1004.4862	(233)
Total delivered energy for all uses												3430.8688	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2476.0347	0.2160	534.8235	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1608.9095	0.2160	347.5245	(264)
Space and water heating			882.3479	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	275.4108	0.5190	142.9382	(268)
Energy saving/generation technologies				
PV Unit	-1004.4862	0.5190	-521.3284	(269)
Total CO2, kg/year			542.8828	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.0100	ZC1
Total Floor Area	TFA	60.2600	
Assumed number of occupants	N	1.9890	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0715	ZC2
CO2 emissions from cooking, equation (L16)		2.7669	ZC3
Total CO2 emissions		28.8485	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.8485	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			8.3900	1.3258	11.1231			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	10.5100	76.1100	0.1800	13.6998			(29a)
Main Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2007			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1655	(36)
Total fabric heat loss					(33) + (36) =		42.3662	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	70.1321	69.9687	69.8084	69.0557	68.9149	68.2594	68.2594	68.1380	68.5119	68.9149	69.1998	69.4976	(39)
Average = Sum(39)m / 12 =												69.0551	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1638	1.1611	1.1585	1.1460	1.1436	1.1327	1.1327	1.1307	1.1369	1.1436	1.1484	1.1533	(40)
HLP (average)												1.1460	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	45.6500	39.7329	42.3300	39.3581	39.0100	36.1452	37.3500	39.0100	39.3581	42.3300	42.5710	45.6500	(61)
Total heat required for water heating calculated for each month													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
								Total per year (kWh/year) = Sum(64)m =				1769.8350	(64)
Heat gains from water heating, kWh/month													
	55.5843	48.5662	50.4482	44.5954	43.1016	37.8141	36.0043	40.3531	40.8056	46.6704	50.0355	54.1905	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.6237	14.7650	12.0077	9.0906	6.7953	5.7369	6.1989	8.0576	10.8149	13.7320	16.0273	17.0857	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	74.7101	72.2711	67.8068	61.9381	57.9323	52.5195	48.3929	54.2380	56.6744	62.7291	69.4938	72.8367	(72)
Total internal gains													
	320.7706	318.2743	306.5131	288.0631	269.5627	251.6258	240.3014	246.2037	255.9370	274.5730	295.8324	311.6995	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.4100	11.2829	0.6300	0.7000	0.7700	4.8620	(75)
Southeast	4.2300	36.7938	0.6300	0.7000	0.7700	47.5650	(77)
Southwest	1.3100	36.7938	0.6300	0.7000	0.7700	14.7305	(79)
Northwest	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654	(81)

Solar gains	72.1229	126.1162	181.2282	239.0836	281.0587	284.8611	272.2083	240.0009	201.1236	141.7231	86.9811	61.3375	(83)
Total gains	392.8935	444.3906	487.7414	527.1467	550.6213	536.4869	512.5097	486.2047	457.0606	416.2961	382.8135	373.0370	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6691	59.8085	59.9458	60.5992	60.7230	61.3062	61.3062	61.4154	61.0803	60.7230	60.4730	60.2139	
alpha	4.9779	4.9872	4.9964	5.0399	5.0482	5.0871	5.0871	5.0944	5.0720	5.0482	5.0315	5.0143	
util living area													
	0.9971	0.9941	0.9863	0.9614	0.8911	0.7398	0.5694	0.6184	0.8491	0.9720	0.9941	0.9978	(86)
MIT	19.7883	19.9350	20.1735	20.4872	20.7655	20.9375	20.9867	20.9800	20.8677	20.5130	20.0938	19.7612	(87)
Th 2	19.9490	19.9512	19.9534	19.9635	19.9654	19.9742	19.9742	19.9758	19.9708	19.9654	19.9615	19.9575	(88)
util rest of house													
	0.9961	0.9921	0.9814	0.9465	0.8485	0.6491	0.4451	0.4936	0.7777	0.9583	0.9918	0.9970	(89)
MIT 2	18.3412	18.5566	18.9039	19.3581	19.7313	19.9316	19.9692	19.9674	19.8638	19.4020	18.7962	18.3077	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9442	19.1310	19.4329	19.8286	20.1623	20.3507	20.3932	20.3894	20.2821	19.8650	19.3369	18.9134	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9442	19.1310	19.4329	19.8286	20.1623	20.3507	20.3932	20.3894	20.2821	19.8650	19.3369	18.9134	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9900	0.9783	0.9442	0.8577	0.6846	0.4973	0.5460	0.8020	0.9566	0.9898	0.9959	(94)
Useful gains	390.8568	439.9532	477.1349	497.7269	472.2537	367.2723	254.8826	265.4463	366.5399	398.2147	378.9184	371.5242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1027.0295	995.7209	902.8263	754.6806	583.1760	392.5406	258.9184	271.8281	423.5501	638.4956	846.7910	1022.5446	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	473.3125	373.4759	316.7144	185.0067	82.5262	0.0000	0.0000	0.0000	0.0000	178.7690	336.8683	484.3591	(98)
Space heating												2431.0321	(98)
Space heating per m2											(98) / (4) =	40.3424	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2602.8181	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	473.3125	373.4759	316.7144	185.0067	82.5262	0.0000	0.0000	0.0000	0.0000	178.7690	336.8683	484.3591	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000		(210)
Space heating fuel (main heating system)													
	506.7586	399.8671	339.0947	198.0799	88.3578	0.0000	0.0000	0.0000	0.0000	191.4015	360.6727	518.5858	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3899	87.1707	86.7060	85.6850	83.7823	80.3000	80.3000	80.3000	80.3000	85.4793	86.8661	87.4879	(217)
Fuel for water heating, kWh/month													
	204.2541	178.8699	187.1000	167.9256	166.2739	152.7955	146.3898	163.1903	164.9925	176.4931	185.3951	199.2340	(219)
Water heating fuel used												2092.9139	(219)
Annual totals kWh/year													
Space heating fuel - main system												2602.8181	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												293.5792	(232)
Total delivered energy for all uses												5064.3112	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2602.8181	0.2160	562.2087	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2092.9139	0.2160	452.0694	(264)
Space and water heating			1014.2781	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	293.5792	0.5190	152.3676	(268)
Total CO2, kg/m2/year			1205.5707	(272)
Emissions per m2 for space and water heating			16.8317	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5285	(272b)
Emissions per m2 for pumps and fans			0.6460	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8317 * 1.00) + 2.5285 + 0.6460, rounded to 2 d.p.			20.0100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 271 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 271	**Prop Type Ref**	
Property	1BM FF, Plot 271, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.01	**TER**	20.01
Environmental	94 A	**% DER<TER**	54.96		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.12	**TFEE**	52.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.01	$kgCO_2/m^2$	Pass
	-11.00 (-55.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.54	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.12	$kWh/m^2/yr$	
	-11.4 (-21.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing South West Windows facing North West	1.41 m², No overhang 4.23 m², No overhang 1.31 m², No overhang 1.44 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 271 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 271	**Prop Type Ref**	
Property	1BM FF, Plot 271, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.01	**TER**	20.01
Environmental	94 A	**% DER<TER**	54.96		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.12	**TFEE**	52.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	4.80 m	3.58 m²	2.83 m
1st Storey:	31.29 m	56.68 m²	2.34 m

7.0 Living Area	25.11	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	149.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	86.62	76.11

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	13.56

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	56.68	56.68

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.16	3.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W2	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W4	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.62	0.052	No
Independently assessed	E3 Sill	7.61	0.004	No
Independently assessed	E4 Jamb	19.50	0.005	No
Independently assessed	E5 Ground floor (normal)	4.80	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	31.29	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	19.89	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.40	0.051	No
Independently assessed	E16 Corner (normal)	17.82	0.037	No
Independently assessed	E18 Party wall between dwellings	2.83	0.030	No
Independently assessed	P1 Party wall - Ground floor	4.80	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.80	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	4.80	0.037	No

Y-value	0.027	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	6	
Total number of L.E.L. fittings	6	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 271 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 271	**Prop Type Ref**	
Property	1BM FF, Plot 271, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.01	**TER**	20.01
Environmental	94 A	**% DER<TER**	54.96		
CO_2 Emissions (t/year)	0.29	**DFEE**	41.12	**TFEE**	52.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	60.26	m^2	
DER	9.01	$kgCO_2/yr/m^2$	
TER	20.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.01	$kgCO_2/yr/m^2$	
Reduction DER/TER	54.96	%	
CfSH ENE1 credits achieved	5.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.12	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	60.26	m^2	
DER	20.73	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.07	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.77	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	40.57	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	40.57	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	17.07	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.77	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.92	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.92	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 272 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 272	**Prop Type Ref**	
Property	3S Semi, Plot 272, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.44 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.88 m², No overhang
Windows facing South East: 7.47 m², No overhang
Windows facing North West: 4.56 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3762	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3467	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6262	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5967	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9100	1.2357	24.6036			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1400	6.8530			(28a)
External Wall	101.4200	22.0300	79.3900	0.2100	16.6719			(29a)
Main Roof	48.9500		48.9500	0.0700	3.4265			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7350			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8244	(36)
Total fabric heat loss (33) + (36) =	59.5594	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7752	50.1771	49.5790	46.5886	45.9905	43.0000	43.0000	42.4019	44.1962	45.9905	47.1867	48.3828	(38)
Heat transfer coeff	110.3346	109.7365	109.1384	106.1480	105.5499	102.5595	102.5595	101.9614	103.7556	105.5499	106.7461	107.9423	(39)
Average = Sum(39)m / 12 =												105.9985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1270	1.1209	1.1148	1.0842	1.0781	1.0476	1.0476	1.0415	1.0598	1.0781	1.0904	1.1026	(40)
HLP (average)												1.0827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8276   10.6761   11.8041   11.3963   11.7554   11.3522   11.7157   11.7414   11.3762   11.7834   11.4278   11.8200 (61)
Total heat required for water heating calculated for each month
              172.9666  151.6093  157.2345  138.1860  133.4132  116.3336  108.9964  123.3725  124.3405  143.4324  155.1329  167.8745 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9666  151.6093  157.2345  138.1860  133.4132  116.3336  108.9964  123.3725  124.3405  143.4324  155.1329  167.8745 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1692.8922 (64)
Heat gains from water heating, kWh/month
               56.5356   49.5293   51.3066   45.0067   43.3901   37.7444   35.2748   40.0527   40.4047   46.7191   50.6389   54.8431 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.5451   20.0244   16.2849   12.3287    9.2159    7.7804    8.4070   10.9278   14.6672   18.6234   21.7363   23.1717 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.8874  255.5116  248.8988  234.8208  217.0499  200.3477  189.1897  186.5655  193.1783  207.2563  225.0272  241.7294 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 (71)
Water heating gains (Table 5)
               75.9887   73.7043   68.9605   62.5093   58.3200   52.4227   47.4123   53.8342   56.1176   62.7945   70.3318   73.7139 (72)
Total internal gains
              418.2095  416.0285  400.9324  376.4470  351.3739  327.3391  311.7972  318.1157  330.7514  355.4625  383.8835  405.4032 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                              7.8800            11.2829            0.4100           1.0000            0.7700           25.2619 (75)
Southeast                              7.4700            36.7938            0.4100           1.0000            0.7700           78.0931 (77)
Northwest                              4.5600            11.2829            0.4100           1.0000            0.7700           14.6185 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.9735  214.1992  328.2623  465.7092  575.4639  594.9808  563.7712  478.2692  375.2896  246.2227  143.7174   99.3998 (83)
Total gains   536.1830  630.2278  729.1947  842.1562  926.8379  922.3200  875.5684  796.3849  706.0410  601.6852  527.6010  504.8030 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3368   46.5894   46.8447   48.1644   48.4373   49.8497   49.8497   50.1421   49.2750   48.4373   47.8945   47.3638
alpha          4.0891    4.1060    4.1230    4.2110    4.2292    4.3233    4.3233    4.3428    4.2850    4.2292    4.1930    4.1576
util living area
               0.9954    0.9906    0.9775    0.9345    0.8312    0.6553    0.5007    0.5631    0.8164    0.9629    0.9915    0.9965 (86)

MIT           19.4300   19.6277   19.9538   20.3975   20.7438   20.9365   20.9843   20.9748   20.8300   20.3712   19.8380   19.4194 (87)
Th 2          19.9788   19.9838   19.9888   20.0137   20.0187   20.0439   20.0439   20.0489   20.0338   20.0187   20.0087   19.9987 (88)
util rest of house
               0.9942    0.9882    0.9714    0.9163    0.7863    0.5760    0.3986    0.4579    0.7515    0.9491    0.9889    0.9955 (89)
MIT 2         17.8762   18.1674   18.6431   19.2899   19.7535   19.9955   20.0364   20.0356   19.8820   19.2671   18.4918   17.8738 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1923 (91)
MIT           18.1751   18.4483   18.8952   19.5029   19.9440   20.1765   20.2187   20.2163   20.0644   19.4794   18.7508   18.1711 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.1751   18.4483   18.8952   19.5029   19.9440   20.1765   20.2187   20.2163   20.0644   19.4794   18.7508   18.1711 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9911    0.9828    0.9623    0.9048    0.7824    0.5877    0.4178    0.4772    0.7539    0.9391    0.9840    0.9929 (94)
Useful gains  531.3856  619.3882  701.7364  761.9412  725.1715  542.0504  365.8463  380.0446  532.2539  565.0153  519.1641  501.2421 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1530.9021 1486.7402 1352.7926 1125.4804  870.1515  571.9227  371.1307  389.1143  618.8363  937.2242 1243.6732 1508.0675 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              743.6403  582.8605  484.3858  261.7482  107.8651    0.0000    0.0000    0.0000    0.0000  276.9234  521.6465  749.0781 (98)
Space heating                                                                                                            3728.1480 (98)
Space heating per m2                                                                                    (98) / (4) =     38.0812 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4013.0765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	743.6403	582.8605	484.3858	261.7482	107.8651	0.0000	0.0000	0.0000	0.0000	276.9234	521.6465	749.0781	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	800.4739	627.4064	521.4056	281.7526	116.1089	0.0000	0.0000	0.0000	0.0000	298.0877	561.5140	806.3273	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2782	89.2203	89.0942	88.7680	88.1020	86.7000	86.7000	86.7000	86.7000	88.7819	89.1458	89.2966	(217)
Fuel for water heating, kWh/month													
	193.7389	169.9270	176.4812	155.6711	151.4304	134.1795	125.7167	142.2981	143.4146	161.5559	174.0215	187.9965	(219)
Water heating fuel used												1916.4314	(219)
Annual totals kWh/year													
Space heating fuel - main system												4013.0765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.1535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 677 * 1.00) =										-1537.0190		-1537.0190	(233)
Total delivered energy for all uses												4865.6424	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4013.0765	0.2160	866.8245	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.4314	0.2160	413.9492	(264)
Space and water heating			1280.7737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.1535	0.5190	206.6417	(268)
Energy saving/generation technologies				
PV Unit	-1537.0190	0.5190	-797.7129	(269)
Total CO2, kg/year			728.6275	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.4400	ZC1
Total Floor Area	TFA	97.9000	
Assumed number of occupants	N	2.7192	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3070	ZC2
CO2 emissions from cooking, equation (L16)		1.8821	ZC3
Total CO2 emissions		24.6292	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.6292	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			19.9100	1.3258	26.3958			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	101.4200	22.0300	79.3900	0.1800	14.2902			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9570			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2048	(36)
Total fabric heat loss					(33) + (36) =		67.1618	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	114.3001	114.0441	113.7932	112.6145	112.3940	111.3674	111.3674	111.1773	111.7628	112.3940	112.8401	113.3065	(39)
Average = Sum(39)m / 12 =												112.6134	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1675	1.1649	1.1623	1.1503	1.1480	1.1376	1.1376	1.1356	1.1416	1.1480	1.1526	1.1574	(40)
HLP (average)												1.1503	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7192	(42)
Average daily hot water use (litres/day)												98.7814	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7398	47.3176	43.8427	45.3041	47.3176	47.7398	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.6558	(64)
Heat gains from water heating, kWh/month													
	66.3184	58.3671	61.0953	54.0925	52.2806	45.8670	43.6719	48.9467	49.4956	56.5130	60.1107	64.6278	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6664	20.1321	16.3725	12.3951	9.2655	7.8223	8.4523	10.9866	14.7461	18.7236	21.8532	23.2964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	89.1377	86.8558	82.1174	75.1285	70.2696	63.7042	58.6987	65.7886	68.7439	75.9583	83.4871	86.8654	(72)
Total internal gains													
	431.4798	429.2878	414.1769	389.1326	363.3732	338.6624	323.1289	330.1289	343.4566	368.7265	397.1558	418.6794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.7000	0.7700	27.1719	(75)
Southeast	7.4700	36.7938	0.6300	0.7000	0.7700	83.9977	(77)
Northwest	4.5600	11.2829	0.6300	0.7000	0.7700	15.7239	(81)

Solar gains	126.8935	230.3948	353.0821	500.9213	618.9746	639.9672	606.3978	514.4310	403.6651	264.8395	154.5839	106.9154	(83)
Total gains	558.3733	659.6826	767.2590	890.0540	982.3478	978.6296	929.5267	844.5599	747.1217	633.5661	551.7397	525.5948	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4803	59.6139	59.7453	60.3707	60.4891	61.0467	61.0467	61.1511	60.8307	60.4891	60.2500	60.0020	
alpha	4.9654	4.9743	4.9830	5.0247	5.0326	5.0698	5.0698	5.0767	5.0554	5.0326	5.0167	5.0001	
util living area													
	0.9984	0.9961	0.9881	0.9558	0.8590	0.6819	0.5173	0.5859	0.8478	0.9785	0.9966	0.9988	(86)
MIT	19.7078	19.8720	20.1463	20.5089	20.8067	20.9563	20.9911	20.9840	20.8676	20.4732	20.0233	19.6793	(87)
Th 2	19.9461	19.9482	19.9502	19.9600	19.9618	19.9703	19.9703	19.9718	19.9670	19.9618	19.9581	19.9543	(88)
util rest of house													
	0.9979	0.9947	0.9838	0.9392	0.8099	0.5905	0.4014	0.4647	0.7760	0.9675	0.9951	0.9984	(89)
MIT 2	18.2217	18.4629	18.8627	19.3846	19.7749	19.9419	19.9671	19.9654	19.8602	19.3444	18.6916	18.1859	(90)
Living area fraction									fLA = Living area / (4) =			0.1923	(91)
MIT	18.5076	18.7339	19.1096	19.6008	19.9733	20.1370	20.1641	20.1613	20.0539	19.5615	18.9477	18.4731	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5076	18.7339	19.1096	19.6008	19.9733	20.1370	20.1641	20.1613	20.0539	19.5615	18.9477	18.4731	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9924	0.9789	0.9320	0.8105	0.6062	0.4237	0.4880	0.7831	0.9617	0.9930	0.9976	(94)
Useful gains	556.5429	654.6375	751.1051	829.5460	796.2148	593.2872	393.8590	412.1327	585.0348	609.2861	547.8983	524.3071	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1623.9266	1577.6777	1434.8891	1205.0681	929.8742	616.6393	396.9192	418.1697	665.4292	1007.2219	1336.8959	1617.2371	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	794.1335	620.2830	508.7353	270.3759	99.4426	0.0000	0.0000	0.0000	0.0000	296.0642	568.0783	813.1399	(98)
Space heating												3970.2526	(98)
Space heating per m2											(98) / (4) =	40.5542	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4250.8058	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	794.1335	620.2830	508.7353	270.3759	99.4426	0.0000	0.0000	0.0000	0.0000	296.0642	568.0783	813.1399	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	850.2499	664.1146	544.6845	289.4816	106.4696	0.0000	0.0000	0.0000	0.0000	316.9853	608.2209	870.5995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0652	87.8411	87.3403	86.1493	83.7673	80.3000	80.3000	80.3000	80.3000	86.2609	87.6055	88.1501	(217)
Fuel for water heating, kWh/month													
	240.8418	212.8394	224.8552	202.5896	201.7201	185.3351	177.5652	197.9436	200.1296	211.6924	220.3288	234.8419	(219)
Water heating fuel used												2510.6827	(219)
Annual totals kWh/year													
Space heating fuel - main system												4250.8058	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.2962	(232)
Total delivered energy for all uses												7236.7847	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4250.8058	0.2160	918.1741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2510.6827	0.2160	542.3075	(264)
Space and water heating			1460.4815	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.2962	0.5190	207.7537	(268)
Total CO2, kg/m2/year			1707.1602	(272)
Emissions per m2 for space and water heating			14.9181	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9181 * 1.00) + 2.1221 + 0.3976, rounded to 2 d.p.			17.4400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 272 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 272	**Prop Type Ref**	
Property	3S Semi, Plot 272, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.44	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.44	$kgCO_2/m^2$	Pass
	-10.00 (-57.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.63	$kWh/m^2/yr$	
	-11.4 (-21.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	7.88 m², No overhang 7.47 m², No overhang 4.56 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	2.84	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 272 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 272	**Prop Type Ref**	
Property	3S Semi, Plot 272, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.95 m²	2.39 m
1st Storey:	20.24 m	48.95 m²	2.63 m

7.0 Living Area	18.83	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.39

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.95	48.95

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	48.95

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 (W13)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.01	0.052	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	36.60	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 272 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 272	**Prop Type Ref**	
Property	3S Semi, Plot 272, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.9	m^2	
DER	7.44	$kgCO_2/yr/m^2$	
TER	17.44	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.44	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.33	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.63	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.9	m^2	
DER	17.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.68	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.87	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.87	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 273 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 273	**Prop Type Ref**	
Property	3A Semi RITR, Plot 273, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.16 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.66 m², No overhang
Windows facing South West: 1.55 m², No overhang
Windows facing North West: 4.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.6600	36.7938	0.4100	1.0000	0.7700	80.0794	(77)
Southwest	1.5500	36.7938	0.4100	1.0000	0.7700	16.2041	(79)
Northwest	4.0300	11.2829	0.4100	1.0000	0.7700	12.9195	(81)

Solar gains	109.2029	190.3043	271.7812	355.8558	416.0269	420.6891	402.3970	356.3339	300.7124	213.4002	131.5814	92.9493	(83)
Total gains	517.2260	596.1576	662.9013	723.1143	758.9028	740.1648	706.7268	666.9197	623.6010	560.3731	506.2440	488.5282	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9960	0.9920	0.9823	0.9532	0.8792	0.7239	0.5593	0.6073	0.8385	0.9668	0.9924	0.9969	(86)
MIT	19.5684	19.7461	20.0256	20.4057	20.7201	20.9252	20.9822	20.9745	20.8412	20.4331	19.9496	19.5614	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9950	0.9899	0.9773	0.9390	0.8416	0.6464	0.4522	0.5006	0.7773	0.9541	0.9900	0.9961	(89)
MIT 2	18.0983	18.3605	18.7697	19.3311	19.7617	20.0264	20.0764	20.0767	19.9318	19.3802	18.6760	18.1020	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4913	18.7309	19.1054	19.6183	20.0179	20.2667	20.3186	20.3167	20.1749	19.6617	19.0165	18.4921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4913	18.7309	19.1054	19.6183	20.0179	20.2667	20.3186	20.3167	20.1749	19.6617	19.0165	18.4921	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9859	0.9709	0.9309	0.8397	0.6629	0.4805	0.5284	0.7849	0.9471	0.9863	0.9941	(94)
Useful gains	513.3538	587.7238	643.6129	673.1718	637.2729	490.6861	339.5912	352.4045	489.4404	530.7418	499.2925	485.6565	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1427.6452	1383.3705	1253.4858	1034.7683	798.2075	527.3622	346.0621	362.2276	572.3940	869.5777	1157.3470	1404.6433	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	680.2328	534.6746	453.7454	260.3494	119.7353	0.0000	0.0000	0.0000	0.0000	252.0939	473.7993	683.7261	(98)
Space heating												3458.3569	(98)
Space heating per m2											(98) / (4) =	37.0830	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3722.6662	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	680.2328	534.6746	453.7454	260.3494	119.7353	0.0000	0.0000	0.0000	0.0000	252.0939	473.7993	683.7261	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	732.2204	575.5378	488.4235	280.2470	128.8863	0.0000	0.0000	0.0000	0.0000	271.3605	510.0100	735.9808	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2384	89.1794	89.0613	88.7724	88.1937	86.7000	86.7000	86.7000	86.7000	88.7212	89.0959	89.2566	(217)
Fuel for water heating, kWh/month													
	191.5881	168.0469	174.5222	153.8914	149.5617	132.6776	124.3250	140.7009	141.7982	159.8271	172.1207	185.9147	(219)
Water heating fuel used												1894.9745	(219)
Annual totals kWh/year													
Space heating fuel - main system												3722.6662	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =												-1333.8260	(233)
Total delivered energy for all uses												4746.6457	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3722.6662	0.2160	804.0959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.9745	0.2160	409.3145	(264)
Space and water heating			1213.4104	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			761.3640	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.1600	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.6867	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.6867	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 50.9589 46.0274 50.7095 47.1493 46.7323 43.3003 44.7437 46.7323 47.1493 50.7095 49.3151 50.9589 (61)
Total heat required for water heating calculated for each month
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (64)
Total per year (kWh/year) = Sum(64)m = 2109.4760 (64)
Heat gains from water heating, kWh/month
65.6556 57.7874 60.4348 53.4234 51.6339 45.2996 43.1316 48.3412 48.8833 55.9092 59.5196 63.9860 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.6600	36.7938	0.6300	0.7000	0.7700	86.1342	(77)
Southwest	1.5500	36.7938	0.6300	0.7000	0.7700	17.4292	(79)
Northwest	4.0300	11.2829	0.6300	0.7000	0.7700	13.8963	(81)

Solar gains	117.4597	204.6932	292.3305	382.7619	447.4826	452.4973	432.8221	383.2762	323.4492	229.5353	141.5303	99.9771	(83)
Total gains	540.0288	624.9389	697.5333	763.1996	802.6835	783.5490	748.7717	706.2977	659.6686	590.7426	530.6950	510.1433	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9983	0.9961	0.9897	0.9674	0.8999	0.7485	0.5755	0.6282	0.8627	0.9786	0.9963	0.9988	(86)
MIT	19.7941	19.9452	20.1849	20.4977	20.7736	20.9417	20.9882	20.9816	20.8700	20.5129	20.0952	19.7678	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9978	0.9947	0.9859	0.9547	0.8604	0.6610	0.4551	0.5070	0.7961	0.9679	0.9948	0.9983	(89)
MIT 2	18.3813	18.6034	18.9534	19.4082	19.7807	19.9781	20.0140	20.0122	19.9075	19.4368	18.8305	18.3491	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7589	18.9621	19.2826	19.6995	20.0461	20.2357	20.2744	20.2714	20.1648	19.7244	19.1685	18.7283	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7589	18.9621	19.2826	19.6995	20.0461	20.2357	20.2744	20.2714	20.1648	19.7244	19.1685	18.7283	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9927	0.9823	0.9497	0.8621	0.6819	0.4875	0.5396	0.8078	0.9638	0.9930	0.9975	(94)
Useful gains	538.2520	620.4005	685.1652	724.8083	691.9670	534.3201	365.0322	381.0888	532.8685	569.3333	526.9804	508.8812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1495.8957	1451.2970	1316.0902	1099.3799	847.8181	566.7950	369.5409	388.6282	612.3102	926.8843	1231.2510	1488.8689	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	712.4869	558.3624	469.4082	269.6916	115.9532	0.0000	0.0000	0.0000	0.0000	266.0179	507.0749	729.1108	(98)
Space heating												3628.1060	(98)
Space heating per m2											(98) / (4) =	38.9031	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3884.4818	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	712.4869	558.3624	469.4082	269.6916	115.9532	0.0000	0.0000	0.0000	0.0000	266.0179	507.0749	729.1108	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	762.8340	597.8185	502.5784	288.7490	124.1469	0.0000	0.0000	0.0000	0.0000	284.8158	542.9067	780.6326	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8827	87.6538	87.1891	86.1737	84.1546	80.3000	80.3000	80.3000	80.3000	86.0229	87.3898	87.9709	(217)
Fuel for water heating, kWh/month													
	239.0738	211.3053	222.8958	200.0269	198.3079	183.0424	175.3686	195.4949	197.6539	210.0951	218.8385	233.1257	(219)
Water heating fuel used												2485.2289	(219)
Annual totals kWh/year													
Space heating fuel - main system												3884.4818	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												6857.1962	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3884.4818	0.2160	839.0481	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.2289	0.2160	536.8094	(264)
Space and water heating			1375.8575	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1628.8625	(272)
Emissions per m2 for space and water heating			14.7529	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7529 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.4700	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 273 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 273	**Prop Type Ref**	
Property	3A Semi RITR, Plot 273, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.16	$kgCO_2/m^2$	Pass
	-9.31 (-53.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.29	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.56	$kWh/m^2/yr$	
	-10.7 (-21.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	7.66 m², No overhang 1.55 m², No overhang 4.03 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

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General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 273 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 273	**Prop Type Ref**	
Property	3A Semi RITR, Plot 273, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	8.16	$kgCO_2/yr/m^2$	
TER	17.47	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.16	$kgCO_2/yr/m^2$	
Reduction DER/TER	53.28	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.56	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.75	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.28	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.28	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.86	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.86	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 274 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 274	**Prop Type Ref**	
Property	Rivermont Semi, Plot 274, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.25	**TER**	18.38
Environmental	95 A	**% DER<TER**	55.11		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.54	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.38 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.25 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 0.96 m², No overhang
Windows facing South East: 6.33 m², No overhang
Windows facing North West: 4.36 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.63 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
               162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
               162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
                53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                19.4453   17.2711   14.0458   10.6336    7.9487    6.7107    7.2511    9.4253   12.6506   16.0628   18.7477   19.9857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
               -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
                71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
               370.9232  368.8708  355.5226  333.9730  312.0873  290.9722  277.2334  283.1489  294.1958  315.9563  340.9723  359.7396 (73)


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6. Solar gains
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[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data       factor                W
                                                      W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                          0.9600           11.2829           0.4100           1.0000           0.7700           3.0776 (75)
Southeast                          6.3300           36.7938           0.4100           1.0000           0.7700          66.1753 (77)
Northwest                          4.3600           11.2829           0.4100           1.0000           0.7700          13.9774 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    83.2303   147.4369  216.7768  293.8183  352.1219  359.7017  342.5768  297.5316  243.2127  167.0063  100.7223   70.5602 (83)
Total gains   454.1535   516.3077  572.2994  627.7913  664.2092  650.6739  619.8101  580.6805  537.4086  482.9626  441.6946  430.2998 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.5606   47.8682   48.1798   49.8008   50.1381   51.8960   51.8960   52.2624   51.1783   50.1381   49.4679   48.8154
alpha          4.1707    4.1912    4.2120    4.3201    4.3425    4.4597    4.4597    4.4842    4.4119    4.3425    4.2979    4.2544
util living area
                0.9957    0.9920    0.9831    0.9558    0.8856    0.7354    0.5747    0.6258    0.8527    0.9692    0.9922    0.9966 (86)

MIT           19.4676   19.6410   19.9291   20.3355   20.6771   20.9090   20.9765   20.9664   20.8080   20.3689   19.8701   19.4680 (87)
Th 2          19.9456   19.9517   19.9577   19.9881   19.9943   20.0250   20.0250   20.0312   20.0127   19.9943   19.9820   19.9699 (88)
util rest of house
                0.9945    0.9898    0.9781    0.9418    0.8476    0.6543    0.4594    0.5114    0.7913    0.9567    0.9897    0.9956 (89)
MIT 2         17.9005   18.1572   18.5795   19.1824   19.6524   19.9543   20.0138   20.0136   19.8400   19.2411   18.5126   17.9172 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1956 (91)
MIT           18.2070   18.4474   18.8434   19.4080   19.8528   20.1410   20.2021   20.1999   20.0293   19.4617   18.7781   18.2205 (92)
Temperature adjustment                                                                                                       0.0000
adjusted MIT  18.2070   18.4474   18.8434   19.4080   19.8528   20.1410   20.2021   20.1999   20.0293   19.4617   18.7781   18.2205 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9915    0.9852    0.9707    0.9315    0.8413    0.6649    0.4813    0.5326    0.7925    0.9478    0.9852    0.9932 (94)
Useful gains  450.2990  508.6467  555.5285  584.7857  558.7737  432.6214  298.3216  309.2613  425.9120  457.7670  435.1607  427.3757 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              1284.9652 1243.6931 1125.8356  927.2268  714.5668  469.2034  305.0196  319.5126  509.1224  776.6969 1037.4170 1262.1470 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
               620.9916  493.9511  424.3085  246.5576  115.9101    0.0000    0.0000    0.0000    0.0000  237.2839  433.6245  621.0698 (98)
Space heating                                                                                                           3193.6973 (98)
Space heating per m2                                                                                    (98) / (4) =     40.3754 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3437.7796	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.9916	493.9511	424.3085	246.5576	115.9101	0.0000	0.0000	0.0000	0.0000	237.2839	433.6245	621.0698	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	668.4517	531.7020	456.7369	265.4011	124.7687	0.0000	0.0000	0.0000	0.0000	255.4186	466.7648	668.5359	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2175	89.1639	89.0516	88.7699	88.2082	86.7000	86.7000	86.7000	86.7000	88.7141	89.0733	89.2334	(217)
Fuel for water heating, kWh/month													
	181.9694	159.6144	165.7912	146.2439	142.1491	126.1921	118.3152	133.8039	134.8180	151.8888	163.5274	176.6059	(219)
Water heating fuel used												1800.9192	(219)
Annual totals kWh/year													
Space heating fuel - main system												3437.7796	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.63 * 1029 * 1.00) =										-1342.0595		-1342.0595	(233)
Total delivered energy for all uses												4315.0492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3437.7796	0.2160	742.5604	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.9192	0.2160	388.9986	(264)
Space and water heating			1131.5590	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1342.0595	0.5190	-696.5289	(269)
Total CO2, kg/year			652.1848	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		26.7942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(75)
Southeast	6.3300	36.7938	0.6300	0.7000	0.7700	71.1788	(77)
Northwest	4.3600	11.2829	0.6300	0.7000	0.7700	15.0342	(81)

Solar gains	89.5233	158.5846	233.1672	316.0338	378.7458	386.8986	368.4789	320.0279	261.6020	179.6336	108.3379	75.8952	(83)
Total gains	474.7368	541.2492	601.6706	662.1648	702.2082	688.5489	656.4263	614.6423	568.0797	508.6946	463.1937	449.9591	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9980	0.9957	0.9892	0.9659	0.8950	0.7398	0.5691	0.6252	0.8630	0.9780	0.9959	0.9985	(86)
MIT	19.7758	19.9216	20.1631	20.4865	20.7710	20.9416	20.9878	20.9807	20.8635	20.4987	20.0805	19.7519	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9973	0.9943	0.9853	0.9525	0.8538	0.6507	0.4476	0.5023	0.7957	0.9670	0.9942	0.9980	(89)
MIT 2	18.3383	18.5527	18.9054	19.3758	19.7588	19.9587	19.9941	19.9923	19.8822	19.4007	18.7936	18.3102	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.6194	18.8204	19.1514	19.5930	19.9568	20.1509	20.1885	20.1856	20.0741	19.6154	19.0453	18.5921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6194	18.8204	19.1514	19.5930	19.9568	20.1509	20.1885	20.1856	20.0741	19.6154	19.0453	18.5921	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9919	0.9809	0.9459	0.8522	0.6654	0.4714	0.5262	0.8019	0.9614	0.9919	0.9969	(94)
Useful gains	472.8334	536.8438	590.1526	626.3354	598.4504	458.1789	309.4539	323.4211	455.5466	489.0823	459.4235	448.5720	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1288.3173	1249.0723	1132.2194	945.1264	728.0850	484.1320	312.9716	329.4943	523.2561	794.9838	1058.3431	1281.4322	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	606.7201	478.6176	403.2978	229.5295	96.4482	0.0000	0.0000	0.0000	0.0000	227.5907	431.2221	619.6480	(98)
Space heating												3093.0739	(98)
Space heating per m2											(98) / (4) =	39.1033	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3311.6423	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	606.7201	478.6176	403.2978	229.5295	96.4482	0.0000	0.0000	0.0000	0.0000	227.5907	431.2221	619.6480	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	649.5932	512.4386	431.7963	245.7489	103.2636	0.0000	0.0000	0.0000	0.0000	243.6731	461.6939	663.4347	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6515	87.4349	86.9748	85.9121	83.8531	80.3000	80.3000	80.3000	80.3000	85.7724	87.1409	87.7404	(217)
Fuel for water heating, kWh/month													
	229.8830	202.0751	211.3580	189.7830	188.2551	173.1411	165.8823	184.9199	186.9622	199.3108	209.4191	224.2362	(219)
Water heating fuel used												2365.2258	(219)
Annual totals kWh/year													
Space heating fuel - main system												3311.6423	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6115.3395	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3311.6423	0.2160	715.3147	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.2258	0.2160	510.8888	(264)
Space and water heating			1226.2035	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1453.7702	(272)
Emissions per m2 for space and water heating			15.5019	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5019 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.3800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 274 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 274	**Prop Type Ref**	
Property	Rivermont Semi, Plot 274, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.25	**TER**	18.38
Environmental	95 A	**% DER<TER**	55.11		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.54	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.38	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.25	$kgCO_2/m^2$	Pass
	-10.13 (-55.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.14	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.54	$kWh/m^2/yr$	
	-10.6 (-20.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	0.96 m², No overhang 6.33 m², No overhang 4.36 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.63	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 274 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 274	**Prop Type Ref**	
Property	Rivermont Semi, Plot 274, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.25	**TER**	18.38
Environmental	95 A	**% DER<TER**	55.11		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.54	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.63	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 274 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 274	**Prop Type Ref**	
Property	Rivermont Semi, Plot 274, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.25	**TER**	18.38
Environmental	95 A	**% DER<TER**	55.11		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.54	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.72		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.25	$kgCO_2/yr/m^2$	
TER	18.38	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.25	$kgCO_2/yr/m^2$	
Reduction DER/TER	55.11	%	
CfSH ENE1 credits achieved	5.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.54	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.14	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.14	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.34	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.34	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 275 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 275	**Prop Type Ref**	
Property	Rivermont Semi, Plot 275, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.19	**TER**	18.26
Environmental	95 A	**% DER<TER**	55.15		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.08	**TFEE**	50.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 6.33 m², No overhang
Windows facing South West: 0.96 m², No overhang
Windows facing North West: 4.36 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8117   10.6579   11.7778   11.3729   11.7338   11.3344   11.6992   11.7216   11.3554   11.7596   11.4092   11.8046 (61)
Total heat required for water heating calculated for each month
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.3486  142.3184  147.6396  129.8205  125.3872  109.4086  102.5793  116.0079  116.8872  134.7468  145.6593  157.5915 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1590.3950 (64)
Heat gains from water heating, kWh/month
               53.0064   46.4416   48.1185   42.2271   40.7232   35.4433   33.1424   37.6056   37.9282   43.8331   47.4905   51.4253 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781  122.2781 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               19.4453   17.2711   14.0458   10.6336    7.9487    6.7107    7.2511    9.4253   12.6506   16.0628   18.7477   19.9857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.5493  219.8067  214.1180  202.0072  186.7196  172.3514  162.7525  160.4951  166.1838  178.2946  193.5822  207.9504 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278   35.2278 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225  -97.8225 (71)
Water heating gains (Table 5)
               71.2452   69.1095   64.6754   58.6487   54.7355   49.2268   44.5463   50.5452   52.6780   58.9155   65.9590   69.1200 (72)
Total internal gains
              370.9232  368.8708  355.5226  333.9730  312.0873  290.9722  277.2334  283.1489  294.1958  315.9563  340.9723  359.7396 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Southeast                            6.3300            36.7938            0.4100           1.0000           0.7700          66.1753 (77)
Southwest                            0.9600            36.7938            0.4100           1.0000           0.7700          10.0361 (79)
Northwest                            4.3600            11.2829            0.4100           1.0000           0.7700          13.9774 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    90.1887  158.2675  228.8804  304.2641  359.6679  365.3658  348.7980  306.1955  254.7865  178.2443  108.8708   76.6357 (83)
Total gains   461.1119  527.1383  584.4030  638.2370  671.7551  656.3380  626.0314  589.3445  548.9823  494.2006  449.8431  436.3753 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           47.5606   47.8682   48.1798   49.8008   50.1381   51.8960   51.8960   52.2624   51.1783   50.1381   49.4679   48.8154
alpha          4.1707    4.1912    4.2120    4.3201    4.3425    4.4597    4.4597    4.4842    4.4119    4.3425    4.2979    4.2544
util living area
               0.9954    0.9914    0.9818    0.9534    0.8821    0.7312    0.5698    0.6184    0.8449    0.9667    0.9917    0.9964 (86)

MIT           19.4772   19.6557   19.9448   20.3475   20.6833   20.9110   20.9773   20.9679   20.8160   20.3826   19.8812   19.4764 (87)
Th 2          19.9456   19.9517   19.9577   19.9881   19.9943   20.0250   20.0250   20.0312   20.0127   19.9943   19.9820   19.9699 (88)
util rest of house
               0.9942    0.9890    0.9765    0.9388    0.8434    0.6500    0.4551    0.5046    0.7820    0.9534    0.9889    0.9954 (89)
MIT 2         17.9145   18.1784   18.6020   19.1989   19.6600   19.9562   20.0142   20.0145   19.8485   19.2601   18.5287   17.9295 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1956 (91)
MIT           18.2201   18.4673   18.8646   19.4235   19.8601   20.1429   20.2026   20.2009   20.0377   19.4796   18.7932   18.2320 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.2201   18.4673   18.8646   19.4235   19.8601   20.1429   20.2026   20.2009   20.0377   19.4796   18.7932   18.2320 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9911    0.9841    0.9688    0.9284    0.8374    0.6607    0.4770    0.5258    0.7839    0.9443    0.9843    0.9929 (94)
Useful gains  456.9897  518.7659  566.1479  592.5189  562.5094  433.6661  298.5951  309.8517  430.3311  466.6639  442.7683  433.2593 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1286.1738 1245.5240 1127.7651  928.6022  715.2060  469.3625  305.0596  319.5988  509.8431  778.2700 1038.7592 1263.1871 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              616.9130  488.3814  417.8432  241.9800  113.6063    0.0000    0.0000    0.0000    0.0000  231.8350  429.1135  617.4662 (98)
Space heating                                                                                                            3157.1386 (98)
Space heating per m2                                                                                   (98) / (4) =     39.9133 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3398.4269	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	616.9130	488.3814	417.8432	241.9800	113.6063	0.0000	0.0000	0.0000	0.0000	231.8350	429.1135	617.4662	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	664.0614	525.7066	449.7774	260.4736	122.2888	0.0000	0.0000	0.0000	0.0000	249.5532	461.9090	664.6569	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2140	89.1574	89.0420	88.7562	88.1922	86.7000	86.7000	86.7000	86.7000	88.6967	89.0669	89.2304	(217)
Fuel for water heating, kWh/month													
	181.9766	159.6259	165.8090	146.2665	142.1748	126.1921	118.3152	133.8039	134.8180	151.9186	163.5392	176.6120	(219)
Water heating fuel used												1801.0520	(219)
Annual totals kWh/year													
Space heating fuel - main system												3398.4269	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =											-1333.8260	-1333.8260	(233)
Total delivered energy for all uses												4284.0627	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3398.4269	0.2160	734.0602	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.0520	0.2160	389.0272	(264)
Space and water heating			1123.0874	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			647.9864	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.1900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.1900	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		26.7342	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.7342	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.3300	36.7938	0.6300	0.7000	0.7700	71.1788	(77)
Southwest	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(79)
Northwest	4.3600	11.2829	0.6300	0.7000	0.7700	15.0342	(81)

Solar gains	97.0079	170.2341	246.1860	327.2694	386.8623	392.9910	375.1705	329.3469	274.0508	191.7213	117.1025	82.4301	(83)
Total gains	482.2214	552.8987	614.6894	673.4003	710.3247	694.6413	663.1179	623.9614	580.5286	520.7823	471.9583	456.4939	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9979	0.9953	0.9882	0.9636	0.8912	0.7353	0.5640	0.6173	0.8546	0.9759	0.9955	0.9984	(86)
MIT	19.7846	19.9351	20.1777	20.4976	20.7765	20.9432	20.9883	20.9818	20.8705	20.5114	20.0907	19.7596	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9971	0.9937	0.9839	0.9495	0.8492	0.6461	0.4432	0.4952	0.7854	0.9639	0.9937	0.9978	(89)
MIT 2	18.3511	18.5723	18.9263	19.3910	19.7653	19.9600	19.9943	19.9929	19.8891	19.4183	18.8084	18.3214	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.6315	18.8389	19.1710	19.6074	19.9630	20.1523	20.1887	20.1863	20.0810	19.6321	19.0592	18.6027	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6315	18.8389	19.1710	19.6074	19.9630	20.1523	20.1887	20.1863	20.0810	19.6321	19.0592	18.6027	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9911	0.9792	0.9428	0.8479	0.6609	0.4669	0.5190	0.7923	0.9582	0.9912	0.9967	(94)
Useful gains	480.1550	547.9907	601.9308	634.8973	602.3146	459.0848	309.6272	323.8420	459.9587	498.9956	467.8090	454.9957	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1289.4019	1250.7283	1133.9797	946.3983	728.6370	484.2500	312.9941	329.5484	523.8630	796.4528	1059.5760	1282.3746	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	602.0797	472.2397	395.8444	224.2807	93.9838	0.0000	0.0000	0.0000	0.0000	221.3081	426.0723	615.5699	(98)
Space heating												3051.3785	(98)
Space heating per m2											(98) / (4) =	38.5762	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3267.0006	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	602.0797	472.2397	395.8444	224.2807	93.9838	0.0000	0.0000	0.0000	0.0000	221.3081	426.0723	615.5699	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	644.6250	505.6099	423.8163	240.1292	100.6251	0.0000	0.0000	0.0000	0.0000	236.9466	456.1802	659.0684	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6361	87.4067	86.9325	85.8543	83.7937	80.3000	80.3000	80.3000	80.3000	85.7021	87.1143	87.7275	(217)
Fuel for water heating, kWh/month													
	229.9234	202.1403	211.4610	189.9107	188.3885	173.1411	165.8823	184.9199	186.9622	199.4742	209.4830	224.2693	(219)
Water heating fuel used												2365.9558	(219)
Annual totals kWh/year													
Space heating fuel - main system												3267.0006	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6071.4278	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3267.0006	0.2160	705.6721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.9558	0.2160	511.0465	(264)
Space and water heating			1216.7186	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1444.2852	(272)
Emissions per m2 for space and water heating			15.3820	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3820 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.2600	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 275 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 275	**Prop Type Ref**	
Property	Rivermont Semi, Plot 275, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.19	**TER**	18.26
Environmental	95 A	**% DER<TER**	55.15		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.08	**TFEE**	50.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.19	$kgCO_2/m^2$	Pass
	-10.07 (-55.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.54	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.08	$kWh/m^2/yr$	
	-10.4 (-20.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	6.33 m², No overhang 0.96 m², No overhang 4.36 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 275 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 275	**Prop Type Ref**	
Property	Rivermont Semi, Plot 275, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.19	**TER**	18.26
Environmental	95 A	**% DER<TER**	55.15		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.08	**TFEE**	50.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 275 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 275	**Prop Type Ref**	
Property	Rivermont Semi, Plot 275, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.19	**TER**	18.26
Environmental	95 A	**% DER<TER**	55.15		
CO_2 Emissions (t/year)	0.29	**DFEE**	40.08	**TFEE**	50.54
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.19	$kgCO_2/yr/m^2$	
TER	18.26	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.19	$kgCO_2/yr/m^2$	
Reduction DER/TER	55.15	%	
CfSH ENE1 credits achieved	5.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.08	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.03	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.03	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.28	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.28	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 276 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 276	**Prop Type Ref**	
Property	Allbrook Det, Plot 276, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.74	**TER**	17.19
Environmental	95 A	**% DER<TER**	60.80		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.78	**TFEE**	55.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 117 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.19 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 8.64 m², No overhang
Windows facing North West: 6.92 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7300 (1b)	x	2.3900 (2b)	=	140.3647	(1b) - (3b)
First floor	58.7300 (1c)	x	2.6300 (2c)	=	154.4599	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.8246	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1696	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3946	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3354	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4276	0.4193	0.4109	0.3689	0.3606	0.3186	0.3186	0.3102	0.3354	0.3606	0.3773	0.3941	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6776	0.6693	0.6609	0.6189	0.6106	0.5686	0.5686	0.5602	0.5854	0.6106	0.6273	0.6441	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5600	1.2357	19.2281			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7300	0.1500	8.8095			(28a)
External Wall	154.3000	19.8000	134.5000	0.2100	28.2450			(29a)
Main Roof	58.7300		58.7300	0.0700	4.1111			(30)
Total net area of external elements Aum(A, m2)			271.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.7537			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	205.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0469	(36)
Total fabric heat loss (33) + (36) =	72.8006	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.9290	65.1132	64.2974	60.2184	59.4026	55.3235	55.3235	54.5077	56.9551	59.4026	61.0342	62.6658	(38)
Heat transfer coeff	138.7296	137.9138	137.0980	133.0190	132.2032	128.1242	128.1242	127.3084	129.7558	132.2032	133.8348	135.4664	(39)
Average = Sum(39)m / 12 =												132.8150	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1811	1.1741	1.1672	1.1325	1.1255	1.0908	1.0908	1.0838	1.1047	1.1255	1.1394	1.1533	(40)
HLP (average)												1.1307	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9574 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1531	108.0748	103.9965	99.9182	95.8399	91.7616	91.7616	95.8399	99.9182	103.9965	108.0748	112.1531	(44)
Energy conte	166.3198	145.4644	150.1062	130.8662	125.5693	108.3567	100.4084	115.2202	116.5963	135.8817	148.3255	161.0719	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1866	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9480	21.8197	22.5159	19.6299	18.8354	16.2535	15.0613	17.2830	17.4894	20.3823	22.2488	24.1608	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8354 10.6829 11.8111 11.4083 11.7665 11.3613 11.7241 11.7516 11.3870 11.7898 11.4347 11.8275 (61)
Total heat required for water heating calculated for each month
178.1553 156.1473 161.9173 142.2746 137.3357 119.7181 112.1326 126.9717 127.9832 147.6715 159.7602 172.8994 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
178.1553 156.1473 161.9173 142.2746 137.3357 119.7181 112.1326 126.9717 127.9832 147.6715 159.7602 172.8994 (64)
Total per year (kWh/year) = Sum(64)m = 1742.9668 (64)
Heat gains from water heating, kWh/month
58.2602 51.0376 52.8631 46.3651 44.6934 38.8690 36.3168 41.2486 41.6150 48.1281 52.1769 56.5133 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
25.4754 22.6271 18.4016 13.9312 10.4137 8.7917 9.4997 12.3481 16.5736 21.0440 24.5615 26.1835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
281.8686 284.7935 277.4228 261.7315 241.9240 223.3078 210.8710 207.9461 215.3168 231.0081 250.8156 269.4318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 37.2647 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 -114.1177 (71)
Water heating gains (Table 5)
78.3067 75.9489 71.0525 64.3960 60.0718 53.9847 48.8130 55.4417 57.7986 64.6883 72.4679 75.9587 (72)
Total internal gains
454.4449 452.1636 435.6711 408.8528 381.2037 354.8783 337.9778 344.5300 358.4831 385.5346 416.6391 440.3682 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	8.6400	36.7938	0.4100	1.0000	0.7700	90.3246	(77)
Northwest	6.9200	11.2829	0.4100	1.0000	0.7700	22.1843	(81)

Solar gains	112.5089	199.0129	291.8708	394.4488	471.7601	481.5201	458.7554	399.0640	327.0769	225.2290	136.1016	95.4158	(83)
Total gains	566.9538	651.1765	727.5419	803.3016	852.9637	836.3984	796.7332	743.5940	685.5600	610.7635	552.7407	535.7840	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.2139	48.4991	48.7877	50.2838	50.5940	52.2048	52.2048	52.5393	51.5483	50.5940	49.9772	49.3753	
alpha	4.2143	4.2333	4.2525	4.3523	4.3729	4.4803	4.4803	4.5026	4.4366	4.3729	4.3318	4.2917	
util living area	0.9980	0.9961	0.9911	0.9751	0.9280	0.8093	0.6559	0.7095	0.9064	0.9838	0.9963	0.9985	(86)
MIT	19.3784	19.5422	19.8233	20.2269	20.5896	20.8649	20.9611	20.9451	20.7422	20.2747	19.7764	19.3783	(87)
Th 2	19.9352	19.9407	19.9463	19.9744	19.9800	20.0084	20.0084	20.0140	19.9970	19.9800	19.9688	19.9575	(88)
util rest of house	0.9974	0.9949	0.9883	0.9662	0.8995	0.7334	0.5307	0.5895	0.8579	0.9765	0.9950	0.9980	(89)
MIT 2	17.7601	18.0030	18.4167	19.0193	19.5307	19.8984	19.9892	19.9839	19.7529	19.0967	18.3646	17.7746	(90)
Living area fraction									fLA = Living area / (4) =			0.1393	(91)
MIT	17.9855	18.2174	18.6126	19.1875	19.6782	20.0330	20.1246	20.1178	19.8907	19.2607	18.5612	17.9980	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9855	18.2174	18.6126	19.1875	19.6782	20.0330	20.1246	20.1178	19.8907	19.2607	18.5612	17.9980	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9920	0.9830	0.9569	0.8889	0.7356	0.5466	0.6035	0.8514	0.9691	0.9923	0.9967	(94)
Useful gains	564.5086	645.9391	715.1514	768.6450	758.2089	615.2539	435.4957	448.7605	583.6848	591.8658	548.4734	533.9894	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1898.5816	1836.6566	1660.6120	1368.4287	1054.7458	696.1041	451.5830	473.3079	751.3803	1144.9776	1533.9112	1869.1653	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	992.5503	800.1621	703.4227	431.8443	220.6235	0.0000	0.0000	0.0000	0.0000	411.5152	709.5152	993.3709	(98)
Space heating												5263.0042	(98)
Space heating per m2											(98) / (4) =	44.8068	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5665.2359	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	992.5503	800.1621	703.4227	431.8443	220.6235	0.0000	0.0000	0.0000	0.0000	411.5152	709.5152	993.3709	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	1068.4072	861.3155	757.1827	464.8485	237.4849	0.0000	0.0000	0.0000	0.0000	442.9658	763.7408	1069.2905	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	178.1553	156.1473	161.9173	142.2746	137.3357	119.7181	112.1326	126.9717	127.9832	147.6715	159.7602	172.8994	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3979	89.3615	89.2834	89.0852	88.6447	86.7000	86.7000	86.7000	86.7000	89.0322	89.2943	89.4108	(217)
Fuel for water heating, kWh/month	199.2835	174.7367	181.3521	159.7062	154.9282	138.0831	129.3340	146.4495	147.6161	165.8630	178.9142	193.3765	(219)
Water heating fuel used												1969.6434	(219)
Annual totals kWh/year													
Space heating fuel - main system												5665.2359	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												449.9044	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1004 * 1.00) =										-1301.1791		-2177.9294	
PV Unit 1 (0.80 * 1.62 * 677 * 1.00) =										-876.7503		-2177.9294	(233)
Total delivered energy for all uses												5981.8543	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5665.2359	0.2160	1223.6910	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1969.6434	0.2160	425.4430	(264)
Space and water heating			1649.1339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	449.9044	0.5190	233.5004	(268)
Energy saving/generation technologies				
PV Unit	-2177.9294	0.5190	-1130.3453	(269)
Total CO2, kg/year			791.2140	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.7400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.7400	ZC1
Total Floor Area	TFA	117.4600	
Assumed number of occupants	N	2.8529	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2201	ZC2
CO2 emissions from cooking, equation (L16)		1.5960	ZC3
Total CO2 emissions		22.5561	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.5561	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7300 (1b)	x	2.3900 (2b)	=	140.3647	(1b) - (3b)
First floor	58.7300 (1c)	x	2.6300 (2c)	=	154.4599	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	294.8246	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1357	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3857	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3278	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4180	0.4098	0.4016	0.3606	0.3524	0.3114	0.3114	0.3032	0.3278	0.3524	0.3688	0.3852	(22b)
Effective ac	0.5874	0.5840	0.5806	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.5600	1.3258	20.6288			(27)
Ground floor			58.7300	0.1300	7.6349			(28a)
External Wall	154.3000	19.8000	134.5000	0.1800	24.2100			(29a)
Main Roof	58.7300		58.7300	0.1300	7.6349			(30)
Total net area of external elements Aum(A, m2)			271.7600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.1966			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4471	(36)
Total fabric heat loss (33) + (36) =	76.6437	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.1446	56.8146	56.4912	54.9718	54.6875	53.3642	53.3642	53.1192	53.8739	54.6875	55.2626	55.8638	(38)
Heat transfer coeff	133.7883	133.4583	133.1348	131.6155	131.3312	130.0079	130.0079	129.7629	130.5176	131.3312	131.9063	132.5075	(39)
Average = Sum(39)m / 12 =												131.6141	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1390	1.1362	1.1334	1.1205	1.1181	1.1068	1.1068	1.1047	1.1112	1.1181	1.1230	1.1281	(40)
HLP (average)												1.1205	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9574 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1531	108.0748	103.9965	99.9182	95.8399	91.7616	91.7616	95.8399	99.9182	103.9965	108.0748	112.1531	(44)
Energy conte	166.3198	145.4644	150.1062	130.8662	125.5693	108.3567	100.4084	115.2202	116.5963	135.8817	148.3255	161.0719	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1866	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9480	21.8197	22.5159	19.6299	18.8354	16.2535	15.0613	17.2830	17.4894	20.3823	22.2488	24.1608	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2747	48.8390	45.2523	46.7607	48.8390	49.2747	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	217.2787	191.4918	201.0651	180.1410	174.4083	153.6091	147.1692	164.0591	165.8710	186.8406	197.6406	212.0308	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	217.2787	191.4918	201.0651	180.1410	174.4083	153.6091	147.1692	164.0591	165.8710	186.8406	197.6406	212.0308	(64)
								Total per year (kWh/year) = Sum(64)m =				2191.6052	(64)
Heat gains from water heating, kWh/month													
	68.0411	59.8738	62.6500	55.8317	53.9615	47.3417	45.0760	50.5204	51.0869	57.9204	61.6470	66.2961	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	142.6471	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.2875	24.2366	19.7105	14.9221	11.1545	9.4171	10.1755	13.2265	17.7525	22.5409	26.3086	28.0460	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8686	284.7935	277.4228	261.7315	241.9240	223.3078	210.8710	207.9461	215.3168	231.0081	250.8156	269.4318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	37.2647	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	-114.1177	(71)
Water heating gains (Table 5)													
	91.4531	89.0979	84.2070	77.5440	72.5289	65.7524	60.5860	67.9038	70.9541	77.8500	85.6208	89.1077	(72)
Total internal gains													
	469.4034	466.9221	450.1345	422.9918	394.4016	367.2713	350.4266	357.8705	372.8175	400.1931	431.5391	455.3796	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	8.6400	36.7938	0.6300	0.7000	0.7700	97.1540	(77)
Northwest	6.9200	11.2829	0.6300	0.7000	0.7700	23.8616	(81)

Solar gains	121.0156	214.0602	313.9391	424.2730	507.4297	517.9277	493.4417	429.2372	351.8071	242.2585	146.3922	102.6302	(83)
Total gains	590.4190	680.9823	764.0736	847.2648	901.8313	885.1991	843.8684	787.1077	724.6246	642.4516	577.9313	558.0098	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9690	61.1198	61.2683	61.9756	62.1097	62.7419	62.7419	62.8604	62.4969	62.1097	61.8389	61.5584	
alpha	5.0646	5.0747	5.0846	5.1317	5.1406	5.1828	5.1828	5.1907	5.1665	5.1406	5.1226	5.1039	
util living area													
	0.9991	0.9980	0.9946	0.9813	0.9349	0.8112	0.6459	0.7052	0.9139	0.9889	0.9981	0.9994	(86)
MIT	19.6826	19.8224	20.0613	20.3881	20.6958	20.9082	20.9782	20.9662	20.8081	20.4125	19.9903	19.6606	(87)
Th 2	19.9691	19.9714	19.9736	19.9841	19.9861	19.9953	19.9953	19.9970	19.9917	19.9861	19.9821	19.9779	(88)
util rest of house													
	0.9988	0.9973	0.9925	0.9733	0.9047	0.7278	0.5142	0.5763	0.8617	0.9829	0.9974	0.9991	(89)
MIT 2	18.2012	18.4073	18.7573	19.2374	19.6653	19.9278	19.9865	19.9815	19.8212	19.2779	18.6607	18.1753	(90)
Living area fraction									fLA = Living area / (4) =			0.1393	(91)
MIT	18.4075	18.6044	18.9389	19.3976	19.8089	20.0643	20.1246	20.1186	19.9586	19.4359	18.8459	18.3822	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4075	18.6044	18.9389	19.3976	19.8089	20.0643	20.1246	20.1186	19.9586	19.4359	18.8459	18.3822	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9894	0.9669	0.8981	0.7344	0.5323	0.5934	0.8595	0.9781	0.9960	0.9986	(94)
Useful gains	589.2906	678.1341	755.9405	819.2222	809.9710	650.0600	449.1760	467.0627	622.8088	628.3527	575.6070	557.2110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1887.4243	1828.9628	1656.0551	1381.6533	1064.9471	710.4081	458.2251	482.5395	764.6562	1160.4321	1549.3562	1879.2459	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	965.8115	773.3569	669.6852	404.9504	189.7022	0.0000	0.0000	0.0000	0.0000	395.8671	701.0994	983.5939	(98)
Space heating												5084.0667	(98)
Space heating per m2											(98) / (4) =	43.2834	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5443.3262	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	965.8115	773.3569	669.6852	404.9504	189.7022	0.0000	0.0000	0.0000	0.0000	395.8671	701.0994	983.5939	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1034.0594	828.0052	717.0078	433.5657	203.1073	0.0000	0.0000	0.0000	0.0000	423.8405	750.6418	1053.0984	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.2787	191.4918	201.0651	180.1410	174.4083	153.6091	147.1692	164.0591	165.8710	186.8406	197.6406	212.0308	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3589	88.1983	87.8486	87.0297	85.2631	80.3000	80.3000	80.3000	80.3000	86.8955	87.9669	88.4276	(217)
Fuel for water heating, kWh/month													
	245.9046	217.1150	228.8769	206.9878	204.5530	191.2940	183.2742	204.3078	206.5641	215.0175	224.6762	239.7790	(219)
Water heating fuel used												2568.3502	(219)
Annual totals kWh/year													
Space heating fuel - main system												5443.3262	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												481.9066	(232)
Total delivered energy for all uses												8568.5830	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5443.3262	0.2160	1175.7585	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2568.3502	0.2160	554.7636	(264)
Space and water heating			1730.5221	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	481.9066	0.5190	250.1095	(268)
Total CO2, kg/m2/year			2019.5566	(272)
Emissions per m2 for space and water heating			14.7329	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1293	(272b)
Emissions per m2 for pumps and fans			0.3314	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7329 * 1.00) + 2.1293 + 0.3314, rounded to 2 d.p.			17.1900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 276 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 276	**Prop Type Ref**	
Property	Allbrook Det, Plot 276, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.74	**TER**	17.19
Environmental	95 A	**% DER<TER**	60.80		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.78	**TFEE**	55.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.19	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	6.74	$kgCO_2/m^2$	Pass
	-10.45 (-60.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.14	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.78	$kWh/m^2/yr$	
	-9.3 (-16.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing South East	8.64 m², No overhang
Windows facing North West	6.92 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	3.24	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 276 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 276	**Prop Type Ref**	
Property	Allbrook Det, Plot 276, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.74	**TER**	17.19
Environmental	95 A	**% DER<TER**	60.80		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.78	**TFEE**	55.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	30.80 m	58.73 m²	2.39 m
1st Storey:	30.80 m	58.73 m²	2.63 m

7.0 Living Area	16.36	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	205.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	154.30	134.50

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.73	58.73

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.15	58.73

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	South East							2.12	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	13.94	0.052	No
Independently assessed	E3 Sill	10.11	0.004	No
Independently assessed	E4 Jamb	33.30	0.005	No
Independently assessed	E5 Ground floor (normal)	30.80	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	30.80	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	30.80	0.087	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.022	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	

Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	45°	None Or Little	Yes
1.62	North West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 276 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 276	**Prop Type Ref**	
Property	Allbrook Det, Plot 276, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.74	**TER**	17.19
Environmental	95 A	**% DER<TER**	60.80		
CO_2 Emissions (t/year)	0.26	**DFEE**	45.78	**TFEE**	55.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.46	m^2	
DER	6.74	$kgCO_2/yr/m^2$	
TER	17.19	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.74	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.80	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	45.78	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.46	m^2	
DER	18.48	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.22	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.60	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.30	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.30	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.86	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.22	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.60	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.68	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.68	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 277 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 277	**Prop Type Ref**	
Property	Buridge Det, Plot 277, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.52 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 10.51 m², No overhang
Windows facing North West: 7.51 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6611	0.6530	0.6449	0.6046	0.5966	0.5563	0.5563	0.5482	0.5724	0.5966	0.6127	0.6288	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.0200	1.2357	22.2681			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1400	9.0370			(28a)
External Wall	163.0100	22.2600	140.7500	0.2100	29.5575			(29a)
Main Roof	64.5500		64.5500	0.0700	4.5185			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.7411			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9257	(36)
Total fabric heat loss					(33) + (36) =		77.6668	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.6903	69.8284	68.9665	64.6570	63.7951	59.4856	59.4856	58.6237	61.2094	63.7951	65.5189	67.2427	(38)
Heat transfer coeff	148.3571	147.4952	146.6333	142.3238	141.4619	137.1524	137.1524	136.2905	138.8762	141.4619	143.1857	144.9095	(39)
Average = Sum(39)m / 12 =												142.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1425	1.1358	1.1024	1.0958	1.0624	1.0624	1.0557	1.0757	1.0958	1.1091	1.1225	(40)
HLP (average)												1.1008	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8377 10.6849 11.8132 11.4103 11.7698 11.3641 11.7267 11.7547 11.3887 11.7916 11.4367 11.8298 (61)
Total heat required for water heating calculated for each month
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (64)
Total per year (kWh/year) = Sum(64)m = 1757.8213 (64)
Heat gains from water heating, kWh/month
58.7719 51.4852 53.3249 46.7678 45.0801 39.2026 36.6260 41.6034 41.9737 48.5461 52.6332 57.0088 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
26.6397 23.6611 19.2425 14.5678 10.8896 9.1935 9.9339 12.9124 17.3310 22.0057 25.6839 27.3801 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
296.6325 299.7107 291.9539 275.4407 254.5957 235.0044 221.9162 218.8380 226.5948 243.1080 263.9530 283.5443 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 (71)
Water heating gains (Table 5)
78.9945 76.6148 71.6733 64.9552 60.5916 54.4481 49.2286 55.9186 58.2969 65.2502 73.1017 76.6248 (72)
Total internal gains
471.6560 469.3759 452.2590 424.3530 395.4662 368.0352 350.4679 357.0584 371.6120 399.7532 432.1279 456.9385 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.4100	1.0000	0.7700	109.8740	(77)
Northwest	7.5100	11.2829	0.4100	1.0000	0.7700	24.0757	(81)

Solar gains	133.9497	236.1629	344.3698	462.2947	550.3061	560.6212	534.5499	466.7040	384.8636	266.7375	161.8972	113.6907	(83)
Total gains	605.6057	705.5388	796.6287	886.6477	945.7723	928.6564	885.0178	823.7624	756.4756	666.4907	594.0251	570.6291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5860	48.8700	49.1572	50.6457	50.9542	52.5553	52.5553	52.8877	51.9029	50.9542	50.3408	49.7420	
alpha	4.2391	4.2580	4.2771	4.3764	4.3969	4.5037	4.5037	4.5258	4.4602	4.3969	4.3561	4.3161	
util living area	0.9981	0.9960	0.9906	0.9727	0.9208	0.7945	0.6379	0.6932	0.8988	0.9829	0.9964	0.9985	(86)
MIT	19.3872	19.5584	19.8454	20.2523	20.6126	20.8772	20.9658	20.9509	20.7565	20.2892	19.7855	19.3852	(87)
Th 2	19.9609	19.9663	19.9717	19.9988	20.0043	20.0317	20.0317	20.0372	20.0207	20.0043	19.9934	19.9825	(88)
util rest of house	0.9975	0.9948	0.9876	0.9633	0.8911	0.7185	0.5169	0.5762	0.8492	0.9755	0.9951	0.9981	(89)
MIT 2	17.7927	18.0463	18.4684	19.0746	19.5807	19.9318	20.0147	20.0100	19.7902	19.1366	18.3970	17.8041	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9918	0.9819	0.9532	0.8796	0.7192	0.5291	0.5868	0.8415	0.9675	0.9923	0.9968	(94)
Useful gains	603.0741	699.7351	782.2344	845.1689	831.9359	667.8904	468.2726	483.4175	636.6073	644.8351	589.4648	568.7997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2028.6587	1964.3926	1777.9449	1467.1620	1131.4343	746.0240	483.1743	506.6036	805.5096	1226.1510	1640.1846	1997.4372	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating												5573.8788	(98)
Space heating per m2											(98) / (4) =	43.1749	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5999.8696	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1141.6953	914.8007	797.4259	482.0614	239.8566	0.0000	0.0000	0.0000	0.0000	465.5533	814.3361	1144.1402	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4218	89.3842	89.3046	89.1020	88.6459	86.7000	86.7000	86.7000	86.7000	89.0580	89.3211	89.4348	(217)
Fuel for water heating, kWh/month													
	200.9517	176.1986	182.8648	161.0357	156.2392	139.2414	130.4073	147.6813	148.8611	167.2271	180.3975	194.9917	(219)
Water heating fuel used												1986.0976	(219)
Annual totals kWh/year													
Space heating fuel - main system												5999.8696	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.4651	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1004 * 1.00) =										-2602.3582		-2602.3582	(233)
Total delivered energy for all uses												5929.0741	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5999.8696	0.2160	1295.9718	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1986.0976	0.2160	428.9971	(264)
Space and water heating			1724.9689	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.4651	0.5190	244.1714	(268)
Energy saving/generation technologies				
PV Unit	-2602.3582	0.5190	-1350.6239	(269)
Total CO2, kg/year			657.4414	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.0900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.0900	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		20.1652	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.1652	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.0200	1.3258	23.8902			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.2600	140.7500	0.1800	25.3350			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.0962			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0549	(36)
Total fabric heat loss					(33) + (36) =		83.1511	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.3754	145.0354	144.7020	143.1364	142.8434	141.4798	141.4798	141.2273	142.0051	142.8434	143.4360	144.0556	(39)
Average = Sum(39)m / 12 =												143.1350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1261	1.1234	1.1209	1.1087	1.1065	1.0959	1.0959	1.0939	1.1000	1.1065	1.1110	1.1158	(40)
HLP (average)												1.1087	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3891	25.2150	20.5062	15.5245	11.6047	9.7972	10.5862	13.7604	18.4692	23.4508	27.3706	29.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.5510	484.0780	466.6764	438.4711	408.7890	380.5509	363.0376	370.5191	385.9190	414.3594	446.9668	471.8847	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.6300	0.7000	0.7700	118.1815	(77)
Northwest	7.5100	11.2829	0.6300	0.7000	0.7700	25.8961	(81)

Solar gains	144.0776	254.0191	370.4075	497.2487	591.9147	603.0096	574.9671	501.9914	413.9631	286.9055	174.1382	122.2868	(83)
Total gains	630.6286	738.0970	837.0839	935.7197	1000.7037	983.5606	938.0047	872.5105	799.8820	701.2649	621.1050	594.1715	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6698	61.8144	61.9568	62.6345	62.7630	63.3679	63.3679	63.4812	63.1335	62.7630	62.5037	62.2349	
alpha	5.1113	5.1210	5.1305	5.1756	5.1842	5.2245	5.2245	5.2321	5.2089	5.1842	5.1669	5.1490	
util living area													
	0.9992	0.9981	0.9946	0.9806	0.9313	0.8027	0.6352	0.6962	0.9109	0.9891	0.9983	0.9995	(86)
MIT	19.6866	19.8316	20.0744	20.4031	20.7093	20.9148	20.9804	20.9690	20.8156	20.4193	19.9935	19.6631	(87)
Th 2	19.9796	19.9817	19.9838	19.9937	19.9956	20.0042	20.0042	20.0058	20.0009	19.9956	19.9918	19.9879	(88)
util rest of house													
	0.9990	0.9975	0.9925	0.9723	0.9001	0.7187	0.5057	0.5686	0.8578	0.9832	0.9976	0.9993	(89)
MIT 2	18.2145	18.4280	18.7838	19.2658	19.6903	19.9421	19.9963	19.9917	19.8376	19.2947	18.6724	18.1861	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9960	0.9893	0.9656	0.8928	0.7234	0.5200	0.5822	0.8543	0.9782	0.9963	0.9988	(94)
Useful gains	629.5660	735.1675	828.1612	903.5436	893.4307	711.4650	487.7849	507.9381	683.3457	685.9616	618.8191	593.4349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2047.1718	1985.2063	1798.7406	1502.2423	1157.9293	771.4588	496.3528	522.9454	830.5725	1260.2542	1681.4659	2038.9805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating												5512.5512	(98)
Space heating per m2											(98) / (4) =	42.6999	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5902.0890	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1129.2278	899.3855	773.1382	461.5236	210.6927	0.0000	0.0000	0.0000	0.0000	457.4665	819.1710	1151.4838	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4877	88.3259	87.9770	87.1534	85.3324	80.3000	80.3000	80.3000	80.3000	87.0532	88.1123	88.5550	(217)
Fuel for water heating, kWh/month													
	247.2841	218.3236	230.1199	208.1283	206.2758	193.0620	184.9681	206.1960	207.9563	216.0708	225.8610	241.1151	(219)
Water heating fuel used												2585.3610	(219)
Annual totals kWh/year													
Space heating fuel - main system												5902.0890	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												501.3605	(232)
Total delivered energy for all uses												9063.8106	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5902.0890	0.2160	1274.8512	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.3610	0.2160	558.4380	(264)
Space and water heating			1833.2892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	501.3605	0.5190	260.2061	(268)
Total CO2, kg/m2/year			2132.4203	(272)
Emissions per m2 for space and water heating			14.2005	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0155	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2005 * 1.00) + 2.0155 + 0.3015, rounded to 2 d.p.			16.5200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 277 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 277	**Prop Type Ref**	
Property	Buridge Det, Plot 277, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.52	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	5.09	$kgCO_2/m^2$	Pass
	-11.43 (-69.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.36	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.58	$kWh/m^2/yr$	
	-9.8 (-18.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	10.51 m², No overhang 7.51 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K	
Thermal bridging y-value	0.020	W/m²K	
Photovoltaic array	3.24	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 277 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 277	**Prop Type Ref**	
Property	Buridge Det, Plot 277, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.54 m	64.55 m²	2.39 m
1st Storey:	32.54 m	64.55 m²	2.63 m

7.0 Living Area	14.69	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	201.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	163.01	140.75

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	South East							2.12	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.052	No
Independently assessed	E3 Sill	12.36	0.004	No
Independently assessed	E4 Jamb	33.30	0.005	No
Independently assessed	E5 Ground floor (normal)	32.54	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.051	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff | Standard

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 277 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 277	**Prop Type Ref**	
Property	Buridge Det, Plot 277, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	5.09	$kgCO_2/yr/m^2$	
TER	16.52	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.09	$kgCO_2/yr/m^2$	
Reduction DER/TER	69.18	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.58	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	17.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.10	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	32	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 278 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 278	**Prop Type Ref**	
Property	Buridge Det, Plot 278, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.52 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 10.51 m², No overhang
Windows facing North West: 7.51 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6611	0.6530	0.6449	0.6046	0.5966	0.5563	0.5563	0.5482	0.5724	0.5966	0.6127	0.6288	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.0200	1.2357	22.2681			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1400	9.0370			(28a)
External Wall	163.0100	22.2600	140.7500	0.2100	29.5575			(29a)
Main Roof	64.5500		64.5500	0.0700	4.5185			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.7411			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9257	(36)
Total fabric heat loss					(33) + (36) =		77.6668	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.6903	69.8284	68.9665	64.6570	63.7951	59.4856	59.4856	58.6237	61.2094	63.7951	65.5189	67.2427	(38)
Heat transfer coeff	148.3571	147.4952	146.6333	142.3238	141.4619	137.1524	137.1524	136.2905	138.8762	141.4619	143.1857	144.9095	(39)
Average = Sum(39)m / 12 =												142.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1425	1.1358	1.1024	1.0958	1.0624	1.0624	1.0557	1.0757	1.0958	1.1091	1.1225	(40)
HLP (average)												1.1008	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8377 10.6849 11.8132 11.4103 11.7698 11.3641 11.7267 11.7547 11.3887 11.7916 11.4367 11.8298 (61)
Total heat required for water heating calculated for each month
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (64)
Total per year (kWh/year) = Sum(64)m = 1757.8213 (64)
Heat gains from water heating, kWh/month
58.7719 51.4852 53.3249 46.7678 45.0801 39.2026 36.6260 41.6034 41.9737 48.5461 52.6332 57.0088 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
26.6397 23.6611 19.2425 14.5678 10.8896 9.1935 9.9339 12.9124 17.3310 22.0057 25.6839 27.3801 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
296.6325 299.7107 291.9539 275.4407 254.5957 235.0044 221.9162 218.8380 226.5948 243.1080 263.9530 283.5443 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 (71)
Water heating gains (Table 5)
78.9945 76.6148 71.6733 64.9552 60.5916 54.4481 49.2286 55.9186 58.2969 65.2502 73.1017 76.6248 (72)
Total internal gains
471.6560 469.3759 452.2590 424.3530 395.4662 368.0352 350.4679 357.0584 371.6120 399.7532 432.1279 456.9385 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.4100	1.0000	0.7700	109.8740	(77)
Northwest	7.5100	11.2829	0.4100	1.0000	0.7700	24.0757	(81)

Solar gains	133.9497	236.1629	344.3698	462.2947	550.3061	560.6212	534.5499	466.7040	384.8636	266.7375	161.8972	113.6907	(83)
Total gains	605.6057	705.5388	796.6287	886.6477	945.7723	928.6564	885.0178	823.7624	756.4756	666.4907	594.0251	570.6291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5860	48.8700	49.1572	50.6457	50.9542	52.5553	52.5553	52.8877	51.9029	50.9542	50.3408	49.7420	
alpha	4.2391	4.2580	4.2771	4.3764	4.3969	4.5037	4.5037	4.5258	4.4602	4.3969	4.3561	4.3161	
util living area	0.9981	0.9960	0.9906	0.9727	0.9208	0.7945	0.6379	0.6932	0.8988	0.9829	0.9964	0.9985	(86)
MIT	19.3872	19.5584	19.8454	20.2523	20.6126	20.8772	20.9658	20.9509	20.7565	20.2892	19.7855	19.3852	(87)
Th 2	19.9609	19.9663	19.9717	19.9988	20.0043	20.0317	20.0317	20.0372	20.0207	20.0043	19.9934	19.9825	(88)
util rest of house	0.9975	0.9948	0.9876	0.9633	0.8911	0.7185	0.5169	0.5762	0.8492	0.9755	0.9951	0.9981	(89)
MIT 2	17.7927	18.0463	18.4684	19.0746	19.5807	19.9318	20.0147	20.0100	19.7902	19.1366	18.3970	17.8041	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9918	0.9819	0.9532	0.8796	0.7192	0.5291	0.5868	0.8415	0.9675	0.9923	0.9968	(94)
Useful gains	603.0741	699.7351	782.2344	845.1689	831.9359	667.8904	468.2726	483.4175	636.6073	644.8351	589.4648	568.7997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2028.6587	1964.3926	1777.9449	1467.1620	1131.4343	746.0240	483.1743	506.6036	805.5096	1226.1510	1640.1846	1997.4372	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating												5573.8788	(98)
Space heating per m2											(98) / (4) =	43.1749	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5999.8696	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1141.6953	914.8007	797.4259	482.0614	239.8566	0.0000	0.0000	0.0000	0.0000	465.5533	814.3361	1144.1402	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4218	89.3842	89.3046	89.1020	88.6459	86.7000	86.7000	86.7000	86.7000	89.0580	89.3211	89.4348	(217)
Fuel for water heating, kWh/month													
	200.9517	176.1986	182.8648	161.0357	156.2392	139.2414	130.4073	147.6813	148.8611	167.2271	180.3975	194.9917	(219)
Water heating fuel used												1986.0976	(219)
Annual totals kWh/year													
Space heating fuel - main system												5999.8696	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.4651	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1004 * 1.00) =										-2602.3582		-2602.3582	(233)
Total delivered energy for all uses												5929.0741	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5999.8696	0.2160	1295.9718	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1986.0976	0.2160	428.9971	(264)
Space and water heating			1724.9689	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.4651	0.5190	244.1714	(268)
Energy saving/generation technologies				
PV Unit	-2602.3582	0.5190	-1350.6239	(269)
Total CO2, kg/year			657.4414	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.0900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.0900	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		20.1652	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.1652	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.0200	1.3258	23.8902			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.2600	140.7500	0.1800	25.3350			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.0962			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0549	(36)
Total fabric heat loss					(33) + (36) =		83.1511	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.3754	145.0354	144.7020	143.1364	142.8434	141.4798	141.4798	141.2273	142.0051	142.8434	143.4360	144.0556	(39)
Average = Sum(39)m / 12 =												143.1350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1261	1.1234	1.1209	1.1087	1.1065	1.0959	1.0959	1.0939	1.1000	1.1065	1.1110	1.1158	(40)
HLP (average)												1.1087	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3891	25.2150	20.5062	15.5245	11.6047	9.7972	10.5862	13.7604	18.4692	23.4508	27.3706	29.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.5510	484.0780	466.6764	438.4711	408.7890	380.5509	363.0376	370.5191	385.9190	414.3594	446.9668	471.8847	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.6300	0.7000	0.7700	118.1815	(77)
Northwest	7.5100	11.2829	0.6300	0.7000	0.7700	25.8961	(81)

Solar gains	144.0776	254.0191	370.4075	497.2487	591.9147	603.0096	574.9671	501.9914	413.9631	286.9055	174.1382	122.2868	(83)
Total gains	630.6286	738.0970	837.0839	935.7197	1000.7037	983.5606	938.0047	872.5105	799.8820	701.2649	621.1050	594.1715	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6698	61.8144	61.9568	62.6345	62.7630	63.3679	63.3679	63.4812	63.1335	62.7630	62.5037	62.2349	
alpha	5.1113	5.1210	5.1305	5.1756	5.1842	5.2245	5.2245	5.2321	5.2089	5.1842	5.1669	5.1490	
util living area													
	0.9992	0.9981	0.9946	0.9806	0.9313	0.8027	0.6352	0.6962	0.9109	0.9891	0.9983	0.9995	(86)
MIT	19.6866	19.8316	20.0744	20.4031	20.7093	20.9148	20.9804	20.9690	20.8156	20.4193	19.9935	19.6631	(87)
Th 2	19.9796	19.9817	19.9838	19.9937	19.9956	20.0042	20.0042	20.0058	20.0009	19.9956	19.9918	19.9879	(88)
util rest of house													
	0.9990	0.9975	0.9925	0.9723	0.9001	0.7187	0.5057	0.5686	0.8578	0.9832	0.9976	0.9993	(89)
MIT 2	18.2145	18.4280	18.7838	19.2658	19.6903	19.9421	19.9963	19.9917	19.8376	19.2947	18.6724	18.1861	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9960	0.9893	0.9656	0.8928	0.7234	0.5200	0.5822	0.8543	0.9782	0.9963	0.9988	(94)
Useful gains	629.5660	735.1675	828.1612	903.5436	893.4307	711.4650	487.7849	507.9381	683.3457	685.9616	618.8191	593.4349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2047.1718	1985.2063	1798.7406	1502.2423	1157.9293	771.4588	496.3528	522.9454	830.5725	1260.2542	1681.4659	2038.9805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating												5512.5512	(98)
Space heating per m2											(98) / (4) =	42.6999	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5902.0890	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1129.2278	899.3855	773.1382	461.5236	210.6927	0.0000	0.0000	0.0000	0.0000	457.4665	819.1710	1151.4838	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4877	88.3259	87.9770	87.1534	85.3324	80.3000	80.3000	80.3000	80.3000	87.0532	88.1123	88.5550	(217)
Fuel for water heating, kWh/month													
	247.2841	218.3236	230.1199	208.1283	206.2758	193.0620	184.9681	206.1960	207.9563	216.0708	225.8610	241.1151	(219)
Water heating fuel used												2585.3610	(219)
Annual totals kWh/year													
Space heating fuel - main system												5902.0890	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												501.3605	(232)
Total delivered energy for all uses												9063.8106	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5902.0890	0.2160	1274.8512	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.3610	0.2160	558.4380	(264)
Space and water heating			1833.2892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	501.3605	0.5190	260.2061	(268)
Total CO2, kg/m2/year			2132.4203	(272)
Emissions per m2 for space and water heating			14.2005	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0155	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2005 * 1.00) + 2.0155 + 0.3015, rounded to 2 d.p.			16.5200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 278 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 278	**Prop Type Ref**	
Property	Buridge Det, Plot 278, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.52	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	5.09	$kgCO_2/m^2$	Pass
	-11.43 (-69.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.36	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.58	$kWh/m^2/yr$	
	-9.8 (-18.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	10.51 m², No overhang 7.51 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K	
Thermal bridging y-value	0.020	W/m²K	
Photovoltaic array	3.24	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 278 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 278	**Prop Type Ref**	
Property	Buridge Det, Plot 278, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.54 m	64.55 m²	2.39 m
1st Storey:	32.54 m	64.55 m²	2.63 m

7.0 Living Area	14.69	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	201.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	163.01	140.75

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	South East							2.12	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.052	No
Independently assessed	E3 Sill	12.36	0.004	No
Independently assessed	E4 Jamb	33.30	0.005	No
Independently assessed	E5 Ground floor (normal)	32.54	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.051	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff | Standard

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 278 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 278	**Prop Type Ref**	
Property	Buridge Det, Plot 278, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	5.09	$kgCO_2/yr/m^2$	
TER	16.52	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.09	$kgCO_2/yr/m^2$	
Reduction DER/TER	69.18	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.58	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	17.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.10	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	32	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 279 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 279	**Prop Type Ref**	
Property	Buridge Det, Plot 279, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.52 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 10.51 m², No overhang
Windows facing North West: 7.51 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1543	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6611	0.6530	0.6449	0.6046	0.5966	0.5563	0.5563	0.5482	0.5724	0.5966	0.6127	0.6288	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.0200	1.2357	22.2681			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1400	9.0370			(28a)
External Wall	163.0100	22.2600	140.7500	0.2100	29.5575			(29a)
Main Roof	64.5500		64.5500	0.0700	4.5185			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.7411			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							201.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9257	(36)
Total fabric heat loss					(33) + (36) =		77.6668	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.6903	69.8284	68.9665	64.6570	63.7951	59.4856	59.4856	58.6237	61.2094	63.7951	65.5189	67.2427	(38)
Heat transfer coeff	148.3571	147.4952	146.6333	142.3238	141.4619	137.1524	137.1524	136.2905	138.8762	141.4619	143.1857	144.9095	(39)
Average = Sum(39)m / 12 =												142.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1492	1.1425	1.1358	1.1024	1.0958	1.0624	1.0624	1.0557	1.0757	1.0958	1.1091	1.1225	(40)
HLP (average)												1.1008	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8377 10.6849 11.8132 11.4103 11.7698 11.3641 11.7267 11.7547 11.3887 11.7916 11.4367 11.8298 (61)
Total heat required for water heating calculated for each month
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
179.6947 157.4937 163.3067 143.4861 138.4996 120.7223 113.0632 128.0397 129.0626 148.9292 161.1331 174.3903 (64)
Total per year (kWh/year) = Sum(64)m = 1757.8213 (64)
Heat gains from water heating, kWh/month
58.7719 51.4852 53.3249 46.7678 45.0801 39.2026 36.6260 41.6034 41.9737 48.5461 52.6332 57.0088 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
26.6397 23.6611 19.2425 14.5678 10.8896 9.1935 9.9339 12.9124 17.3310 22.0057 25.6839 27.3801 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
296.6325 299.7107 291.9539 275.4407 254.5957 235.0044 221.9162 218.8380 226.5948 243.1080 263.9530 283.5443 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 37.4631 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 -115.7048 (71)
Water heating gains (Table 5)
78.9945 76.6148 71.6733 64.9552 60.5916 54.4481 49.2286 55.9186 58.2969 65.2502 73.1017 76.6248 (72)
Total internal gains
471.6560 469.3759 452.2590 424.3530 395.4662 368.0352 350.4679 357.0584 371.6120 399.7532 432.1279 456.9385 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.4100	1.0000	0.7700	109.8740	(77)
Northwest	7.5100	11.2829	0.4100	1.0000	0.7700	24.0757	(81)

Solar gains	133.9497	236.1629	344.3698	462.2947	550.3061	560.6212	534.5499	466.7040	384.8636	266.7375	161.8972	113.6907	(83)
Total gains	605.6057	705.5388	796.6287	886.6477	945.7723	928.6564	885.0178	823.7624	756.4756	666.4907	594.0251	570.6291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5860	48.8700	49.1572	50.6457	50.9542	52.5553	52.5553	52.8877	51.9029	50.9542	50.3408	49.7420	
alpha	4.2391	4.2580	4.2771	4.3764	4.3969	4.5037	4.5037	4.5258	4.4602	4.3969	4.3561	4.3161	
util living area	0.9981	0.9960	0.9906	0.9727	0.9208	0.7945	0.6379	0.6932	0.8988	0.9829	0.9964	0.9985	(86)
MIT	19.3872	19.5584	19.8454	20.2523	20.6126	20.8772	20.9658	20.9509	20.7565	20.2892	19.7855	19.3852	(87)
Th 2	19.9609	19.9663	19.9717	19.9988	20.0043	20.0317	20.0317	20.0372	20.0207	20.0043	19.9934	19.9825	(88)
util rest of house	0.9975	0.9948	0.9876	0.9633	0.8911	0.7185	0.5169	0.5762	0.8492	0.9755	0.9951	0.9981	(89)
MIT 2	17.7927	18.0463	18.4684	19.0746	19.5807	19.9318	20.0147	20.0100	19.7902	19.1366	18.3970	17.8041	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9742	18.2184	18.6251	19.2086	19.6982	20.0394	20.1229	20.1171	19.9002	19.2677	18.5549	17.9840	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9918	0.9819	0.9532	0.8796	0.7192	0.5291	0.5868	0.8415	0.9675	0.9923	0.9968	(94)
Useful gains	603.0741	699.7351	782.2344	845.1689	831.9359	667.8904	468.2726	483.4175	636.6073	644.8351	589.4648	568.7997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2028.6587	1964.3926	1777.9449	1467.1620	1131.4343	746.0240	483.1743	506.6036	805.5096	1226.1510	1640.1846	1997.4372	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating												5573.8788	(98)
Space heating per m2											(98) / (4) =	43.1749	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5999.8696	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1060.6349	849.8499	740.8086	447.8351	222.8268	0.0000	0.0000	0.0000	0.0000	432.4990	756.5183	1062.9063	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1141.6953	914.8007	797.4259	482.0614	239.8566	0.0000	0.0000	0.0000	0.0000	465.5533	814.3361	1144.1402	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4218	89.3842	89.3046	89.1020	88.6459	86.7000	86.7000	86.7000	86.7000	89.0580	89.3211	89.4348	(217)
Fuel for water heating, kWh/month													
	200.9517	176.1986	182.8648	161.0357	156.2392	139.2414	130.4073	147.6813	148.8611	167.2271	180.3975	194.9917	(219)
Water heating fuel used												1986.0976	(219)
Annual totals kWh/year													
Space heating fuel - main system												5999.8696	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.4651	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 1004 * 1.00) =										-2602.3582		-2602.3582	(233)
Total delivered energy for all uses												5929.0741	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5999.8696	0.2160	1295.9718	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1986.0976	0.2160	428.9971	(264)
Space and water heating			1724.9689	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.4651	0.5190	244.1714	(268)
Energy saving/generation technologies				
PV Unit	-2602.3582	0.5190	-1350.6239	(269)
Total CO2, kg/year			657.4414	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.0900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.0900	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		20.1652	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.1652	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.3900 (2b)	=	154.2745	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	324.0410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1234	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3734	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4047	0.3968	0.3888	0.3492	0.3412	0.3016	0.3016	0.2936	0.3174	0.3412	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			18.0200	1.3258	23.8902			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	163.0100	22.2600	140.7500	0.1800	25.3350			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			292.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.0962			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.0549	(36)
Total fabric heat loss					(33) + (36) =		83.1511	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2244	61.8843	61.5510	59.9853	59.6924	58.3287	58.3287	58.0762	58.8540	59.6924	60.2850	60.9045	(38)
Heat transfer coeff	145.3754	145.0354	144.7020	143.1364	142.8434	141.4798	141.4798	141.2273	142.0051	142.8434	143.4360	144.0556	(39)
Average = Sum(39)m / 12 =												143.1350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1261	1.1234	1.1209	1.1087	1.1065	1.0959	1.0959	1.0939	1.1000	1.1065	1.1110	1.1158	(40)
HLP (average)												1.1087	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.3891	25.2150	20.5062	15.5245	11.6047	9.7972	10.5862	13.7604	18.4692	23.4508	27.3706	29.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	486.5510	484.0780	466.6764	438.4711	408.7890	380.5509	363.0376	370.5191	385.9190	414.3594	446.9668	471.8847	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	10.5100	36.7938	0.6300	0.7000	0.7700	118.1815	(77)
Northwest	7.5100	11.2829	0.6300	0.7000	0.7700	25.8961	(81)

Solar gains	144.0776	254.0191	370.4075	497.2487	591.9147	603.0096	574.9671	501.9914	413.9631	286.9055	174.1382	122.2868	(83)
Total gains	630.6286	738.0970	837.0839	935.7197	1000.7037	983.5606	938.0047	872.5105	799.8820	701.2649	621.1050	594.1715	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6698	61.8144	61.9568	62.6345	62.7630	63.3679	63.3679	63.4812	63.1335	62.7630	62.5037	62.2349	
alpha	5.1113	5.1210	5.1305	5.1756	5.1842	5.2245	5.2245	5.2321	5.2089	5.1842	5.1669	5.1490	
util living area													
	0.9992	0.9981	0.9946	0.9806	0.9313	0.8027	0.6352	0.6962	0.9109	0.9891	0.9983	0.9995	(86)
MIT	19.6866	19.8316	20.0744	20.4031	20.7093	20.9148	20.9804	20.9690	20.8156	20.4193	19.9935	19.6631	(87)
Th 2	19.9796	19.9817	19.9838	19.9937	19.9956	20.0042	20.0042	20.0058	20.0009	19.9956	19.9918	19.9879	(88)
util rest of house													
	0.9990	0.9975	0.9925	0.9723	0.9001	0.7187	0.5057	0.5686	0.8578	0.9832	0.9976	0.9993	(89)
MIT 2	18.2145	18.4280	18.7838	19.2658	19.6903	19.9421	19.9963	19.9917	19.8376	19.2947	18.6724	18.1861	(90)
Living area fraction									fLA = Living area / (4) =			0.1138	(91)
MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3820	18.5877	18.9307	19.3952	19.8063	20.0528	20.1083	20.1029	19.9489	19.4226	18.8228	18.3541	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9960	0.9893	0.9656	0.8928	0.7234	0.5200	0.5822	0.8543	0.9782	0.9963	0.9988	(94)
Useful gains	629.5660	735.1675	828.1612	903.5436	893.4307	711.4650	487.7849	507.9381	683.3457	685.9616	618.8191	593.4349	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2047.1718	1985.2063	1798.7406	1502.2423	1157.9293	771.4588	496.3528	522.9454	830.5725	1260.2542	1681.4659	2038.9805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating												5512.5512	(98)
Space heating per m2											(98) / (4) =	42.6999	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5902.0890	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1054.6987	840.0260	722.1111	431.0631	196.7870	0.0000	0.0000	0.0000	0.0000	427.2737	765.1057	1075.4859	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1129.2278	899.3855	773.1382	461.5236	210.6927	0.0000	0.0000	0.0000	0.0000	457.4665	819.1710	1151.4838	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.4877	88.3259	87.9770	87.1534	85.3324	80.3000	80.3000	80.3000	80.3000	87.0532	88.1123	88.5550	(217)
Fuel for water heating, kWh/month													
	247.2841	218.3236	230.1199	208.1283	206.2758	193.0620	184.9681	206.1960	207.9563	216.0708	225.8610	241.1151	(219)
Water heating fuel used												2585.3610	(219)
Annual totals kWh/year													
Space heating fuel - main system												5902.0890	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												501.3605	(232)
Total delivered energy for all uses												9063.8106	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5902.0890	0.2160	1274.8512	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.3610	0.2160	558.4380	(264)
Space and water heating			1833.2892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	501.3605	0.5190	260.2061	(268)
Total CO2, kg/m2/year			2132.4203	(272)
Emissions per m2 for space and water heating			14.2005	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0155	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2005 * 1.00) + 2.0155 + 0.3015, rounded to 2 d.p.			16.5200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 279 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 279	**Prop Type Ref**	
Property	Buridge Det, Plot 279, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.52	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	5.09	$kgCO_2/m^2$	Pass
	-11.43 (-69.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.36	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.58	$kWh/m^2/yr$	
	-9.8 (-18.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing North West	10.51 m², No overhang 7.51 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K	
Thermal bridging y-value	0.020	W/m²K	
Photovoltaic array	3.24	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 279 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 279	**Prop Type Ref**	
Property	Buridge Det, Plot 279, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	32.54 m	64.55 m²	2.39 m
1st Storey:	32.54 m	64.55 m²	2.63 m

7.0 Living Area	14.69	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	201.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	163.01	140.75

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	64.55	64.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	64.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 10	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.90	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.71	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
D2 (W10)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
D3	Half Glazed Door	[1] External Wall	South East							2.12	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	16.19	0.052	No
Independently assessed	E3 Sill	12.36	0.004	No
Independently assessed	E4 Jamb	33.30	0.005	No
Independently assessed	E5 Ground floor (normal)	32.54	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	32.54	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.81	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.73	0.051	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing | Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System | No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

23.0 Electricity Tariff | Standard

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 279 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 279	**Prop Type Ref**	
Property	Buridge Det, Plot 279, Boorley Gardens, Southampton, SO32		

SAP Rating	97 A	**DER**	5.09	**TER**	16.52
Environmental	97 A	**% DER<TER**	69.18		
CO_2 Emissions (t/year)	0.09	**DFEE**	44.58	**TFEE**	54.36
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.99		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	129.1	m^2	
DER	5.09	$kgCO_2/yr/m^2$	
TER	16.52	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.09	$kgCO_2/yr/m^2$	
Reduction DER/TER	69.18	%	
CfSH ENE1 credits achieved	6.9		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.58	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	129.1	m^2	
DER	17.56	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.10	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.62	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.46	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.18	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	32	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 280 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 280	**Prop Type Ref**	
Property	Marwell Det, Plot 280, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	6.09	**TER**	17.49
Environmental	96 A	**% DER<TER**	65.17		
CO_2 Emissions (t/year)	0.19	**DFEE**	47.54	**TFEE**	58.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 120 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing North East: 6.41 m², No overhang
Windows facing East: 1.04 m², No overhang
Windows facing South East: 8.09 m², No overhang
Windows facing North West: 6.92 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 3.25 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1662	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3912	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3325	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4239	0.4156	0.4073	0.3657	0.3574	0.3159	0.3159	0.3076	0.3325	0.3574	0.3741	0.3907	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6739	0.6656	0.6573	0.6157	0.6074	0.5659	0.5659	0.5576	0.5825	0.6074	0.6241	0.6407	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			23.5000	1.2357	29.0399			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			60.5600	0.1400	8.4784			(28a)
External Wall	170.8400	25.6200	145.2200	0.2100	30.4962			(29a)
Main Roof	59.3800		59.3800	0.0700	4.1566			(30)
Bay roof	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.5383			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	205.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.3260	(36)
Total fabric heat loss	(33) + (36) = 81.8644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	66.9203	66.0949	65.2695	61.1425	60.3171	56.1901	56.1901	55.3647	57.8409	60.3171	61.9679	63.6187	(38)
Heat transfer coeff	148.7847	147.9593	147.1339	143.0069	142.1815	138.0545	138.0545	137.2291	139.7053	142.1815	143.8323	145.4831	(39)
Average = Sum(39)m / 12 =												142.8005	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2405	1.2336	1.2267	1.1923	1.1854	1.1510	1.1510	1.1441	1.1648	1.1854	1.1992	1.2130	(40)
HLP (average)												1.1906	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8360	10.6834	11.8116	11.4090	11.7673	11.3621	11.7248	11.7524	11.3875	11.7902	11.4352	11.8281 (61)

Total heat required for water heating calculated for each month

	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805 (64)

Total per year (kWh/year) = Sum(64)m = 1746.7634 (64)

Heat gains from water heating, kWh/month

	58.3910	51.1520	52.9811	46.4680	44.7922	38.9542	36.3959	41.3393	41.7067	48.2349	52.2935	56.6399 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	25.4200	22.5778	18.3615	13.9008	10.3910	8.7726	9.4791	12.3212	16.5375	20.9982	24.5080	26.1265	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)

Water heating gains (Table 5)

	78.4825	76.1191	71.2112	64.5390	60.2046	54.1031	48.9192	55.5636	57.9260	64.8319	72.6299	76.1289	(72)

Total internal gains

	457.9838	455.7370	439.1567	412.1506	384.2695	357.7175	340.6591	347.1869	361.2217	388.4615	419.8063	443.7558	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.4100	1.0000	0.7700	3.1421	(74)
Northeast	6.4100	11.2829	0.4100	1.0000	0.7700	20.5493	(75)
East	1.0400	19.6403	0.4100	1.0000	0.7700	5.8036	(76)
Southeast	8.0900	36.7938	0.4100	1.0000	0.7700	84.5747	(77)
Northwest	6.9200	11.2829	0.4100	1.0000	0.7700	22.1843	(81)

Solar gains	136.2541	248.4054	382.7326	545.2687	675.0246	698.2653	661.5103	560.5075	438.4098	286.1417	166.1836	114.6688	(83)
Total gains	594.2378	704.1424	821.8893	957.4193	1059.2940	1055.9828	1002.1695	907.6944	799.6316	674.6032	585.9899	558.4246	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.9047	46.1608	46.4197	47.7594	48.0366	49.4726	49.4726	49.7702	48.8880	48.0366	47.4853	46.9465	
alpha	4.0603	4.0774	4.0946	4.1840	4.2024	4.2982	4.2982	4.3180	4.2592	4.2024	4.1657	4.1298	
util living area	0.9977	0.9951	0.9875	0.9606	0.8856	0.7328	0.5763	0.6438	0.8771	0.9796	0.9957	0.9983	(86)
MIT	19.3055	19.4917	19.8126	20.2665	20.6519	20.8999	20.9727	20.9572	20.7610	20.2589	19.7209	19.3003	(87)
Th 2	19.8877	19.8932	19.8987	19.9261	19.9317	19.9594	19.9594	19.9649	19.9483	19.9317	19.9206	19.9096	(88)
util rest of house	0.9970	0.9936	0.9836	0.9473	0.8458	0.6471	0.4536	0.5211	0.8185	0.9705	0.9942	0.9978	(89)
MIT 2	17.6224	17.8979	18.3685	19.0385	19.5674	19.8837	19.9470	19.9432	19.7316	19.0397	18.2514	17.6292	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	17.8643	18.1270	18.5761	19.2150	19.7233	20.0298	20.0945	20.0889	19.8796	19.2149	18.4626	17.8694	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8643	18.1270	18.5761	19.2150	19.7233	20.0298	20.0945	20.0889	19.8796	19.2149	18.4626	17.8694	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9900	0.9767	0.9356	0.8365	0.6535	0.4704	0.5370	0.8138	0.9616	0.9910	0.9962	(94)
Useful gains	591.3044	697.1233	802.7125	895.7927	886.0713	690.0517	471.3924	487.3959	650.7150	648.7292	580.7219	556.3038	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2018.1653	1957.0590	1776.8057	1475.1158	1140.7670	749.6040	482.4251	506.2305	807.4347	1224.8856	1634.3132	1988.6629	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1061.5845	846.6768	724.7253	417.1126	189.4936	0.0000	0.0000	0.0000	0.0000	428.6603	758.5857	1065.6751	(98)
Space heating												5492.5140	(98)
Space heating per m2										(98) / (4) =		45.7938	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5912.2863	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1061.5845	846.6768	724.7253	417.1126	189.4936	0.0000	0.0000	0.0000	0.0000	428.6603	758.5857	1065.6751	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1142.7174	911.3851	780.1134	448.9909	203.9759	0.0000	0.0000	0.0000	0.0000	461.4212	816.5616	1147.1207	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.5487	156.4914	162.2724	142.5843	137.6332	119.9747	112.3704	127.2447	128.2592	147.9929	160.1111	173.2805	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4248	89.3853	89.2970	89.0626	88.5253	86.7000	86.7000	86.7000	86.7000	89.0564	89.3254	89.4383	(217)
Fuel for water heating, kWh/month													
	199.6635	175.0750	181.7220	160.0945	155.4733	138.3792	129.6083	146.7643	147.9344	166.1788	179.2447	193.7430	(219)
Water heating fuel used												1973.8810	(219)
Annual totals kWh/year													
Space heating fuel - main system												5912.2863	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												448.9251	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1004 * 1.00) =										-979.9003		-2398.1757	
PV Unit 1 (0.80 * 1.22 * 1004 * 1.00) =										-979.9003		-2398.1757	
PV Unit 2 (0.80 * 0.81 * 677 * 1.00) =										-438.3751		-2398.1757	(233)
Total delivered energy for all uses												6011.9167	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5912.2863	0.2160	1277.0538	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.8810	0.2160	426.3583	(264)
Space and water heating			1703.4121	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	448.9251	0.5190	232.9921	(268)
Energy saving/generation technologies				
PV Unit	-2398.1757	0.5190	-1244.6532	(269)
Total CO2, kg/year			730.6761	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.0900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.0900	ZC1
Total Floor Area	TFA	119.9400	
Assumed number of occupants	N	2.8631	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.0875	ZC2
CO2 emissions from cooking, equation (L16)		1.5651	ZC3
Total CO2 emissions		21.7425	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		21.7425	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	60.5600 (1b)	x	2.3900 (2b)	=	144.7384	(1b) - (3b)
First floor	59.3800 (1c)	x	2.6300 (2c)	=	156.1694	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.9400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	300.9078	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1329	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3829	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3255	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4150	0.4069	0.3987	0.3580	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825	(22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			23.5000	1.3258	31.1553			(27)
Ground floor			60.5600	0.1300	7.8728			(28a)
External Wall	170.8400	25.6200	145.2200	0.1800	26.1396			(29a)
Main Roof	59.3800		59.3800	0.1300	7.7194			(30)
Bay roof	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			291.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.5832			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3718	(36)
Total fabric heat loss (33) + (36) =	88.9550	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2008	57.8687	57.5433	56.0145	55.7285	54.3971	54.3971	54.1505	54.9099	55.7285	56.3071	56.9121	(38)
Heat transfer coeff	147.1558	146.8237	146.4983	144.9695	144.6835	143.3521	143.3521	143.1055	143.8649	144.6835	145.2621	145.8671	(39)
Average = Sum(39)m / 12 =												144.9682	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2269	1.2241	1.2214	1.2087	1.2063	1.1952	1.1952	1.1931	1.1995	1.2063	1.2111	1.2162	(40)
HLP (average)												1.2087	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8631 (42)
Average daily hot water use (litres/day)	102.1982 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.4180	108.3301	104.2422	100.1542	96.0663	91.9784	91.9784	96.0663	100.1542	104.2422	108.3301	112.4180	(44)
Energy conte	166.7127	145.8080	150.4608	131.1753	125.8659	108.6127	100.6456	115.4923	116.8717	136.2026	148.6758	161.4523	(45)
Energy content (annual)										Total = Sum(45)m =		1607.9757	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0069	21.8712	22.5691	19.6763	18.8799	16.2919	15.0968	17.3238	17.5307	20.4304	22.3014	24.2179	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	48.9543	45.3592	46.8712	48.9543	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112 (64)
								Total per year (kWh/year) = Sum(64)m =				2195.9230 (64)
Heat gains from water heating, kWh/month												
	68.1717	59.9880	62.7679	55.9446	54.0890	47.4535	45.1825	50.6398	51.1886	58.0271	61.7635	66.4226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	143.1541	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.6574	22.7887	18.5330	14.0307	10.4881	8.8545	9.5676	12.4363	16.6920	21.1943	24.7369	26.3705	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.1350	288.0939	280.6377	264.7646	244.7276	225.8956	213.3147	210.3559	217.8120	233.6851	253.7222	272.5541	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	37.3154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	-114.5233	(71)
Water heating gains (Table 5)													
	91.6286	89.2679	84.3655	77.7008	72.7003	65.9077	60.7291	68.0642	71.0953	77.9934	85.7826	89.2777	(72)
Total internal gains													
	471.3673	469.0966	452.4825	425.4423	396.8621	369.6040	352.5576	359.8026	374.5455	401.8191	433.1879	457.1486	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
Northeast	6.4100	11.2829	0.6300	0.7000	0.7700	22.1030	(75)
East	1.0400	19.6403	0.6300	0.7000	0.7700	6.2424	(76)
Southeast	8.0900	36.7938	0.6300	0.7000	0.7700	90.9694	(77)
Northwest	6.9200	11.2829	0.6300	0.7000	0.7700	23.8616	(81)

Solar gains	146.5562	267.1873	411.6709	586.4963	726.0630	751.0610	711.5269	602.8874	471.5579	307.7768	178.7487	123.3389	(83)
Total gains	617.9235	736.2839	864.1534	1011.9386	1122.9252	1120.6650	1064.0846	962.6900	846.1034	709.5959	611.9366	580.4874	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6010	56.7290	56.8551	57.4546	57.5682	58.1029	58.1029	58.2030	57.8957	57.5682	57.3389	57.1011	
alpha	4.7734	4.7819	4.7903	4.8303	4.8379	4.8735	4.8735	4.8802	4.8597	4.8379	4.8226	4.8067	
util living area													
	0.9990	0.9974	0.9920	0.9691	0.8942	0.7377	0.5730	0.6459	0.8882	0.9859	0.9978	0.9992	(86)
MIT	19.5790	19.7411	20.0206	20.4007	20.7354	20.9295	20.9836	20.9717	20.8129	20.3760	19.9092	19.5528	(87)
Th 2	19.8985	19.9007	19.9029	19.9131	19.9150	19.9238	19.9238	19.9255	19.9204	19.9150	19.9111	19.9071	(88)
util rest of house													
	0.9986	0.9965	0.9889	0.9565	0.8514	0.6437	0.4428	0.5132	0.8250	0.9782	0.9969	0.9990	(89)
MIT 2	18.0003	18.2387	18.6475	19.1997	19.6510	19.8763	19.9178	19.9136	19.7621	19.1730	18.4922	17.9679	(90)
Living area fraction									fLA = Living area / (4) =			0.1437	(91)
MIT	18.2272	18.4546	18.8448	19.3723	19.8068	20.0277	20.0710	20.0656	19.9131	19.3459	18.6959	18.1957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2272	18.4546	18.8448	19.3723	19.8068	20.0277	20.0710	20.0656	19.9131	19.3459	18.6959	18.1957	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9846	0.9481	0.8462	0.6537	0.4614	0.5317	0.8245	0.9723	0.9952	0.9983	(94)
Useful gains	616.5110	732.2773	850.8461	959.4466	950.2641	732.5415	490.9823	511.8826	697.5922	689.9419	608.9778	579.5022	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2049.4703	1990.1438	1808.4975	1518.1703	1172.9261	778.0676	497.5785	524.5738	836.3034	1265.3916	1684.4471	2041.5133	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1066.1217	845.2863	712.4926	402.2811	165.6605	0.0000	0.0000	0.0000	0.0000	428.1346	774.3379	1087.7363	(98)
Space heating												5482.0509	(98)
Space heating per m2											(98) / (4) =	45.7066	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5869.4335	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1066.1217	845.2863	712.4926	402.2811	165.6605	0.0000	0.0000	0.0000	0.0000	428.1346	774.3379	1087.7363	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1141.4579	905.0174	762.8401	430.7078	177.3667	0.0000	0.0000	0.0000	0.0000	458.3882	829.0555	1164.5999	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.6716	191.8354	201.4197	180.4904	174.8202	153.9719	147.5168	164.4467	166.1867	187.1615	197.9909	212.4112	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5124	88.3447	87.9616	87.0105	84.9160	80.3000	80.3000	80.3000	80.3000	87.0688	88.1425	88.5798	(217)
Fuel for water heating, kWh/month													
	245.9222	217.1443	228.9858	207.4352	205.8742	191.7458	183.7071	204.7903	206.9573	214.9582	224.6259	239.7965	(219)
Water heating fuel used												2571.9429	(219)
Annual totals kWh/year													
Space heating fuel - main system												5869.4335	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												453.1175	(232)
Total delivered energy for all uses												8969.4939	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5869.4335	0.2160	1267.7976	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2571.9429	0.2160	555.5397	(264)
Space and water heating			1823.3373	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	453.1175	0.5190	235.1680	(268)
Total CO2, kg/m2/year			2097.4303	(272)
Emissions per m2 for space and water heating			15.2021	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9607	(272b)
Emissions per m2 for pumps and fans			0.3245	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2021 * 1.00) + 1.9607 + 0.3245, rounded to 2 d.p.			17.4900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 280 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 280	**Prop Type Ref**	
Property	Marwell Det, Plot 280, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	6.09	**TER**	17.49
Environmental	96 A	**% DER<TER**	65.17		
CO_2 Emissions (t/year)	0.19	**DFEE**	47.54	**TFEE**	58.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	6.09	$kgCO_2/m^2$	Pass
	-11.40 (-65.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.68	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.54	$kWh/m^2/yr$	
	-11.2 (-19.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	1.04 m², No overhang		
Windows facing North East	6.41 m², No overhang		
Windows facing East	1.04 m², No overhang		
Windows facing South East	8.09 m², No overhang		
Windows facing North West	6.92 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	3.25	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 280 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 280	**Prop Type Ref**	
Property	Marwell Det, Plot 280, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	6.09	**TER**	17.49
Environmental	96 A	**% DER<TER**	65.17		
CO_2 Emissions (t/year)	0.19	**DFEE**	47.54	**TFEE**	58.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.36 m	60.56 m²	2.39 m
1st Storey:	33.86 m	59.38 m²	2.63 m

7.0 Living Area	17.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	205.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	170.84	145.22

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Slope Roof	0.07	59.38	59.38
Bay roof	External Flat Roof	0.16	1.17	1.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	60.56

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.69	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.04	100
W4	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.25	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.04	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W14)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.72	100
D3 (w15)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
W9	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100

W10	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W11	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.84	0.052	No
Independently assessed	E3 Sill	13.66	0.004	No
Independently assessed	E4 Jamb	44.40	0.005	No
Independently assessed	E5 Ground floor (normal)	34.36	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	33.86	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	15.19	0.051	No
Independently assessed	E14 Flat roof	3.05	0.029	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.022	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	

Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South East	45°	None Or Little	Yes
1.22	South West	45°	None Or Little	Yes
0.81	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 280 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 280	**Prop Type Ref**	
Property	Marwell Det, Plot 280, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	6.09	**TER**	17.49
Environmental	96 A	**% DER<TER**	65.17		
CO_2 Emissions (t/year)	0.19	**DFEE**	47.54	**TFEE**	58.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	119.94	m^2	
DER	6.09	$kgCO_2/yr/m^2$	
TER	17.49	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.09	$kgCO_2/yr/m^2$	
Reduction DER/TER	65.17	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	47.54	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	119.94	m^2	
DER	18.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.29	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.29	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.26	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.09	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.57	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	23.91	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	23.91	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 281 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 281	**Prop Type Ref**	
Property	3S Semi, Plot 281, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.44 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 7.88 m², No overhang
Windows facing South East: 7.47 m², No overhang
Windows facing North West: 4.56 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3762	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3467	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6262	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5967	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9100	1.2357	24.6036			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1400	6.8530			(28a)
External Wall	101.4200	22.0300	79.3900	0.2100	16.6719			(29a)
Main Roof	48.9500		48.9500	0.0700	3.4265			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7350			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8244	(36)
Total fabric heat loss (33) + (36) =	59.5594	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7752	50.1771	49.5790	46.5886	45.9905	43.0000	43.0000	42.4019	44.1962	45.9905	47.1867	48.3828	(38)
Heat transfer coeff	110.3346	109.7365	109.1384	106.1480	105.5499	102.5595	102.5595	101.9614	103.7556	105.5499	106.7461	107.9423	(39)
Average = Sum(39)m / 12 =												105.9985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1270	1.1209	1.1148	1.0842	1.0781	1.0476	1.0476	1.0415	1.0598	1.0781	1.0904	1.1026	(40)
HLP (average)												1.0827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8276   10.6761   11.8041   11.3963   11.7554   11.3522   11.7157   11.7414   11.3762   11.7834   11.4278   11.8200 (61)
Total heat required for water heating calculated for each month
              172.9666  151.6093  157.2345  138.1860  133.4132  116.3336  108.9964  123.3725  124.3405  143.4324  155.1329  167.8745 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.9666  151.6093  157.2345  138.1860  133.4132  116.3336  108.9964  123.3725  124.3405  143.4324  155.1329  167.8745 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1692.8922 (64)
Heat gains from water heating, kWh/month
               56.5356   49.5293   51.3066   45.0067   43.3901   37.7444   35.2748   40.0527   40.4047   46.7191   50.6389   54.8431 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608  135.9608 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.5451   20.0244   16.2849   12.3287    9.2159    7.7804    8.4070   10.9278   14.6672   18.6234   21.7363   23.1717 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              252.8874  255.5116  248.8988  234.8208  217.0499  200.3477  189.1897  186.5655  193.1783  207.2563  225.0272  241.7294 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961   36.5961 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 -108.7687 (71)
Water heating gains (Table 5)
               75.9887   73.7043   68.9605   62.5093   58.3200   52.4227   47.4123   53.8342   56.1176   62.7945   70.3318   73.7139 (72)
Total internal gains
              418.2095  416.0285  400.9324  376.4470  351.3739  327.3391  311.7972  318.1157  330.7514  355.4625  383.8835  405.4032 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
Northeast                              7.8800            11.2829            0.4100           1.0000            0.7700           25.2619 (75)
Southeast                              7.4700            36.7938            0.4100           1.0000            0.7700           78.0931 (77)
Northwest                              4.5600            11.2829            0.4100           1.0000            0.7700           14.6185 (81)
-------------------------------------------------------------------------------------------------------------------

Solar gains   117.9735  214.1992  328.2623  465.7092  575.4639  594.9808  563.7712  478.2692  375.2896  246.2227  143.7174   99.3998 (83)
Total gains   536.1830  630.2278  729.1947  842.1562  926.8379  922.3200  875.5684  796.3849  706.0410  601.6852  527.6010  504.8030 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3368   46.5894   46.8447   48.1644   48.4373   49.8497   49.8497   50.1421   49.2750   48.4373   47.8945   47.3638
alpha          4.0891    4.1060    4.1230    4.2110    4.2292    4.3233    4.3233    4.3428    4.2850    4.2292    4.1930    4.1576
util living area
               0.9954    0.9906    0.9775    0.9345    0.8312    0.6553    0.5007    0.5631    0.8164    0.9629    0.9915    0.9965 (86)

MIT           19.4300   19.6277   19.9538   20.3975   20.7438   20.9365   20.9843   20.9748   20.8300   20.3712   19.8380   19.4194 (87)
Th 2          19.9788   19.9838   19.9888   20.0137   20.0187   20.0439   20.0439   20.0489   20.0338   20.0187   20.0087   19.9987 (88)
util rest of house
               0.9942    0.9882    0.9714    0.9163    0.7863    0.5760    0.3986    0.4579    0.7515    0.9491    0.9889    0.9955 (89)
MIT 2         17.8762   18.1674   18.6431   19.2899   19.7535   19.9955   20.0364   20.0356   19.8820   19.2671   18.4918   17.8738 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.1923 (91)
MIT           18.1751   18.4483   18.8952   19.5029   19.9440   20.1765   20.2187   20.2163   20.0644   19.4794   18.7508   18.1711 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  18.1751   18.4483   18.8952   19.5029   19.9440   20.1765   20.2187   20.2163   20.0644   19.4794   18.7508   18.1711 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9911    0.9828    0.9623    0.9048    0.7824    0.5877    0.4178    0.4772    0.7539    0.9391    0.9840    0.9929 (94)
Useful gains  531.3856  619.3882  701.7364  761.9412  725.1715  542.0504  365.8463  380.0446  532.2539  565.0153  519.1641  501.2421 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1530.9021 1486.7402 1352.7926 1125.4804  870.1515  571.9227  371.1307  389.1143  618.8363  937.2242 1243.6732 1508.0675 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              743.6403  582.8605  484.3858  261.7482  107.8651    0.0000    0.0000    0.0000    0.0000  276.9234  521.6465  749.0781 (98)
Space heating                                                                                                            3728.1480 (98)
Space heating per m2                                                                                    (98) / (4) =     38.0812 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4013.0765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	743.6403	582.8605	484.3858	261.7482	107.8651	0.0000	0.0000	0.0000	0.0000	276.9234	521.6465	749.0781	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	800.4739	627.4064	521.4056	281.7526	116.1089	0.0000	0.0000	0.0000	0.0000	298.0877	561.5140	806.3273	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2782	89.2203	89.0942	88.7680	88.1020	86.7000	86.7000	86.7000	86.7000	88.7819	89.1458	89.2966	(217)
Fuel for water heating, kWh/month													
	193.7389	169.9270	176.4812	155.6711	151.4304	134.1795	125.7167	142.2981	143.4146	161.5559	174.0215	187.9965	(219)
Water heating fuel used												1916.4314	(219)
Annual totals kWh/year													
Space heating fuel - main system												4013.0765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.1535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 677 * 1.00) =										-1537.0190		-1537.0190	(233)
Total delivered energy for all uses												4865.6424	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4013.0765	0.2160	866.8245	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.4314	0.2160	413.9492	(264)
Space and water heating			1280.7737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.1535	0.5190	206.6417	(268)
Energy saving/generation technologies				
PV Unit	-1537.0190	0.5190	-797.7129	(269)
Total CO2, kg/year			728.6275	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.4400	ZC1
Total Floor Area	TFA	97.9000	
Assumed number of occupants	N	2.7192	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3070	ZC2
CO2 emissions from cooking, equation (L16)		1.8821	ZC3
Total CO2 emissions		24.6292	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.6292	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			19.9100	1.3258	26.3958			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	101.4200	22.0300	79.3900	0.1800	14.2902			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9570			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2048	(36)
Total fabric heat loss					(33) + (36) =		67.1618	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	114.3001	114.0441	113.7932	112.6145	112.3940	111.3674	111.3674	111.1773	111.7628	112.3940	112.8401	113.3065	(39)
Average = Sum(39)m / 12 =												112.6134	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1675	1.1649	1.1623	1.1503	1.1480	1.1376	1.1376	1.1356	1.1416	1.1480	1.1526	1.1574	(40)
HLP (average)												1.1503	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7192	(42)
Average daily hot water use (litres/day)												98.7814	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7398	47.3176	43.8427	45.3041	47.3176	47.7398	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.6558	(64)
Heat gains from water heating, kWh/month													
	66.3184	58.3671	61.0953	54.0925	52.2806	45.8670	43.6719	48.9467	49.4956	56.5130	60.1107	64.6278	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6664	20.1321	16.3725	12.3951	9.2655	7.8223	8.4523	10.9866	14.7461	18.7236	21.8532	23.2964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	89.1377	86.8558	82.1174	75.1285	70.2696	63.7042	58.6987	65.7886	68.7439	75.9583	83.4871	86.8654	(72)
Total internal gains													
	431.4798	429.2878	414.1769	389.1326	363.3732	338.6624	323.1289	330.1289	343.4566	368.7265	397.1558	418.6794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8800	11.2829	0.6300	0.7000	0.7700	27.1719	(75)
Southeast	7.4700	36.7938	0.6300	0.7000	0.7700	83.9977	(77)
Northwest	4.5600	11.2829	0.6300	0.7000	0.7700	15.7239	(81)

Solar gains	126.8935	230.3948	353.0821	500.9213	618.9746	639.9672	606.3978	514.4310	403.6651	264.8395	154.5839	106.9154	(83)
Total gains	558.3733	659.6826	767.2590	890.0540	982.3478	978.6296	929.5267	844.5599	747.1217	633.5661	551.7397	525.5948	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4803	59.6139	59.7453	60.3707	60.4891	61.0467	61.0467	61.1511	60.8307	60.4891	60.2500	60.0020	
alpha	4.9654	4.9743	4.9830	5.0247	5.0326	5.0698	5.0698	5.0767	5.0554	5.0326	5.0167	5.0001	
util living area													
	0.9984	0.9961	0.9881	0.9558	0.8590	0.6819	0.5173	0.5859	0.8478	0.9785	0.9966	0.9988	(86)
MIT	19.7078	19.8720	20.1463	20.5089	20.8067	20.9563	20.9911	20.9840	20.8676	20.4732	20.0233	19.6793	(87)
Th 2	19.9461	19.9482	19.9502	19.9600	19.9618	19.9703	19.9703	19.9718	19.9670	19.9618	19.9581	19.9543	(88)
util rest of house													
	0.9979	0.9947	0.9838	0.9392	0.8099	0.5905	0.4014	0.4647	0.7760	0.9675	0.9951	0.9984	(89)
MIT 2	18.2217	18.4629	18.8627	19.3846	19.7749	19.9419	19.9671	19.9654	19.8602	19.3444	18.6916	18.1859	(90)
Living area fraction									fLA = Living area / (4) =			0.1923	(91)
MIT	18.5076	18.7339	19.1096	19.6008	19.9733	20.1370	20.1641	20.1613	20.0539	19.5615	18.9477	18.4731	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5076	18.7339	19.1096	19.6008	19.9733	20.1370	20.1641	20.1613	20.0539	19.5615	18.9477	18.4731	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9924	0.9789	0.9320	0.8105	0.6062	0.4237	0.4880	0.7831	0.9617	0.9930	0.9976	(94)
Useful gains	556.5429	654.6375	751.1051	829.5460	796.2148	593.2872	393.8590	412.1327	585.0348	609.2861	547.8983	524.3071	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1623.9266	1577.6777	1434.8891	1205.0681	929.8742	616.6393	396.9192	418.1697	665.4292	1007.2219	1336.8959	1617.2371	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	794.1335	620.2830	508.7353	270.3759	99.4426	0.0000	0.0000	0.0000	0.0000	296.0642	568.0783	813.1399	(98)
Space heating												3970.2526	(98)
Space heating per m2											(98) / (4) =	40.5542	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4250.8058	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	794.1335	620.2830	508.7353	270.3759	99.4426	0.0000	0.0000	0.0000	0.0000	296.0642	568.0783	813.1399	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	850.2499	664.1146	544.6845	289.4816	106.4696	0.0000	0.0000	0.0000	0.0000	316.9853	608.2209	870.5995	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0652	87.8411	87.3403	86.1493	83.7673	80.3000	80.3000	80.3000	80.3000	86.2609	87.6055	88.1501	(217)
Fuel for water heating, kWh/month													
	240.8418	212.8394	224.8552	202.5896	201.7201	185.3351	177.5652	197.9436	200.1296	211.6924	220.3288	234.8419	(219)
Water heating fuel used												2510.6827	(219)
Annual totals kWh/year													
Space heating fuel - main system												4250.8058	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.2962	(232)
Total delivered energy for all uses												7236.7847	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4250.8058	0.2160	918.1741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2510.6827	0.2160	542.3075	(264)
Space and water heating			1460.4815	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.2962	0.5190	207.7537	(268)
Total CO2, kg/m2/year			1707.1602	(272)
Emissions per m2 for space and water heating			14.9181	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9181 * 1.00) + 2.1221 + 0.3976, rounded to 2 d.p.			17.4400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 281 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 281	**Prop Type Ref**	
Property	3S Semi, Plot 281, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.44	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.44	$kgCO_2/m^2$	Pass
	-10.00 (-57.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.63	$kWh/m^2/yr$	
	-11.4 (-21.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	7.88 m², No overhang 7.47 m², No overhang 4.56 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	2.84	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 281 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 281	**Prop Type Ref**	
Property	3S Semi, Plot 281, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.95 m²	2.39 m
1st Storey:	20.24 m	48.95 m²	2.63 m

7.0 Living Area	18.83	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.39

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.95	48.95

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	48.95

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 (W13)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North East							2.12	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.01	0.052	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	36.60	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	North East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 281 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 281	**Prop Type Ref**	
Property	3S Semi, Plot 281, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.44	**TER**	17.44
Environmental	95 A	**% DER<TER**	57.33		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.63	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.45		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.9	m^2	
DER	7.44	$kgCO_2/yr/m^2$	
TER	17.44	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.44	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.33	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.63	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.9	m^2	
DER	17.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.01	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.68	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.87	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.87	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 282 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 282	**Prop Type Ref**	
Property	3A Semi RITR, Plot 282, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.16 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.66 m², No overhang
Windows facing South West: 1.55 m², No overhang
Windows facing North West: 4.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.6600	36.7938	0.4100	1.0000	0.7700	80.0794	(77)
Southwest	1.5500	36.7938	0.4100	1.0000	0.7700	16.2041	(79)
Northwest	4.0300	11.2829	0.4100	1.0000	0.7700	12.9195	(81)

Solar gains	109.2029	190.3043	271.7812	355.8558	416.0269	420.6891	402.3970	356.3339	300.7124	213.4002	131.5814	92.9493	(83)
Total gains	517.2260	596.1576	662.9013	723.1143	758.9028	740.1648	706.7268	666.9197	623.6010	560.3731	506.2440	488.5282	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9960	0.9920	0.9823	0.9532	0.8792	0.7239	0.5593	0.6073	0.8385	0.9668	0.9924	0.9969	(86)
MIT	19.5684	19.7461	20.0256	20.4057	20.7201	20.9252	20.9822	20.9745	20.8412	20.4331	19.9496	19.5614	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9950	0.9899	0.9773	0.9390	0.8416	0.6464	0.4522	0.5006	0.7773	0.9541	0.9900	0.9961	(89)
MIT 2	18.0983	18.3605	18.7697	19.3311	19.7617	20.0264	20.0764	20.0767	19.9318	19.3802	18.6760	18.1020	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4913	18.7309	19.1054	19.6183	20.0179	20.2667	20.3186	20.3167	20.1749	19.6617	19.0165	18.4921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4913	18.7309	19.1054	19.6183	20.0179	20.2667	20.3186	20.3167	20.1749	19.6617	19.0165	18.4921	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9859	0.9709	0.9309	0.8397	0.6629	0.4805	0.5284	0.7849	0.9471	0.9863	0.9941	(94)
Useful gains	513.3538	587.7238	643.6129	673.1718	637.2729	490.6861	339.5912	352.4045	489.4404	530.7418	499.2925	485.6565	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1427.6452	1383.3705	1253.4858	1034.7683	798.2075	527.3622	346.0621	362.2276	572.3940	869.5777	1157.3470	1404.6433	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	680.2328	534.6746	453.7454	260.3494	119.7353	0.0000	0.0000	0.0000	0.0000	252.0939	473.7993	683.7261	(98)
Space heating												3458.3569	(98)
Space heating per m2											(98) / (4) =	37.0830	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3722.6662	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	680.2328	534.6746	453.7454	260.3494	119.7353	0.0000	0.0000	0.0000	0.0000	252.0939	473.7993	683.7261	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	732.2204	575.5378	488.4235	280.2470	128.8863	0.0000	0.0000	0.0000	0.0000	271.3605	510.0100	735.9808	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2384	89.1794	89.0613	88.7724	88.1937	86.7000	86.7000	86.7000	86.7000	88.7212	89.0959	89.2566	(217)
Fuel for water heating, kWh/month													
	191.5881	168.0469	174.5222	153.8914	149.5617	132.6776	124.3250	140.7009	141.7982	159.8271	172.1207	185.9147	(219)
Water heating fuel used												1894.9745	(219)
Annual totals kWh/year													
Space heating fuel - main system												3722.6662	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =												-1333.8260	(233)
Total delivered energy for all uses												4746.6457	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3722.6662	0.2160	804.0959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.9745	0.2160	409.3145	(264)
Space and water heating			1213.4104	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			761.3640	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.1600	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.6867	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.6867	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 50.9589 46.0274 50.7095 47.1493 46.7323 43.3003 44.7437 46.7323 47.1493 50.7095 49.3151 50.9589 (61)
Total heat required for water heating calculated for each month
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (64)
Total per year (kWh/year) = Sum(64)m = 2109.4760 (64)
Heat gains from water heating, kWh/month
65.6556 57.7874 60.4348 53.4234 51.6339 45.2996 43.1316 48.3412 48.8833 55.9092 59.5196 63.9860 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.6600	36.7938	0.6300	0.7000	0.7700	86.1342	(77)
Southwest	1.5500	36.7938	0.6300	0.7000	0.7700	17.4292	(79)
Northwest	4.0300	11.2829	0.6300	0.7000	0.7700	13.8963	(81)

Solar gains	117.4597	204.6932	292.3305	382.7619	447.4826	452.4973	432.8221	383.2762	323.4492	229.5353	141.5303	99.9771	(83)
Total gains	540.0288	624.9389	697.5333	763.1996	802.6835	783.5490	748.7717	706.2977	659.6686	590.7426	530.6950	510.1433	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9983	0.9961	0.9897	0.9674	0.8999	0.7485	0.5755	0.6282	0.8627	0.9786	0.9963	0.9988	(86)
MIT	19.7941	19.9452	20.1849	20.4977	20.7736	20.9417	20.9882	20.9816	20.8700	20.5129	20.0952	19.7678	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9978	0.9947	0.9859	0.9547	0.8604	0.6610	0.4551	0.5070	0.7961	0.9679	0.9948	0.9983	(89)
MIT 2	18.3813	18.6034	18.9534	19.4082	19.7807	19.9781	20.0140	20.0122	19.9075	19.4368	18.8305	18.3491	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7589	18.9621	19.2826	19.6995	20.0461	20.2357	20.2744	20.2714	20.1648	19.7244	19.1685	18.7283	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7589	18.9621	19.2826	19.6995	20.0461	20.2357	20.2744	20.2714	20.1648	19.7244	19.1685	18.7283	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9927	0.9823	0.9497	0.8621	0.6819	0.4875	0.5396	0.8078	0.9638	0.9930	0.9975	(94)
Useful gains	538.2520	620.4005	685.1652	724.8083	691.9670	534.3201	365.0322	381.0888	532.8685	569.3333	526.9804	508.8812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1495.8957	1451.2970	1316.0902	1099.3799	847.8181	566.7950	369.5409	388.6282	612.3102	926.8843	1231.2510	1488.8689	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	712.4869	558.3624	469.4082	269.6916	115.9532	0.0000	0.0000	0.0000	0.0000	266.0179	507.0749	729.1108	(98)
Space heating												3628.1060	(98)
Space heating per m2											(98) / (4) =	38.9031	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3884.4818	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	712.4869	558.3624	469.4082	269.6916	115.9532	0.0000	0.0000	0.0000	0.0000	266.0179	507.0749	729.1108	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	762.8340	597.8185	502.5784	288.7490	124.1469	0.0000	0.0000	0.0000	0.0000	284.8158	542.9067	780.6326	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8827	87.6538	87.1891	86.1737	84.1546	80.3000	80.3000	80.3000	80.3000	86.0229	87.3898	87.9709	(217)
Fuel for water heating, kWh/month													
	239.0738	211.3053	222.8958	200.0269	198.3079	183.0424	175.3686	195.4949	197.6539	210.0951	218.8385	233.1257	(219)
Water heating fuel used												2485.2289	(219)
Annual totals kWh/year													
Space heating fuel - main system												3884.4818	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												6857.1962	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3884.4818	0.2160	839.0481	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.2289	0.2160	536.8094	(264)
Space and water heating			1375.8575	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1628.8625	(272)
Emissions per m2 for space and water heating			14.7529	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7529 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.4700	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 282 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 282	**Prop Type Ref**	
Property	3A Semi RITR, Plot 282, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.16	$kgCO_2/m^2$	Pass
	-9.31 (-53.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.29	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.56	$kWh/m^2/yr$	
	-10.7 (-21.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	7.66 m², No overhang 1.55 m², No overhang 4.03 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 282 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 282	**Prop Type Ref**	
Property	3A Semi RITR, Plot 282, Boorley Gardens, Southampton, SO32		

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Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 282 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 282	**Prop Type Ref**	
Property	3A Semi RITR, Plot 282, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	8.16	**TER**	17.47
Environmental	94 A	**% DER<TER**	53.28		
CO_2 Emissions (t/year)	0.38	**DFEE**	39.56	**TFEE**	50.29
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	8.16	$kgCO_2/yr/m^2$	
TER	17.47	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.16	$kgCO_2/yr/m^2$	
Reduction DER/TER	53.28	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.56	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.75	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.28	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.28	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.86	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.86	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 283 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 283	**Prop Type Ref**	
Property	3A Semi RITR, Plot 283, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.43	**TER**	17.63
Environmental	96 A	**% DER<TER**	63.54		
CO_2 Emissions (t/year)	0.19	**DFEE**	40.20	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.63 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.43 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.55 m², No overhang
Windows facing South East: 7.66 m², No overhang
Windows facing North West: 4.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5500	11.2829	0.4100	1.0000	0.7700	4.9690	(75)
Southeast	7.6600	36.7938	0.4100	1.0000	0.7700	80.0794	(77)
Northwest	4.0300	11.2829	0.4100	1.0000	0.7700	12.9195	(81)

Solar gains	97.9679	172.8174	252.2389	338.9902	403.8433	411.5439	392.3523	342.3452	282.0256	195.2554	118.4250	83.1399	(83)
Total gains	505.9910	578.6707	643.3590	706.2487	746.7192	731.0196	696.6821	652.9310	604.9142	542.2284	493.0876	478.7188	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9964	0.9929	0.9842	0.9567	0.8844	0.7300	0.5663	0.6180	0.8501	0.9705	0.9932	0.9972	(86)
MIT	19.5549	19.7253	20.0034	20.3889	20.7116	20.9225	20.9813	20.9726	20.8304	20.4137	19.9339	19.5495	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9954	0.9910	0.9796	0.9435	0.8477	0.6527	0.4584	0.5104	0.7910	0.9589	0.9910	0.9964	(89)
MIT 2	18.0786	18.3305	18.7379	19.3080	19.7514	20.0240	20.0759	20.0755	19.9204	19.3535	18.6532	18.0845	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4732	18.7033	19.0762	19.5969	20.0081	20.2642	20.3179	20.3153	20.1636	19.6369	18.9956	18.4761	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4732	18.7033	19.0762	19.5969	20.0081	20.2642	20.3179	20.3153	20.1636	19.6369	18.9956	18.4761	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9872	0.9736	0.9354	0.8454	0.6690	0.4868	0.5384	0.7975	0.9521	0.9875	0.9946	(94)
Useful gains	502.4925	571.2871	626.3607	660.6408	631.3009	489.0649	339.1793	351.5064	482.4384	516.2683	486.9200	476.1102	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1425.8257	1380.6124	1250.5793	1032.6991	797.2599	527.1320	346.0055	362.1045	571.3338	867.2002	1155.3183	1403.0751	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	686.9599	543.8666	464.4186	267.8820	123.4735	0.0000	0.0000	0.0000	0.0000	261.0933	481.2468	689.6619	(98)
Space heating												3518.6026	(98)
Space heating per m2											(98) / (4) =	37.7290	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3787.5163	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	686.9599	543.8666	464.4186	267.8820	123.4735	0.0000	0.0000	0.0000	0.0000	261.0933	481.2468	689.6619	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	739.4617	585.4323	499.9124	288.3552	132.9101	0.0000	0.0000	0.0000	0.0000	281.0477	518.0267	742.3702	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2436	89.1889	89.0756	88.7931	88.2182	86.7000	86.7000	86.7000	86.7000	88.7472	89.1053	89.2610	(217)
Fuel for water heating, kWh/month													
	191.5771	168.0291	174.4941	153.8554	149.5201	132.6776	124.3250	140.7009	141.7982	159.7802	172.1027	185.9054	(219)
Water heating fuel used												1894.7659	(219)
Annual totals kWh/year													
Space heating fuel - main system												3787.5163	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1029 * 1.00) =											-1671.3992	-1671.3992	(233)
Total delivered energy for all uses												4473.7140	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3787.5163	0.2160	818.1035	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.7659	0.2160	409.2694	(264)
Space and water heating			1227.3730	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1671.3992	0.5190	-867.4562	(269)
Total CO2, kg/year			600.1261	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.4300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.4300	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		23.9567	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.9567	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 50.9589 46.0274 50.7095 47.1493 46.7323 43.3003 44.7437 46.7323 47.1493 50.7095 49.3151 50.9589 (61)
Total heat required for water heating calculated for each month
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
210.1045 185.2171 194.3409 172.3706 166.8851 146.9831 140.8210 156.9824 158.7161 180.7299 191.2425 205.0829 (64)
Total per year (kWh/year) = Sum(64)m = 2109.4760 (64)
Heat gains from water heating, kWh/month
65.6556 57.7874 60.4348 53.4234 51.6339 45.2996 43.1316 48.3412 48.8833 55.9092 59.5196 63.9860 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
23.3566 20.7452 16.8711 12.7725 9.5476 8.0605 8.7096 11.3211 15.1952 19.2938 22.5187 24.0058 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
244.9491 247.4909 241.0856 227.4496 210.2365 194.0587 183.2509 180.7090 187.1143 200.7504 217.9634 234.1413 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 36.3388 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 -106.7106 (71)
Water heating gains (Table 5)
88.2468 85.9932 81.2296 74.1992 69.4004 62.9161 57.9726 64.9748 67.8935 75.1467 82.6662 86.0026 (72)
Total internal gains
422.5690 420.2458 405.2028 380.4377 355.2010 331.0517 315.9496 323.0214 336.2194 361.2073 389.1648 410.1662 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.5500	11.2829	0.6300	0.7000	0.7700	5.3447	(75)
Southeast	7.6600	36.7938	0.6300	0.7000	0.7700	86.1342	(77)
Northwest	4.0300	11.2829	0.6300	0.7000	0.7700	13.8963	(81)

Solar gains	105.3752	185.8841	271.3106	364.6212	434.3778	442.6606	422.0179	368.2298	303.3495	210.0187	127.3791	89.4261	(83)
Total gains	527.9443	606.1298	676.5134	745.0589	789.5787	773.7124	737.9675	691.2513	639.5689	571.2260	516.5439	499.5923	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9985	0.9966	0.9910	0.9704	0.9050	0.7549	0.5830	0.6397	0.8743	0.9814	0.9968	0.9989	(86)
MIT	19.7819	19.9265	20.1647	20.4821	20.7657	20.9392	20.9874	20.9800	20.8599	20.4951	20.0810	19.7572	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9980	0.9954	0.9877	0.9586	0.8667	0.6677	0.4615	0.5173	0.8105	0.9719	0.9954	0.9985	(89)
MIT 2	18.3635	18.5762	18.9243	19.3868	19.7713	19.9762	20.0137	20.0115	19.8974	19.4120	18.8100	18.3335	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7427	18.9372	19.2559	19.6796	20.0371	20.2336	20.2740	20.2704	20.1547	19.7016	19.1497	18.7141	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7427	18.9372	19.2559	19.6796	20.0371	20.2336	20.2740	20.2704	20.1547	19.7016	19.1497	18.7141	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9936	0.9843	0.9537	0.8679	0.6884	0.4942	0.5501	0.8211	0.9679	0.9938	0.9977	(94)
Useful gains	526.3719	602.2603	665.8753	710.5457	685.2973	532.6562	364.6966	380.2852	525.1315	552.9015	513.3216	498.4669	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1494.2151	1448.7245	1313.3397	1097.3556	846.9043	566.5867	369.4989	388.5288	611.2893	924.5592	1229.3325	1487.4083	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	720.0754	568.8239	481.7136	278.5031	120.2356	0.0000	0.0000	0.0000	0.0000	276.5133	515.5279	735.7724	(98)
Space heating												3697.1653	(98)
Space heating per m2											(98) / (4) =	39.6436	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3958.4211	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	720.0754	568.8239	481.7136	278.5031	120.2356	0.0000	0.0000	0.0000	0.0000	276.5133	515.5279	735.7724	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	770.9587	609.0192	515.7533	298.1832	128.7319	0.0000	0.0000	0.0000	0.0000	296.0528	551.9571	787.7649	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9027	87.6908	87.2455	86.2525	84.2414	80.3000	80.3000	80.3000	80.3000	86.1186	87.4246	87.9877	(217)
Fuel for water heating, kWh/month													
	239.0195	211.2162	222.7517	199.8441	198.1035	183.0424	175.3686	195.4949	197.6539	209.8616	218.7514	233.0814	(219)
Water heating fuel used												2484.1893	(219)
Annual totals kWh/year													
Space heating fuel - main system												3958.4211	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												6930.0959	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3958.4211	0.2160	855.0190	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.1893	0.2160	536.5849	(264)
Space and water heating			1391.6038	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1644.6088	(272)
Emissions per m2 for space and water heating			14.9218	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9218 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.6300	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 283 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 283	**Prop Type Ref**	
Property	3A Semi RITR, Plot 283, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.43	**TER**	17.63
Environmental	96 A	**% DER<TER**	63.54		
CO_2 Emissions (t/year)	0.19	**DFEE**	40.20	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.63	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	6.43	$kgCO_2/m^2$	Pass
	-11.20 (-63.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.14	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.20	$kWh/m^2/yr$	
	-10.9 (-21.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	1.55 m², No overhang 7.66 m², No overhang 4.03 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 283 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 283	**Prop Type Ref**	
Property	3A Semi RITR, Plot 283, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.43	**TER**	17.63
Environmental	96 A	**% DER<TER**	63.54		
CO_2 Emissions (t/year)	0.19	**DFEE**	40.20	**TFEE**	51.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	6.43	$kgCO_2/yr/m^2$	
TER	17.63	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.43	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.54	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.20	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.90	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.43	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.43	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.13	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.13	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 284 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 284	**Prop Type Ref**	
Property	3S Semi, Plot 284, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.29	**TER**	16.68
Environmental	96 A	**% DER<TER**	62.28		
CO_2 Emissions (t/year)	0.22	**DFEE**	38.82	**TFEE**	49.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.68 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.29 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.47 m², No overhang
Windows facing South West: 7.88 m², No overhang
Windows facing North West: 4.56 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3471	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2950	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3762	0.3688	0.3614	0.3245	0.3171	0.2803	0.2803	0.2729	0.2950	0.3171	0.3319	0.3467	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6262	0.6188	0.6114	0.5745	0.5671	0.5303	0.5303	0.5229	0.5450	0.5671	0.5819	0.5967	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			19.9100	1.2357	24.6036			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1400	6.8530			(28a)
External Wall	101.4200	22.0300	79.3900	0.2100	16.6719			(29a)
Main Roof	48.9500		48.9500	0.0700	3.4265			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.7350			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	188.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8244	(36)
Total fabric heat loss (33) + (36) =	59.5594	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7752	50.1771	49.5790	46.5886	45.9905	43.0000	43.0000	42.4019	44.1962	45.9905	47.1867	48.3828	(38)
Heat transfer coeff	110.3346	109.7365	109.1384	106.1480	105.5499	102.5595	102.5595	101.9614	103.7556	105.5499	106.7461	107.9423	(39)
Average = Sum(39)m / 12 =												105.9985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1270	1.1209	1.1148	1.0842	1.0781	1.0476	1.0476	1.0415	1.0598	1.0781	1.0904	1.1026	(40)
HLP (average)												1.0827	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)

Total heat required for water heating calculated for each month

	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)

Total per year (kWh/year) = Sum(64)m = 1692.8922 (64)

Heat gains from water heating, kWh/month

	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5451	20.0244	16.2849	12.3287	9.2159	7.7804	8.4070	10.9278	14.6672	18.6234	21.7363	23.1717	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)

Water heating gains (Table 5)

	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)

Total internal gains

	418.2095	416.0285	400.9324	376.4470	351.3739	327.3391	311.7972	318.1157	330.7514	355.4625	383.8835	405.4032	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.4700	36.7938	0.4100	1.0000	0.7700	78.0931	(77)
Southwest	7.8800	36.7938	0.4100	1.0000	0.7700	82.3793	(79)
Northwest	4.5600	11.2829	0.4100	1.0000	0.7700	14.6185	(81)

Solar gains	175.0910	303.1004	427.6128	551.4514	637.4037	641.4739	614.8372	549.3860	470.2908	338.4681	210.6029	149.2692	(83)
Total gains	593.3005	719.1290	828.5453	927.8984	988.7776	968.8130	926.6344	867.5017	801.0422	693.9306	594.4864	554.6724	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.3368	46.5894	46.8447	48.1644	48.4373	49.8497	49.8497	50.1421	49.2750	48.4373	47.8945	47.3638	
alpha	4.0891	4.1060	4.1230	4.2110	4.2292	4.3233	4.3233	4.3428	4.2850	4.2292	4.1930	4.1576	
util living area	0.9934	0.9851	0.9657	0.9135	0.8058	0.6311	0.4756	0.5228	0.7627	0.9418	0.9869	0.9949	(86)
MIT	19.4968	19.7287	20.0589	20.4710	20.7758	20.9450	20.9871	20.9811	20.8721	20.4612	19.9149	19.4783	(87)
Th 2	19.9788	19.9838	19.9888	20.0137	20.0187	20.0439	20.0439	20.0489	20.0338	20.0187	20.0087	19.9987	(88)
util rest of house	0.9917	0.9813	0.9569	0.8912	0.7579	0.5525	0.3775	0.4226	0.6919	0.9221	0.9830	0.9937	(89)
MIT 2	17.9733	18.3132	18.7919	19.3879	19.7902	20.0026	20.0378	20.0392	19.9242	19.3893	18.6028	17.9596	(90)

Living area fraction fLA = Living area / (4) = 0.1923 (91)

MIT	18.2664	18.5855	19.0356	19.5962	19.9798	20.1839	20.2204	20.2203	20.1066	19.5955	18.8552	18.2517	(92)

Temperature adjustment 0.0000

adjusted MIT	18.2664	18.5855	19.0356	19.5962	19.9798	20.1839	20.2204	20.2203	20.1066	19.5955	18.8552	18.2517	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9741	0.9460	0.8799	0.7558	0.5646	0.3961	0.4413	0.6978	0.9113	0.9766	0.9903	(94)
Useful gains	585.8788	700.4694	783.7912	816.4785	747.3354	546.9949	367.0025	382.8022	558.9797	632.3943	580.5541	549.2726	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1540.9726	1501.7983	1368.1196	1135.3815	873.9305	572.6787	371.3038	389.5257	623.2138	949.4730	1254.8225	1516.7772	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	710.5897	538.4930	434.7403	229.6102	94.1867	0.0000	0.0000	0.0000	0.0000	235.9065	485.4732	719.8235	(98)

Space heating 3448.8231 (98)

Space heating per m2 (98) / (4) = 35.2280 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3712.4038	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	710.5897	538.4930	434.7403	229.6102	94.1867	0.0000	0.0000	0.0000	0.0000	235.9065	485.4732	719.8235	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	764.8975	579.6480	467.9659	247.1584	101.3851	0.0000	0.0000	0.0000	0.0000	253.9359	522.5761	774.8369	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2551	89.1769	89.0272	88.6704	87.9962	86.7000	86.7000	86.7000	86.7000	88.6627	89.1036	89.2769	(217)
Fuel for water heating, kWh/month													
	193.7890	170.0096	176.6139	155.8424	151.6124	134.1795	125.7167	142.2981	143.4146	161.7732	174.1040	188.0381	(219)
Water heating fuel used												1917.3914	(219)
Annual totals kWh/year													
Space heating fuel - main system												3712.4038	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.1535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 1004 * 1.00) =										-1630.4898		-1630.4898	(233)
Total delivered energy for all uses												4472.4589	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3712.4038	0.2160	801.8792	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.3914	0.2160	414.1565	(264)
Space and water heating			1216.0358	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.1535	0.5190	206.6417	(268)
Energy saving/generation technologies				
PV Unit	-1630.4898	0.5190	-846.2242	(269)
Total CO2, kg/year			615.3782	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.2900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.2900	ZC1
Total Floor Area	TFA	97.9000	
Assumed number of occupants	N	2.7192	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3070	ZC2
CO2 emissions from cooking, equation (L16)		1.8821	ZC3
Total CO2 emissions		23.4792	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.4792	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			19.9100	1.3258	26.3958			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	101.4200	22.0300	79.3900	0.1800	14.2902			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			199.3200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9570			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.2048	(36)
Total fabric heat loss					(33) + (36) =		67.1618	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	114.3001	114.0441	113.7932	112.6145	112.3940	111.3674	111.3674	111.1773	111.7628	112.3940	112.8401	113.3065	(39)
Average = Sum(39)m / 12 =												112.6134	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1675	1.1649	1.1623	1.1503	1.1480	1.1376	1.1376	1.1356	1.1416	1.1480	1.1526	1.1574	(40)
HLP (average)												1.1503	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7192	(42)
Average daily hot water use (litres/day)												98.7814	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7398	47.3176	43.8427	45.3041	47.3176	47.7398	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.6558	(64)
Heat gains from water heating, kWh/month													
	66.3184	58.3671	61.0953	54.0925	52.2806	45.8670	43.6719	48.9467	49.4956	56.5130	60.1107	64.6278	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6664	20.1321	16.3725	12.3951	9.2655	7.8223	8.4523	10.9866	14.7461	18.7236	21.8532	23.2964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	89.1377	86.8558	82.1174	75.1285	70.2696	63.7042	58.6987	65.7886	68.7439	75.9583	83.4871	86.8654	(72)
Total internal gains													
	431.4798	429.2878	414.1769	389.1326	363.3732	338.6624	323.1289	330.1289	343.4566	368.7265	397.1558	418.6794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.4700	36.7938	0.6300	0.7000	0.7700	83.9977	(77)
Southwest	7.8800	36.7938	0.6300	0.7000	0.7700	88.6080	(79)
Northwest	4.5600	11.2829	0.6300	0.7000	0.7700	15.7239	(81)

Solar gains	188.3296	326.0178	459.9445	593.1465	685.5976	689.9755	661.3249	590.9249	505.8494	364.0596	226.5266	160.5554	(83)
Total gains	619.8094	755.3056	874.1215	982.2791	1048.9708	1028.6379	984.4538	921.0538	849.3060	732.7861	623.6824	579.2348	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4803	59.6139	59.7453	60.3707	60.4891	61.0467	61.0467	61.1511	60.8307	60.4891	60.2500	60.0020	
alpha	4.9654	4.9743	4.9830	5.0247	5.0326	5.0698	5.0698	5.0767	5.0554	5.0326	5.0167	5.0001	
util living area													
	0.9975	0.9929	0.9797	0.9374	0.8328	0.6558	0.4904	0.5424	0.7921	0.9622	0.9941	0.9982	(86)
MIT	19.7659	19.9608	20.2404	20.5761	20.8352	20.9633	20.9930	20.9886	20.9054	20.5549	20.0905	19.7303	(87)
Th 2	19.9461	19.9482	19.9502	19.9600	19.9618	19.9703	19.9703	19.9718	19.9670	19.9618	19.9581	19.9543	(88)
util rest of house													
	0.9966	0.9905	0.9727	0.9157	0.7796	0.5653	0.3795	0.4277	0.7119	0.9446	0.9917	0.9976	(89)
MIT 2	18.3065	18.5917	18.9966	19.4738	19.8060	19.9468	19.9678	19.9674	19.8951	19.4558	18.7891	18.2603	(90)
Living area fraction									fLA = Living area / (4) =			0.1923	(91)
MIT	18.5872	18.8551	19.2358	19.6859	20.0040	20.1423	20.1650	20.1638	20.0894	19.6672	19.0394	18.5430	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5872	18.8551	19.2358	19.6859	20.0040	20.1423	20.1650	20.1638	20.0894	19.6672	19.0394	18.5430	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9870	0.9664	0.9088	0.7820	0.5812	0.4009	0.4498	0.7225	0.9381	0.9886	0.9963	(94)
Useful gains	616.6673	745.4512	844.7664	892.6972	820.2963	597.8305	394.6419	414.2552	613.6419	687.4338	616.5826	577.0866	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1633.0284	1591.4927	1449.2504	1214.6446	933.3170	617.2366	397.0238	418.4498	669.3973	1019.0953	1347.2444	1625.1601	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	756.1727	568.5399	449.7361	231.8021	84.0874	0.0000	0.0000	0.0000	0.0000	246.7561	526.0765	779.7667	(98)
Space heating												3642.9376	(98)
Space heating per m2											(98) / (4) =	37.2108	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3900.3614	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	756.1727	568.5399	449.7361	231.8021	84.0874	0.0000	0.0000	0.0000	0.0000	246.7561	526.0765	779.7667	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	809.6067	608.7151	481.5162	248.1821	90.0294	0.0000	0.0000	0.0000	0.0000	264.1928	563.2511	834.8680	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9761	87.6712	87.0712	85.7665	83.3960	80.3000	80.3000	80.3000	80.3000	85.8098	87.4476	88.0760	(217)
Fuel for water heating, kWh/month													
	241.0857	213.2520	225.5501	203.4939	202.6181	185.3351	177.5652	197.9436	200.1296	212.8055	220.7266	235.0396	(219)
Water heating fuel used												2515.5450	(219)
Annual totals kWh/year													
Space heating fuel - main system												3900.3614	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.2962	(232)
Total delivered energy for all uses												6891.2026	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3900.3614	0.2160	842.4781	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.5450	0.2160	543.3577	(264)
Space and water heating			1385.8358	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.2962	0.5190	207.7537	(268)
Total CO2, kg/m2/year			1632.5145	(272)
Emissions per m2 for space and water heating			14.1556	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1221	(272b)
Emissions per m2 for pumps and fans			0.3976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1556 * 1.00) + 2.1221 + 0.3976, rounded to 2 d.p.			16.6800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 284 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 284	**Prop Type Ref**	
Property	3S Semi, Plot 284, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.29	**TER**	16.68
Environmental	96 A	**% DER<TER**	62.28		
CO_2 Emissions (t/year)	0.22	**DFEE**	38.82	**TFEE**	49.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.68	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	6.29	$kgCO_2/m^2$	Pass
	-10.39 (-62.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.21	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	38.82	$kWh/m^2/yr$	
	-10.4 (-21.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	7.47 m², No overhang 7.88 m², No overhang 4.56 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 284 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 284	**Prop Type Ref**	
Property	3S Semi, Plot 284, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.29	**TER**	16.68
Environmental	96 A	**% DER<TER**	62.28		
CO_2 Emissions (t/year)	0.22	**DFEE**	38.82	**TFEE**	49.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.24 m	48.95 m²	2.39 m
1st Storey:	20.24 m	48.95 m²	2.63 m

7.0 Living Area	18.83	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	188.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	101.42	79.39

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	48.95	48.95

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	48.95

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m^2)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					2.17	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W5	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 (W13)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	South West							2.12	100
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	100
W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	17.01	0.052	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	36.60	0.005	No
Independently assessed	E5 Ground floor (normal)	20.24	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	20.24	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.14	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.10	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting		
Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 284 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 284	**Prop Type Ref**	
Property	3S Semi, Plot 284, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	6.29	**TER**	16.68
Environmental	96 A	**% DER<TER**	62.28		
CO_2 Emissions (t/year)	0.22	**DFEE**	38.82	**TFEE**	49.21
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.9	m^2	
DER	6.29	$kgCO_2/yr/m^2$	
TER	16.68	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.29	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.28	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	38.82	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.9	m^2	
DER	17.13	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.32	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.32	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.31	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.88	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.68	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.68	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	25	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 285 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 285	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 285, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 6.33 m², No overhang
Windows facing West: 4.22 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
										Total per year (kWh/year) = Sum(64)m =		1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(76)
West	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(80)

Solar gains	61.7735	120.7111	199.0844	291.7449	359.3833	368.8476	350.7562	299.9579	231.9133	143.2549	76.9859	50.8323	(83)
Total gains	432.7140	489.5972	554.6195	625.7273	671.4776	659.8258	627.9960	583.1152	526.1204	459.2254	417.9747	410.5896	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9937	0.9892	0.9771	0.9410	0.8584	0.7031	0.5484	0.6014	0.8350	0.9628	0.9895	0.9949	(86)
MIT	19.3052	19.4888	19.8180	20.2807	20.6537	20.8992	20.9719	20.9598	20.7803	20.2880	19.7420	19.3078	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9922	0.9866	0.9713	0.9251	0.8192	0.6265	0.4418	0.4951	0.7759	0.9499	0.9865	0.9936	(89)
MIT 2	17.7013	17.9725	18.4539	19.1353	19.6470	19.9682	20.0357	20.0336	19.8325	19.1591	18.3626	17.7207	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0292	18.2825	18.7327	19.3695	19.8528	20.1585	20.2271	20.2230	20.0263	19.3899	18.6446	18.0451	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9802	0.9614	0.9121	0.8115	0.6360	0.4625	0.5150	0.7751	0.9387	0.9805	0.9900	(94)
Useful gains	427.4590	479.9203	533.1993	570.7464	544.9185	419.6173	290.4455	300.2895	407.7872	431.0823	409.8052	406.4888	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1234.7632	1195.6327	1085.6481	898.0770	694.5090	457.0119	298.2147	312.0469	494.2855	748.7833	997.1579	1212.3061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating												3098.3798	(98)
Space heating per m2											(98) / (4) =	39.1704	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3335.1774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.6343	480.9588	411.0219	235.6780	111.2953	0.0000	0.0000	0.0000	0.0000	236.3695	422.8939	599.5281	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	646.5385	517.7166	442.4348	253.6900	119.8012	0.0000	0.0000	0.0000	0.0000	254.4343	455.2141	645.3478	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1995	89.1487	89.0316	88.7367	88.1759	86.7000	86.7000	86.7000	86.7000	88.7112	89.0579	89.2146	(217)
Fuel for water heating, kWh/month													
	182.0063	159.6416	165.8284	146.2986	142.2012	126.1921	118.3152	133.8039	134.8180	151.8938	163.5557	176.6432	(219)
Water heating fuel used												1801.1980	(219)
Annual totals kWh/year													
Space heating fuel - main system												3335.1774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4378.5104	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3335.1774	0.2160	720.3983	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.1980	0.2160	389.0588	(264)
Space and water heating			1109.4571	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			716.1252	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.0500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.5942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.5942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
							Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(76)
West	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(80)

Solar gains 66.4442	129.8380	214.1371	313.8037	386.5562	396.7361	377.2768	322.6377	249.4483	154.0863	82.8067	54.6757	(83)
Total gains 451.7107	512.5498	582.6788	659.9636	710.0403	698.4046	665.2440	617.2778	555.9605	483.1911	437.7137	428.7941	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9984	0.9966	0.9903	0.9648	0.8860	0.7220	0.5511	0.6114	0.8647	0.9816	0.9968	0.9988	(86)
MIT	19.7842	19.9228	20.1735	20.5109	20.7939	20.9511	20.9904	20.9839	20.8686	20.4943	20.0808	19.7626	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9979	0.9955	0.9868	0.9513	0.8433	0.6338	0.4346	0.4922	0.7987	0.9722	0.9955	0.9984	(89)
MIT 2	18.3658	18.5700	18.9363	19.4265	19.8049	19.9871	20.0166	20.0153	19.9074	19.4115	18.8097	18.3411	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6558	18.8466	19.1892	19.6481	20.0071	20.1842	20.2157	20.2133	20.1039	19.6328	19.0695	18.6317	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9829	0.9450	0.8431	0.6497	0.4585	0.5166	0.8055	0.9673	0.9936	0.9976	(94)
Useful gains	450.2709	509.2300	572.6984	623.6777	598.6560	453.7339	305.0170	318.8569	447.8421	467.3686	434.9105	427.7450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1261.7099	1222.3907	1109.1972	927.6278	715.2339	475.4111	307.8197	323.9617	513.3738	777.7182	1035.5745	1254.9203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating												3066.4845	(98)
Space heating per m2											(98) / (4) =	38.7672	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3283.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	603.7106	479.2440	399.1551	218.8441	86.7340	0.0000	0.0000	0.0000	0.0000	230.9001	432.4781	615.4184	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	646.3711	513.1092	427.3610	234.3084	92.8630	0.0000	0.0000	0.0000	0.0000	247.2164	463.0387	658.9062	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6415	87.4376	86.9514	85.7929	83.6126	80.3000	80.3000	80.3000	80.3000	85.8086	87.1473	87.7270	(217)
Fuel for water heating, kWh/month													
	229.9091	202.0688	211.4149	190.0466	188.7965	173.1411	165.8823	184.9199	186.9622	199.2267	209.4037	224.2706	(219)
Water heating fuel used												2366.0425	(219)
Annual totals kWh/year													
Space heating fuel - main system												3283.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6088.6247	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3283.1739	0.2160	709.1656	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2366.0425	0.2160	511.0652	(264)
Space and water heating			1220.2308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1448.2836	(272)
Emissions per m2 for space and water heating			15.4264	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4264 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.3100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 285 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 285	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 285, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.31	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.05	$kgCO_2/m^2$	Pass
	-9.26 (-50.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.68	$kWh/m^2/yr$	
	-11.1 (-21.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 6.33 m², No overhang 4.22 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 285 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 285	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 285, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 285 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 285	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 285, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.05	**TER**	18.31
Environmental	94 A	**% DER<TER**	50.57		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.68	**TFEE**	50.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.05	$kgCO_2/yr/m^2$	
TER	18.31	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.05	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.57	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.68	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.92	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.66	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.20	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 286 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 286	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 286, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.33 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 4.22 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
									Total per year (kWh/year) = Sum(64)m =			1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(76)
South	0.9600	46.7521	0.4100	1.0000	0.7700	12.7523	(78)
West	4.2200	19.6403	0.4100	1.0000	0.7700	23.5492	(80)

Solar gains	71.6254	136.0533	216.2695	306.6842	370.3363	377.1839	359.8489	312.4091	248.3799	159.1833	88.5237	59.4335	(83)
Total gains	442.5659	504.9394	571.8046	640.6666	682.4306	668.1621	637.0887	595.5664	542.5870	475.1538	429.5125	419.1909	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9932	0.9880	0.9748	0.9369	0.8531	0.6972	0.5417	0.5913	0.8237	0.9587	0.9885	0.9945	(86)
MIT	19.3204	19.5119	19.8425	20.2991	20.6630	20.9023	20.9731	20.9622	20.7926	20.3095	19.7595	19.3211	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9916	0.9851	0.9684	0.9202	0.8131	0.6205	0.4359	0.4859	0.7627	0.9446	0.9852	0.9932	(89)
MIT 2	17.7233	18.0059	18.4889	19.1603	19.6582	19.9711	20.0364	20.0352	19.8458	19.1888	18.3880	17.7402	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0498	18.3138	18.7656	19.3931	19.8636	20.1614	20.2279	20.2247	20.0393	19.4179	18.6684	18.0634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9870	0.9784	0.9580	0.9071	0.8058	0.6302	0.4566	0.5057	0.7628	0.9331	0.9788	0.9893	(94)
Useful gains	436.8070	494.0117	547.8156	581.1377	549.8686	421.0558	290.8629	301.1697	413.8930	443.3717	420.4010	414.7198	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1236.6157	1198.4316	1088.5670	900.1027	695.4304	457.2497	298.2805	312.1860	495.3744	751.1687	999.2098	1213.9019	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating												3049.0345	(98)
Space heating per m2											(98) / (4) =	38.5466	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3282.0608	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.0577	473.3702	402.3191	229.6548	108.2980	0.0000	0.0000	0.0000	0.0000	229.0009	416.7423	594.5915	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	640.5357	509.5481	433.0668	247.2064	116.5748	0.0000	0.0000	0.0000	0.0000	246.5026	448.5924	640.0339	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1944	89.1395	89.0180	88.7175	88.1542	86.7000	86.7000	86.7000	86.7000	88.6874	89.0488	89.2102	(217)
Fuel for water heating, kWh/month													
	182.0167	159.6581	165.8537	146.3303	142.2362	126.1921	118.3152	133.8039	134.8180	151.9345	163.5725	176.6520	(219)
Water heating fuel used												1801.3832	(219)
Annual totals kWh/year													
Space heating fuel - main system												3282.0608	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4325.5790	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3282.0608	0.2160	708.9251	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.3832	0.2160	389.0988	(264)
Space and water heating			1098.0239	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			704.6920	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.9100	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.4542	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.4542	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

	385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	4.2200	19.6403	0.6300	0.7000	0.7700	25.3298	(80)

Solar gains	77.0410	146.3402	232.6216	329.8725	398.3373	405.7027	387.0570	336.0303	267.1598	171.2191	95.2169	63.9273	(83)
Total gains	462.3075	529.0520	601.1633	676.0325	721.8214	707.3713	675.0242	630.6705	573.6721	500.3239	450.1239	438.0457	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9982	0.9961	0.9889	0.9614	0.8803	0.7153	0.5438	0.6001	0.8524	0.9787	0.9963	0.9987	(86)
MIT	19.7968	19.9422	20.1944	20.5267	20.8015	20.9532	20.9909	20.9852	20.8786	20.5128	20.0954	19.7736	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9977	0.9948	0.9849	0.9468	0.8364	0.6271	0.4285	0.4823	0.7837	0.9680	0.9948	0.9982	(89)
MIT 2	18.3842	18.5981	18.9663	19.4480	19.8136	19.9887	20.0168	20.0159	19.9172	19.4371	18.8309	18.3572	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6729	18.8729	19.2174	19.6685	20.0156	20.1859	20.2160	20.2140	20.1137	19.6570	19.0894	18.6468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9926	0.9807	0.9405	0.8366	0.6430	0.4522	0.5064	0.7915	0.9629	0.9928	0.9973	(94)
Useful gains	460.6766	525.1371	589.5397	635.7798	603.9055	454.8733	305.2198	319.3700	454.0709	481.7418	446.8777	436.8668	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1263.2167	1224.6992	1111.6570	929.3842	715.9624	475.5555	307.8456	324.0264	514.2107	779.7991	1037.2929	1256.2284	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating												3006.8749	(98)
Space heating per m2											(98) / (4) =	38.0136	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3219.3521	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.0898	470.1057	388.4553	211.3952	83.3704	0.0000	0.0000	0.0000	0.0000	221.7546	425.0989	609.6051	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	639.2824	503.3252	415.9050	226.3331	89.2616	0.0000	0.0000	0.0000	0.0000	237.4246	455.1380	652.6821	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6193	87.3971	86.8895	85.7060	83.5252	80.3000	80.3000	80.3000	80.3000	85.7072	87.1092	87.7083	(217)
Fuel for water heating, kWh/month													
	229.9673	202.1623	211.5657	190.2393	188.9942	173.1411	165.8823	184.9199	186.9622	199.4624	209.4952	224.3184	(219)
Water heating fuel used												2367.1103	(219)
Annual totals kWh/year													
Space heating fuel - main system												3219.3521	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6025.8707	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3219.3521	0.2160	695.3801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2367.1103	0.2160	511.2958	(264)
Space and water heating			1206.6759	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1434.7288	(272)
Emissions per m2 for space and water heating			15.2551	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2551 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.1400	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 286 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 286	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 286, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.14	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	8.91	$kgCO_2/m^2$	Pass
	-9.23 (-50.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.95	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.06	$kWh/m^2/yr$	
	-10.8 (-21.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East	6.33 m², No overhang		
Windows facing South	0.96 m², No overhang		
Windows facing West	4.22 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Roof U-value	0.07	W/m²K	
Thermal bridging y-value	0.024	W/m²K	
Photovoltaic array	1.62	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 286 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 286	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 286, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 286 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 286	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 286, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.91	**TER**	18.14
Environmental	94 A	**% DER<TER**	50.88		
CO_2 Emissions (t/year)	0.36	**DFEE**	39.06	**TFEE**	49.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	8.91	$kgCO_2/yr/m^2$	
TER	18.14	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.88	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.06	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.23	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.77	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.51	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.05	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 287 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 287	**Prop Type Ref**	
Property	Rivermont Semi, Plot 287, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 6.33 m², No overhang
Windows facing West: 4.36 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)

Total heat required for water heating calculated for each month

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)

Total per year (kWh/year) = Sum(64)m = 1590.3950 (64)

Heat gains from water heating, kWh/month

	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.4453	17.2711	14.0458	10.6336	7.9487	6.7107	7.2511	9.4253	12.6506	16.0628	18.7477	19.9857	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)

Total internal gains

	370.9232	368.8708	355.5226	333.9730	312.0873	290.9722	277.2334	283.1489	294.1958	315.9563	340.9723	359.7396	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.4100	1.0000	0.7700	2.9004	(74)
East	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(76)
West	4.3600	19.6403	0.4100	1.0000	0.7700	24.3305	(80)

Solar gains	62.5548	122.2394	201.6013	295.4156	363.8819	373.4527	355.1405	303.7240	234.8406	145.0683	77.9600	51.4748	(83)
Total gains	433.4780	491.1102	557.1239	629.3886	675.9692	664.4250	632.3739	586.8729	529.0364	461.0246	418.9323	411.2144	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5606	47.8682	48.1798	49.8008	50.1381	51.8960	51.8960	52.2624	51.1783	50.1381	49.4679	48.8154	
alpha	4.1707	4.1912	4.2120	4.3201	4.3425	4.4597	4.4597	4.4842	4.4119	4.3425	4.2979	4.2544	
util living area	0.9964	0.9934	0.9847	0.9555	0.8802	0.7254	0.5650	0.6205	0.8582	0.9737	0.9936	0.9971	(86)
MIT	19.4391	19.6068	19.9092	20.3374	20.6867	20.9139	20.9780	20.9675	20.8020	20.3416	19.8389	19.4414	(87)
Th 2	19.9456	19.9517	19.9577	19.9881	19.9943	20.0250	20.0250	20.0312	20.0127	19.9943	19.9820	19.9699	(88)
util rest of house	0.9954	0.9915	0.9801	0.9414	0.8411	0.6439	0.4508	0.5065	0.7981	0.9629	0.9915	0.9963	(89)
MIT 2	17.8590	18.1075	18.5511	19.1850	19.6641	19.9587	20.0146	20.0142	19.8336	19.2033	18.4674	17.8784	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.1681	18.4007	18.8167	19.4103	19.8641	20.1455	20.2030	20.2007	20.0230	19.4259	18.7357	18.1841	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1681	18.4007	18.8167	19.4103	19.8641	20.1455	20.2030	20.2007	20.0230	19.4259	18.7357	18.1841	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9874	0.9730	0.9310	0.8352	0.6549	0.4726	0.5277	0.7988	0.9544	0.9876	0.9942	(94)
Useful gains	430.3443	484.9359	542.0950	585.9748	564.5661	435.1104	298.8625	309.6868	422.5920	440.0205	413.7520	408.8360	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1281.3640	1239.4092	1123.3973	927.4383	715.5575	469.5820	305.0988	319.5747	508.5789	773.5603	1033.6452	1258.8723	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	633.1587	507.0061	432.4889	245.8537	112.3376	0.0000	0.0000	0.0000	0.0000	248.1536	446.3231	632.4270	(98)
Space heating												3257.7486	(98)
Space heating per m2											(98) / (4) =	41.1852	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3506.7262	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.1587	507.0061	432.4889	245.8537	112.3376	0.0000	0.0000	0.0000	0.0000	248.1536	446.3231	632.4270	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	681.5487	545.7547	465.5424	264.6434	120.9231	0.0000	0.0000	0.0000	0.0000	267.1190	480.4339	680.7610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2279	89.1786	89.0634	88.7678	88.1833	86.7000	86.7000	86.7000	86.7000	88.7473	89.0909	89.2429	(217)
Fuel for water heating, kWh/month													
	181.9483	159.5881	165.7691	146.2473	142.1893	126.1921	118.3152	133.8039	134.8180	151.8320	163.4951	176.5871	(219)
Water heating fuel used												1800.7855	(219)
Annual totals kWh/year													
Space heating fuel - main system												3506.7262	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4549.3423	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3506.7262	0.2160	757.4529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.7855	0.2160	388.9697	(264)
Space and water heating			1146.4225	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			752.9326	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.5200	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		28.0642	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.0642	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(76)
West	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(80)

Solar gains	67.2845	131.4819	216.8443	317.7519	391.3949	401.6894	381.9926	326.6885	252.5968	156.0369	83.8545	55.3668	(83)
Total gains	452.4980	514.1465	585.3477	663.8829	714.8574	703.3397	669.9400	621.3029	559.0746	485.0979	438.7103	429.4306	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9984	0.9966	0.9904	0.9655	0.8891	0.7289	0.5589	0.6195	0.8690	0.9819	0.9968	0.9988	(86)
MIT	19.7496	19.8900	20.1447	20.4882	20.7796	20.9455	20.9888	20.9815	20.8582	20.4733	20.0518	19.7276	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9979	0.9954	0.9869	0.9521	0.8466	0.6395	0.4389	0.4972	0.8031	0.9726	0.9954	0.9984	(89)
MIT 2	18.3000	18.5068	18.8790	19.3781	19.7688	19.9617	19.9945	19.9927	19.8769	19.3655	18.7520	18.2747	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5835	18.7773	19.1265	19.5952	19.9665	20.1541	20.1890	20.1861	20.0688	19.5822	19.0062	18.5588	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9934	0.9828	0.9454	0.8455	0.6545	0.4624	0.5210	0.8088	0.9674	0.9935	0.9975	(94)
Useful gains	451.0208	510.7593	575.2587	627.6528	604.4347	460.3276	309.7951	323.7249	452.2013	469.2936	435.8608	428.3512	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1285.0885	1245.2019	1129.9957	945.3221	728.9393	484.4116	313.0159	329.5333	522.7943	792.0526	1054.8826	1278.4672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating												3166.4842	(98)
Space heating per m2											(98) / (4) =	40.0314	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3390.2400	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.5464	493.5455	412.7243	228.7219	92.6314	0.0000	0.0000	0.0000	0.0000	240.1327	445.6957	632.4863	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	664.3966	528.4213	441.8890	244.8843	99.1771	0.0000	0.0000	0.0000	0.0000	257.1014	477.1902	677.1802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6963	87.4988	87.0269	85.9033	83.7607	80.3000	80.3000	80.3000	80.3000	85.9066	87.2133	87.7804	(217)
Fuel for water heating, kWh/month													
	229.7654	201.9275	211.2315	189.8024	188.4628	173.1411	165.8823	184.9199	186.9622	198.9995	209.2451	224.1341	(219)
Water heating fuel used												2364.4739	(219)
Annual totals kWh/year													
Space heating fuel - main system												3390.2400	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6193.1853	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3390.2400	0.2160	732.2918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4739	0.2160	510.7264	(264)
Space and water heating			1243.0182	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1470.5849	(272)
Emissions per m2 for space and water heating			15.7145	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7145 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.5900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 287 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 287	**Prop Type Ref**	
Property	Rivermont Semi, Plot 287, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.52	$kgCO_2/m^2$	Pass
	-9.07 (-48.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.49	$kWh/m^2/yr$	
	-10.9 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.96 m², No overhang 6.33 m², No overhang 4.36 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 287 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 287	**Prop Type Ref**	
Property	Rivermont Semi, Plot 287, Boorley Gardens, Southampton, SO32		

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Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 287 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 287	**Prop Type Ref**	
Property	Rivermont Semi, Plot 287, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.52	**TER**	18.59
Environmental	93 A	**% DER<TER**	48.79		
CO_2 Emissions (t/year)	0.40	**DFEE**	41.49	**TFEE**	52.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.52	$kgCO_2/yr/m^2$	
TER	18.59	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.52	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.79	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.49	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.80	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.34	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.34	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.62	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.62	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 288 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 288	**Prop Type Ref**	
Property	Rivermont Semi, Plot 288, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.37 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.8 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.33 m², No overhang
Windows facing South: 0.96 m², No overhang
Windows facing West: 4.36 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6500	1.2357	14.3964			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	89.1400	13.7700	75.3700	0.2100	15.8277			(29a)
Main Roof	39.5500		39.5500	0.0700	2.7685			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7096			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.0258	(36)
Total fabric heat loss (33) + (36) =	45.7354	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	92.3968	91.8031	91.2093	88.2405	87.6467	84.6779	84.6779	84.0842	85.8654	87.6467	88.8343	90.0218	(39)
Average = Sum(39)m / 12 =												88.0921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1681	1.1606	1.1531	1.1156	1.1080	1.0705	1.0705	1.0630	1.0855	1.1080	1.1231	1.1381	(40)
HLP (average)												1.1137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)

Total heat required for water heating calculated for each month

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)

Total per year (kWh/year) = Sum(64)m = 1590.3950 (64)

Heat gains from water heating, kWh/month

	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.4453	17.2711	14.0458	10.6336	7.9487	6.7107	7.2511	9.4253	12.6506	16.0628	18.7477	19.9857	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)

Total internal gains

	370.9232	368.8708	355.5226	333.9730	312.0873	290.9722	277.2334	283.1489	294.1958	315.9563	340.9723	359.7396	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.3300	19.6403	0.4100	1.0000	0.7700	35.3239	(76)
South	0.9600	46.7521	0.4100	1.0000	0.7700	12.7523	(78)
West	4.3600	19.6403	0.4100	1.0000	0.7700	24.3305	(80)

Solar gains	72.4067	137.5816	218.7864	310.3550	374.8349	381.7891	364.2332	316.1752	251.3071	160.9967	89.4978	60.0760	(83)
Total gains	443.3299	506.4524	574.3091	644.3279	686.9221	672.7613	641.4666	599.3241	545.5030	476.9530	430.4701	419.8156	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5606	47.8682	48.1798	49.8008	50.1381	51.8960	51.8960	52.2624	51.1783	50.1381	49.4679	48.8154	
alpha	4.1707	4.1912	4.2120	4.3201	4.3425	4.4597	4.4597	4.4842	4.4119	4.3425	4.2979	4.2544	
util living area	0.9961	0.9926	0.9829	0.9520	0.8751	0.7194	0.5581	0.6101	0.8472	0.9704	0.9929	0.9969	(86)
MIT	19.4527	19.6277	19.9317	20.3545	20.6955	20.9168	20.9791	20.9696	20.8136	20.3615	19.8547	19.4534	(87)
Th 2	19.9456	19.9517	19.9577	19.9881	19.9943	20.0250	20.0250	20.0312	20.0127	19.9943	19.9820	19.9699	(88)
util rest of house	0.9950	0.9905	0.9779	0.9370	0.8351	0.6377	0.4448	0.4970	0.7848	0.9585	0.9906	0.9960	(89)
MIT 2	17.8788	18.1378	18.5832	19.2084	19.6747	19.9612	20.0152	20.0154	19.8460	19.2309	18.4904	17.8959	(90)

Living area fraction fLA = Living area / (4) = 0.1956 (91)

MIT	18.1866	18.4292	18.8470	19.4325	19.8743	20.1481	20.2037	20.2020	20.0352	19.4520	18.7572	18.2005	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1866	18.4292	18.8470	19.4325	19.8743	20.1481	20.2037	20.2020	20.0352	19.4520	18.7572	18.2005	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9922	0.9861	0.9704	0.9265	0.8295	0.6489	0.4665	0.5181	0.7865	0.9497	0.9864	0.9938	(94)
Useful gains	439.8664	499.4003	557.2976	596.9808	569.8142	436.5428	299.2268	310.4907	429.0231	452.9549	424.6319	417.2016	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1283.0818	1242.0215	1126.1569	929.3955	716.4526	469.7993	305.1521	319.6921	509.6301	775.8462	1035.5610	1260.3494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	627.3523	499.0414	423.2314	239.3387	109.0989	0.0000	0.0000	0.0000	0.0000	240.2311	439.8689	627.3019	(98)

Space heating 3205.4647 (98)

Space heating per m2 (98) / (4) = 40.5242 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3450.4463	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	627.3523	499.0414	423.2314	239.3387	109.0989	0.0000	0.0000	0.0000	0.0000	240.2311	439.8689	627.3019	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	675.2985	537.1813	455.5774	257.6304	117.4369	0.0000	0.0000	0.0000	0.0000	258.5911	473.4865	675.2443	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2230	89.1697	89.0500	88.7481	88.1600	86.7000	86.7000	86.7000	86.7000	88.7233	89.0821	89.2387	(217)
Fuel for water heating, kWh/month													
	181.9583	159.6040	165.7941	146.2798	142.2268	126.1921	118.3152	133.8039	134.8180	151.8731	163.5113	176.5955	(219)
Water heating fuel used												1800.9722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3450.4463	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.4098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4493.2492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3450.4463	0.2160	745.2964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.9722	0.2160	389.0100	(264)
Space and water heating			1134.3064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.4098	0.5190	178.2297	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			740.8165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.3700	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		27.9142	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9142	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6500	1.3258	15.4451			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	13.7700	75.3700	0.1800	13.5666			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.8387			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.1818	(36)
Total fabric heat loss	(33) + (36) =	51.0205	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	89.9699	89.7295	89.4939	88.3873	88.1802	87.2163	87.2163	87.0379	87.5876	88.1802	88.5991	89.0370	(39)
Average = Sum(39)m / 12 =												88.3863	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1374	1.1344	1.1314	1.1174	1.1148	1.1026	1.1026	1.1004	1.1073	1.1148	1.1201	1.1256	(40)
HLP (average)												1.1174	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5813	18.2801	14.8664	11.2548	8.4131	7.1027	7.6747	9.9759	13.3896	17.0012	19.8429	21.1533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.2135	382.6646	368.5034	346.1310	323.4624	301.6503	287.9474	294.6144	306.4777	329.0610	354.8558	374.0638	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.3300	19.6403	0.6300	0.7000	0.7700	37.9947	(76)
South	0.9600	46.7521	0.6300	0.7000	0.7700	13.7165	(78)
West	4.3600	19.6403	0.6300	0.7000	0.7700	26.1701	(80)

Solar gains	77.8813	147.9841	235.3288	333.8208	403.1761	410.6560	391.7728	340.0811	270.3084	173.1697	96.2647	64.6183	(83)
Total gains	463.0948	530.6487	603.8322	679.9518	726.6385	712.3063	679.7202	634.6956	576.7862	502.2306	451.1205	438.6822	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.0544	61.2179	61.3791	62.1476	62.2935	62.9820	62.9820	63.1111	62.7150	62.2935	61.9990	61.6941	
alpha	5.0703	5.0812	5.0919	5.1432	5.1529	5.1988	5.1988	5.2074	5.1810	5.1529	5.1333	5.1129	
util living area													
	0.9982	0.9961	0.9890	0.9622	0.8836	0.7224	0.5516	0.6084	0.8571	0.9792	0.9963	0.9987	(86)
MIT	19.7621	19.9092	20.1655	20.5040	20.7873	20.9478	20.9894	20.9829	20.8684	20.4918	20.0664	19.7386	(87)
Th 2	19.9704	19.9729	19.9753	19.9866	19.9888	19.9987	19.9987	20.0005	19.9949	19.9888	19.9845	19.9800	(88)
util rest of house													
	0.9976	0.9947	0.9850	0.9477	0.8399	0.6328	0.4328	0.4873	0.7885	0.9686	0.9948	0.9982	(89)
MIT 2	18.3183	18.5348	18.9089	19.3997	19.7777	19.9635	19.9948	19.9934	19.8870	19.3912	18.7732	18.2907	(90)
Living area fraction										fLA = Living area / (4) =		0.1956	(91)
MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6006	18.8036	19.1546	19.6157	19.9752	20.1560	20.1893	20.1869	20.0790	19.6064	19.0261	18.5738	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9925	0.9806	0.9410	0.8392	0.6480	0.4561	0.5109	0.7952	0.9631	0.9927	0.9972	(94)
Useful gains	461.4250	526.6658	592.1145	639.8316	609.8195	461.5487	310.0213	324.2914	458.6578	483.7181	447.8288	437.4716	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1286.6282	1247.5614	1132.5125	947.1311	729.7056	484.5702	313.0453	329.6062	523.6843	794.1890	1056.6395	1279.8042	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating												3106.9296	(98)
Space heating per m2											(98) / (4) =	39.2785	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3326.4771	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	613.9512	484.4418	402.0562	221.2556	89.1953	0.0000	0.0000	0.0000	0.0000	230.9904	438.3437	626.6955	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	657.3353	518.6743	430.4670	236.8904	95.4982	0.0000	0.0000	0.0000	0.0000	247.3131	469.3187	670.9802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6751	87.4601	86.9679	85.8203	83.6752	80.3000	80.3000	80.3000	80.3000	85.8096	87.1769	87.7625	(217)
Fuel for water heating, kWh/month													
	229.8210	202.0167	211.3750	189.9858	188.6553	173.1411	165.8823	184.9199	186.9622	199.2245	209.3325	224.1798	(219)
Water heating fuel used												2365.4962	(219)
Annual totals kWh/year													
Space heating fuel - main system												3326.4771	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.4714	(232)
Total delivered energy for all uses												6130.4447	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3326.4771	0.2160	718.5191	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2365.4962	0.2160	510.9472	(264)
Space and water heating			1229.4662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.4714	0.5190	188.6417	(268)
Total CO2, kg/m2/year			1457.0329	(272)
Emissions per m2 for space and water heating			15.5432	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3849	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5432 * 1.00) + 2.3849 + 0.4921, rounded to 2 d.p.			18.4200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 288 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 288	**Prop Type Ref**	
Property	Rivermont Semi, Plot 288, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.37	$kgCO_2/m^2$	Pass
	-9.05 (-49.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.83	$kWh/m^2/yr$	
	-10.7 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	6.33 m², No overhang 0.96 m², No overhang 4.36 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 288 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 288	**Prop Type Ref**	
Property	Rivermont Semi, Plot 288, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	15.47	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	89.14	75.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.55	39.55

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	West							2.12	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.76	0.052	No
Independently assessed	E3 Sill	6.93	0.004	No
Independently assessed	E4 Jamb	23.85	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	17.79	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.10	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	8.69	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	8.69	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.69	0.037	No

Y-value	0.024	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 288 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 288	**Prop Type Ref**	
Property	Rivermont Semi, Plot 288, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.37	**TER**	18.42
Environmental	94 A	**% DER<TER**	49.13		
CO_2 Emissions (t/year)	0.39	**DFEE**	40.83	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	9.37	$kgCO_2/yr/m^2$	
TER	18.42	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.37	$kgCO_2/yr/m^2$	
Reduction DER/TER	49.13	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.83	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.64	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.18	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.92	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.46	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 289 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 289	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 289, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.84	**TER**	18.09
Environmental	95 A	**% DER<TER**	56.66		
CO_2 Emissions (t/year)	0.28	**DFEE**	38.74	**TFEE**	49.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.09 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.84 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 0.96 m², No overhang
Windows facing South East: 6.33 m², No overhang
Windows facing North West: 4.22 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
										Total per year (kWh/year) = Sum(64)m =		1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9600	11.2829	0.4100	1.0000	0.7700	3.0776	(75)
Southeast	6.3300	36.7938	0.4100	1.0000	0.7700	66.1753	(77)
Northwest	4.2200	11.2829	0.4100	1.0000	0.7700	13.5286	(81)

Solar gains	82.7814	146.5233	215.1308	291.1151	348.4883	355.8279	338.9529	294.6426	241.2071	165.8898	100.1576	70.1937	(83)
Total gains	453.7219	515.4094	570.6659	625.0975	660.5826	646.8061	616.1927	577.7999	535.4141	481.8604	441.1465	429.9510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9926	0.9872	0.9750	0.9412	0.8637	0.7124	0.5572	0.6058	0.8286	0.9569	0.9874	0.9940	(86)
MIT	19.3374	19.5276	19.8409	20.2800	20.6443	20.8941	20.9702	20.9588	20.7873	20.3184	19.7771	19.3378	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9908	0.9841	0.9686	0.9254	0.8254	0.6361	0.4496	0.4992	0.7685	0.9423	0.9838	0.9925	(89)
MIT 2	17.7482	18.0286	18.4866	19.1342	19.6355	19.9636	20.0348	20.0329	19.8401	19.2011	18.4134	17.7645	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0731	18.3351	18.7635	19.3685	19.8417	20.1538	20.2260	20.2222	20.0338	19.4295	18.6922	18.0861	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0731	18.3351	18.7635	19.3685	19.8417	20.1538	20.2260	20.2222	20.0338	19.4295	18.6922	18.0861	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9770	0.9583	0.9123	0.8173	0.6451	0.4704	0.5190	0.7681	0.9307	0.9770	0.9884	(94)
Useful gains	447.3524	503.5674	546.8529	570.3038	539.8648	417.2630	289.8680	299.8927	411.2784	448.4640	431.0119	424.9839	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1238.7075	1200.3318	1088.3747	897.9906	693.5658	456.6216	298.1235	311.9841	494.9089	752.1571	1001.2672	1215.8937	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	588.7682	468.2257	402.8922	235.9345	114.3535	0.0000	0.0000	0.0000	0.0000	225.9477	410.5838	588.4369	(98)
Space heating												3035.1426	(98)
Space heating per m2											(98) / (4) =	38.3710	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3267.1072	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.7682	468.2257	402.8922	235.9345	114.3535	0.0000	0.0000	0.0000	0.0000	225.9477	410.5838	588.4369	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	633.7656	504.0104	433.6837	253.9661	123.0932	0.0000	0.0000	0.0000	0.0000	243.2160	441.9632	633.4089	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1885	89.1331	89.0189	88.7375	88.1975	86.7000	86.7000	86.7000	86.7000	88.6773	89.0394	89.2045	(217)
Fuel for water heating, kWh/month													
	182.0287	159.6695	165.8520	146.2973	142.1664	126.1921	118.3152	133.8039	134.8180	151.9518	163.5897	176.6632	(219)
Water heating fuel used												1801.3477	(219)
Annual totals kWh/year													
Space heating fuel - main system												3267.1072	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =											-1333.8260	-1333.8260	(233)
Total delivered energy for all uses												4153.3430	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3267.1072	0.2160	705.6952	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.3477	0.2160	389.0911	(264)
Space and water heating			1094.7863	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			619.8432	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.8400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.8400	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		26.3842	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.3842	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

	385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9600	11.2829	0.6300	0.7000	0.7700	3.3103	(75)
Southeast	6.3300	36.7938	0.6300	0.7000	0.7700	71.1788	(77)
Northwest	4.2200	11.2829	0.6300	0.7000	0.7700	14.5515	(81)

Solar gains	89.0405	157.6019	231.3968	313.1263	374.8374	382.7319	364.5811	316.9204	259.4447	178.4327	107.7305	75.5010	(83)
Total gains	474.3070	540.3137	599.9385	659.2863	698.3215	684.4005	652.5482	611.5606	565.9570	507.5375	462.6374	449.6194	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9980	0.9957	0.9890	0.9650	0.8916	0.7325	0.5608	0.6163	0.8578	0.9774	0.9958	0.9985	(86)
MIT	19.8110	19.9553	20.1930	20.5102	20.7862	20.9476	20.9896	20.9833	20.8743	20.5205	20.1100	19.7874	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9974	0.9942	0.9851	0.9515	0.8501	0.6446	0.4428	0.4966	0.7902	0.9662	0.9942	0.9980	(89)
MIT 2	18.4049	18.6173	18.9643	19.4255	19.7960	19.9845	20.0163	20.0150	19.9131	19.4477	18.8522	18.3773	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.6923	18.8908	19.2155	19.6473	19.9984	20.1814	20.2152	20.2129	20.1096	19.6670	19.1093	18.6656	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6923	18.8908	19.2155	19.6473	19.9984	20.1814	20.2152	20.2129	20.1096	19.6670	19.1093	18.6656	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9919	0.9808	0.9452	0.8495	0.6602	0.4670	0.5210	0.7976	0.9609	0.9919	0.9970	(94)
Useful gains	472.4365	535.9483	588.4295	623.1617	593.2490	451.8347	304.7299	318.6210	451.4199	487.7004	458.8923	448.2608	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1264.9205	1226.2695	1111.4947	927.5529	714.4813	475.1698	307.7832	323.9320	513.8552	780.6620	1039.0195	1257.8632	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	589.6081	463.8958	389.1606	219.1617	90.1968	0.0000	0.0000	0.0000	0.0000	217.9634	417.6916	602.3442	(98)
Space heating												2990.0221	(98)
Space heating per m2											(98) / (4) =	37.8005	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3201.3084	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	589.6081	463.8958	389.1606	219.1617	90.1968	0.0000	0.0000	0.0000	0.0000	217.9634	417.6916	602.3442	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	631.2720	496.6765	416.6601	234.6485	96.5704	0.0000	0.0000	0.0000	0.0000	233.3655	447.2072	644.9081	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5938	87.3690	86.8936	85.7965	83.7004	80.3000	80.3000	80.3000	80.3000	85.6639	87.0701	87.6846	(217)
Fuel for water heating, kWh/month													
	230.0342	202.2274	211.5556	190.0386	188.5987	173.1411	165.8823	184.9199	186.9622	199.5633	209.5893	224.3791	(219)
Water heating fuel used												2366.8917	(219)
Annual totals kWh/year													
Space heating fuel - main system												3201.3084	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												6007.6084	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3201.3084	0.2160	691.4826	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2366.8917	0.2160	511.2486	(264)
Space and water heating			1202.7312	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1430.7841	(272)
Emissions per m2 for space and water heating			15.2052	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2052 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			18.0900	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 289 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 289	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 289, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.84	**TER**	18.09
Environmental	95 A	**% DER<TER**	56.66		
CO_2 Emissions (t/year)	0.28	**DFEE**	38.74	**TFEE**	49.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.09	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.84	$kgCO_2/m^2$	Pass
	-10.25 (-56.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.55	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	38.74	$kWh/m^2/yr$	
	-10.8 (-21.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North East Windows facing South East Windows facing North West	0.96 m², No overhang 6.33 m², No overhang 4.22 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 289 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 289	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 289, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.84	**TER**	18.09
Environmental	95 A	**% DER<TER**	56.66		
CO_2 Emissions (t/year)	0.28	**DFEE**	38.74	**TFEE**	49.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 289 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 289	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 289, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.84	**TER**	18.09
Environmental	95 A	**% DER<TER**	56.66		
CO_2 Emissions (t/year)	0.28	**DFEE**	38.74	**TFEE**	49.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	7.84	$kgCO_2/yr/m^2$	
TER	18.09	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.84	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.66	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	38.74	$kWh/m^2/yr$
CfSH ENE2 credits achieved	8.8	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.72	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.72	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.97	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.97	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 290 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 290	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 290, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.74	**TER**	17.97
Environmental	95 A	**% DER<TER**	56.92		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.31	**TFEE**	48.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.97 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 6.33 m², No overhang
Windows facing South West: 0.96 m², No overhang
Windows facing North West: 4.22 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2015	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.4265	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3625	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4622	0.4531	0.4441	0.3987	0.3897	0.3444	0.3444	0.3353	0.3625	0.3897	0.4078	0.4259	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.7122	0.7031	0.6941	0.6487	0.6397	0.5944	0.5944	0.5853	0.6125	0.6397	0.6578	0.6759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5100	1.2357	14.2234			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1400	5.5370			(28a)
External Wall	75.5500	13.6300	61.9200	0.2100	13.0032			(29a)
Dormer wall	1.8000		1.8000	0.1900	0.3420			(29a)
Main Roof	35.2800		35.2800	0.0700	2.4696			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1600	0.2640			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.4352			(33)
Party Wall			43.5500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							172.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8404	(36)
Total fabric heat loss					(33) + (36) =		43.2755	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.6614	46.0677	45.4739	42.5051	41.9113	38.9425	38.9425	38.3488	40.1301	41.9113	43.0989	44.2864	(38)
Heat transfer coeff	89.9370	89.3432	88.7494	85.7806	85.1869	82.2181	82.2181	81.6243	83.4056	85.1869	86.3744	87.5619	(39)
Average = Sum(39)m / 12 =												85.6322	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1370	1.1295	1.1220	1.0845	1.0770	1.0394	1.0394	1.0319	1.0544	1.0770	1.0920	1.1070	(40)
HLP (average)												1.0826	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m													
	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
									Total per year (kWh/year) = Sum(64)m =			1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4625	17.2864	14.0583	10.6430	7.9558	6.7166	7.2575	9.4336	12.6618	16.0770	18.7643	20.0034	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	370.9404	368.8861	355.5351	333.9824	312.0943	290.9782	277.2398	283.1573	294.2071	315.9705	340.9889	359.7573	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.3300	36.7938	0.4100	1.0000	0.7700	66.1753	(77)
Southwest	0.9600	36.7938	0.4100	1.0000	0.7700	10.0361	(79)
Northwest	4.2200	11.2829	0.4100	1.0000	0.7700	13.5286	(81)

Solar gains	89.7399	157.3539	227.2344	301.5609	356.0343	361.4920	345.1742	303.3066	252.7808	177.1278	108.3061	76.2691	(83)
Total gains	460.6804	526.2401	582.7695	635.5433	668.1286	652.4702	622.4140	586.4638	546.9879	493.0984	449.2949	436.0265	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.0208	42.3001	42.5831	44.0568	44.3639	45.9658	45.9658	46.3002	45.3114	44.3639	43.7540	43.1606	
alpha	3.8014	3.8200	3.8389	3.9371	3.9576	4.0644	4.0644	4.0867	4.0208	3.9576	3.9169	3.8774	
util living area													
	0.9922	0.9863	0.9733	0.9383	0.8600	0.7083	0.5526	0.5987	0.8206	0.9538	0.9866	0.9937	(86)
MIT	19.3481	19.5438	19.8580	20.2928	20.6509	20.8963	20.9711	20.9605	20.7957	20.3332	19.7894	19.3472	(87)
Th 2	19.9707	19.9768	19.9829	20.0135	20.0197	20.0506	20.0506	20.0568	20.0382	20.0197	20.0074	19.9951	(88)
util rest of house													
	0.9904	0.9830	0.9666	0.9219	0.8211	0.6319	0.4454	0.4926	0.7592	0.9384	0.9828	0.9922	(89)
MIT 2	17.7636	18.0520	18.5110	19.1518	19.6435	19.9656	20.0353	20.0341	19.8492	19.2214	18.4311	17.7782	(90)
Living area fraction										fLA = Living area / (4) =		0.2044	(91)
MIT	18.0875	18.3570	18.7864	19.3850	19.8494	20.1559	20.2266	20.2234	20.0427	19.4487	18.7088	18.0989	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0875	18.3570	18.7864	19.3850	19.8494	20.1559	20.2266	20.2234	20.0427	19.4487	18.7088	18.0989	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9756	0.9559	0.9088	0.8133	0.6411	0.4662	0.5124	0.7595	0.9266	0.9757	0.9879	(94)
Useful gains	453.9077	513.3986	557.0417	577.5978	543.3789	418.3037	290.1776	300.5329	415.4634	456.8871	438.3988	430.7625	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1240.0089	1202.2888	1090.4113	899.4128	694.2220	456.7943	298.1724	312.0853	495.6533	753.7919	1002.7009	1217.0158	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	584.8593	462.9342	396.8270	231.7068	112.2272	0.0000	0.0000	0.0000	0.0000	220.8972	406.2975	584.9725	(98)
Space heating												3000.7216	(98)
Space heating per m2											(98) / (4) =	37.9358	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3230.0556	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	584.8593	462.9342	396.8270	231.7068	112.2272	0.0000	0.0000	0.0000	0.0000	220.8972	406.2975	584.9725	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	629.5580	498.3145	427.1550	249.4153	120.8043	0.0000	0.0000	0.0000	0.0000	237.7795	437.3493	629.6797	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1848	89.1265	89.0092	88.7241	88.1825	86.7000	86.7000	86.7000	86.7000	88.6602	89.0328	89.2013	(217)
Fuel for water heating, kWh/month													
	182.0362	159.6814	165.8701	146.3194	142.1905	126.1921	118.3152	133.8039	134.8180	151.9812	163.6018	176.6696	(219)
Water heating fuel used												1801.4794	(219)
Annual totals kWh/year													
Space heating fuel - main system												3230.0556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.7141	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1029 * 1.00) =											-1333.8260	-1333.8260	(233)
Total delivered energy for all uses												4116.4231	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3230.0556	0.2160	697.6920	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.4794	0.2160	389.1195	(264)
Space and water heating			1086.8115	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.7141	0.5190	178.3876	(268)
Energy saving/generation technologies				
PV Unit	-1333.8260	0.5190	-692.2557	(269)
Total CO2, kg/year			611.8685	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.7400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.7400	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		26.2842	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.2842	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5100	1.3258	15.2595			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	75.5500	13.6300	61.9200	0.1800	11.1456			(29a)
Dormer wall	1.8000		1.8000	0.1800	0.3240			(29a)
Main Roof	35.2800		35.2800	0.1300	4.5864			(30)
Sloping roof	3.2000		3.2000	0.1300	0.4160			(30)
Dormer roof	1.6500		1.6500	0.1300	0.2145			(30)
Total net area of external elements Aum(A, m2)			157.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.6315			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3077	(36)
Total fabric heat loss					(33) + (36) =		48.9392	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	87.8886	87.6482	87.4126	86.3060	86.0989	85.1350	85.1350	84.9565	85.5063	86.0989	86.5178	86.9557	(39)
Average = Sum(39)m / 12 =												86.3050	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1111	1.1081	1.1051	1.0911	1.0885	1.0763	1.0763	1.0740	1.0810	1.0885	1.0938	1.0993	(40)
HLP (average)												1.0911	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)

Total heat required for water heating calculated for each month

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)

Heat gains from water heating, kWh/month

	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.6343	18.3272	14.9047	11.2838	8.4348	7.1210	7.6945	10.0016	13.4241	17.0450	19.8940	21.2078	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)

Water heating gains (Table 5)

	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)

Total internal gains

	385.2665	382.7117	368.5417	346.1600	323.4841	301.6686	287.9671	294.6402	306.5123	329.1048	354.9069	374.1184	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.3300	36.7938	0.6300	0.7000	0.7700	71.1788	(77)
Southwest	0.9600	36.7938	0.6300	0.7000	0.7700	10.7949	(79)
Northwest	4.2200	11.2829	0.6300	0.7000	0.7700	14.5515	(81)

Solar gains	96.5251	169.2514	244.4156	324.3618	382.9539	388.8243	371.2727	326.2395	271.8935	190.5204	116.4951	82.0358	(83)
Total gains	481.7917	551.9632	612.9573	670.5218	706.4381	690.4929	659.2398	620.8797	578.4058	519.6252	471.4020	456.1542	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5002	62.6716	62.8405	63.6463	63.7994	64.5217	64.5217	64.6572	64.2415	63.7994	63.4905	63.1708	
alpha	5.1667	5.1781	5.1894	5.2431	5.2533	5.3014	5.3014	5.3105	5.2828	5.2533	5.2327	5.2114	
util living area	0.9979	0.9953	0.9880	0.9626	0.8877	0.7279	0.5556	0.6083	0.8491	0.9751	0.9955	0.9984	(86)
MIT	19.8198	19.9689	20.2076	20.5213	20.7916	20.9492	20.9900	20.9842	20.8811	20.5332	20.1203	19.7951	(87)
Th 2	19.9918	19.9942	19.9967	20.0081	20.0103	20.0202	20.0202	20.0221	20.0164	20.0103	20.0059	20.0014	(88)
util rest of house	0.9972	0.9937	0.9836	0.9483	0.8454	0.6399	0.4384	0.4895	0.7797	0.9629	0.9936	0.9979	(89)
MIT 2	18.4178	18.6370	18.9853	19.4406	19.8022	19.9857	20.0165	20.0154	19.9196	19.4653	18.8671	18.3887	(90)
Living area fraction									fLA = Living area / (4) =			0.2044	(91)
MIT	18.7044	18.9093	19.2352	19.6616	20.0045	20.1826	20.2155	20.2135	20.1162	19.6836	19.1233	18.6762	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7044	18.9093	19.2352	19.6616	20.0045	20.1826	20.2155	20.2135	20.1162	19.6836	19.1233	18.6762	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9912	0.9792	0.9420	0.8451	0.6556	0.4625	0.5138	0.7878	0.9575	0.9912	0.9968	(94)
Useful gains	479.7583	547.0915	600.1877	631.6597	597.0137	452.6795	304.8848	319.0002	455.6511	497.5575	467.2742	454.6850	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1265.9818	1227.8891	1113.2137	928.7864	715.0056	475.2772	307.8029	323.9798	514.4222	782.0895	1040.2250	1258.7852	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	584.9502	457.4960	381.6913	213.9312	87.7859	0.0000	0.0000	0.0000	0.0000	211.6918	412.5246	598.2506	(98)
Space heating												2948.3217	(98)
Space heating per m2											(98) / (4) =	37.2733	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3156.6613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	584.9502	457.4960	381.6913	213.9312	87.7859	0.0000	0.0000	0.0000	0.0000	211.6918	412.5246	598.2506	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	626.2850	489.8244	408.6630	229.0484	93.9892	0.0000	0.0000	0.0000	0.0000	226.6508	441.6751	640.5253	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5777	87.3394	86.8491	85.7359	83.6395	80.3000	80.3000	80.3000	80.3000	85.5904	87.0423	87.6710	(217)
Fuel for water heating, kWh/month													
	230.0765	202.2959	211.6640	190.1728	188.7358	173.1411	165.8823	184.9199	186.9622	199.7347	209.6564	224.4138	(219)
Water heating fuel used												2367.6554	(219)
Annual totals kWh/year													
Space heating fuel - main system												3156.6613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												364.4083	(232)
Total delivered energy for all uses												5963.7249	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3156.6613	0.2160	681.8388	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2367.6554	0.2160	511.4136	(264)
Space and water heating			1193.2524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	364.4083	0.5190	189.1279	(268)
Total CO2, kg/m2/year			1421.3053	(272)
Emissions per m2 for space and water heating			15.0854	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3910	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0854 * 1.00) + 2.3910 + 0.4921, rounded to 2 d.p.			17.9700	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 290 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 290	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 290, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.74	**TER**	17.97
Environmental	95 A	**% DER<TER**	56.92		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.31	**TFEE**	48.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.97	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.74	$kgCO_2/m^2$	Pass
	-10.23 (-56.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	38.31	$kWh/m^2/yr$	
	-10.6 (-21.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing South East Windows facing South West Windows facing North West	6.33 m², No overhang 0.96 m², No overhang 4.22 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	1.62	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 290 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 290	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 290, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.74	**TER**	17.97
Environmental	95 A	**% DER<TER**	56.92		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.31	**TFEE**	48.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.79 m	39.55 m²	2.39 m
1st Storey:	17.79 m	39.55 m²	2.63 m

7.0 Living Area	16.17	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	172.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	75.55	61.92
Dormer wall	Cavity Wall	0.19	1.80	1.80

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	43.55

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	35.28	35.28
Sloping roof	External Slope Roof	0.13	3.20	3.20
Dormer roof	External Plane Roof	0.16	1.65	1.65

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	39.55

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.17	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100
W3	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.48	100
D2 (W7)	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	North West							2.12	100
W7	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.05	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	9.63	0.052	No
Independently assessed	E3 Sill	6.81	0.004	No
Independently assessed	E4 Jamb	21.60	0.005	No
Independently assessed	E5 Ground floor (normal)	17.79	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	35.59	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.43	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	4.55	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.51	0.051	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	8.69	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	17.38	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.51	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	1.15	0.000	No

Y-value	0.024	W/m²K

18.0 Pressure Testing Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings	10
Total number of L.E.L. fittings	10

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 290 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 290	**Prop Type Ref**	
Property	Rivermont 1 Semi RITR, Plot 290, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.74	**TER**	17.97
Environmental	95 A	**% DER<TER**	56.92		
CO_2 Emissions (t/year)	0.27	**DFEE**	38.31	**TFEE**	48.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79.1	m^2	
DER	7.74	$kgCO_2/yr/m^2$	
TER	17.97	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.74	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.92	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	38.31	$kWh/m^2/yr$
CfSH ENE2 credits achieved	8.9	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79.1	m^2	
DER	19.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.62	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.62	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.33	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.87	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.87	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 291 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 291	**Prop Type Ref**	
Property	Moorgreen Det, Plot 291, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.91	**TER**	18.22
Environmental	95 A	**% DER<TER**	62.07		
CO_2 Emissions (t/year)	0.22	**DFEE**	46.86	**TFEE**	57.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.31 m², No overhang
Windows facing East: 1.02 m², No overhang
Windows facing South East: 5.07 m², No overhang
Windows facing South: 1.02 m², No overhang
Windows facing South West: 6.53 m², No overhang
Windows facing North West: 5.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.024 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800 (1b)	x	2.3900 (2b)	=	117.7792	(1b) - (3b)
First floor	47.9200 (1c)	x	2.6300 (2c)	=	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2051	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4301	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3333	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4250	0.4166	0.4083	0.3666	0.3583	0.3166	0.3166	0.3083	0.3333	0.3583	0.3750	0.3916	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6750	0.6666	0.6583	0.6166	0.6083	0.5666	0.5666	0.5583	0.5833	0.6083	0.6250	0.6416	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.8900	1.2357	25.8146			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.2800	0.1500	7.3920			(28a)
External Wall	142.9500	25.1300	117.8200	0.2100	24.7422			(29a)
Main Roof	47.9200		47.9200	0.0700	3.3544			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.8616			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7382	(36)
Total fabric heat loss					(33) + (36) =		73.5998	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.3061	53.6357	52.9653	49.6131	48.9427	45.5905	45.5905	44.9201	46.9314	48.9427	50.2835	51.6244	(38)
Heat transfer coeff	127.9059	127.2355	126.5651	123.2129	122.5425	119.1904	119.1904	118.5199	120.5312	122.5425	123.8834	125.2242	(39)
Average = Sum(39)m / 12 =												123.0453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3159	1.3090	1.3021	1.2676	1.2607	1.2262	1.2262	1.2193	1.2400	1.2607	1.2745	1.2883	(40)
HLP (average)												1.2659	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7120 (42)
Average daily hot water use (litres/day)		98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8272    10.6758    11.8037    11.3957    11.7548    11.3517    11.7152    11.7409    11.3757    11.7831    11.4274    11.8196 (61)
Total heat required for water heating calculated for each month
              172.6885   151.3661   156.9835   137.9669   133.2029   116.1522   108.8283   123.1796   124.1453   143.2052   154.8849   167.6052 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              172.6885   151.3661   156.9835   137.9669   133.2029   116.1522   108.8283   123.1796   124.1453   143.2052   154.8849   167.6052 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1690.2085 (64)
Heat gains from water heating, kWh/month
               56.4432    49.4485    51.2232    44.9339    43.3202    37.6841    35.2189    39.9886    40.3398    46.6436    50.5565    54.7536 (65)
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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m      135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025   135.6025 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.4410    19.9319    16.2097    12.2718     9.1733     7.7445     8.3682    10.8773    14.5995    18.5374    21.6359    23.0647 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              251.7201   254.3321   247.7498   233.7368   216.0479   199.4229   188.3163   185.7043   192.2866   206.2996   223.9885   240.6135 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602    36.5602 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820  -108.4820 (71)
Water heating gains (Table 5)
               75.8645    73.5840    68.8484    62.4081    58.2261    52.3390    47.3372    53.7481    56.0275    62.6930    70.2173    73.5936 (72)
Total internal gains
              416.7063   414.5288   399.4887   375.0975   350.1281   326.1872   310.7025   317.0104   329.5944   354.2108   382.5224   403.9525 (73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3100	11.2829	0.4100	1.0000	0.7700	4.1996	(75)
East	1.0200	19.6403	0.4100	1.0000	0.7700	5.6920	(76)
Southeast	5.0700	36.7938	0.4100	1.0000	0.7700	53.0030	(77)
South	1.0200	46.7521	0.4100	1.0000	0.7700	13.5493	(78)
Southwest	6.5300	36.7938	0.4100	1.0000	0.7700	68.2661	(79)
Northwest	5.9400	11.2829	0.4100	1.0000	0.7700	19.0426	(81)

```
Solar gains   163.7526   287.2014   414.4746   548.8721   646.4827   655.6082   626.3437   551.5067   460.7501   323.2630   197.6550   139.1505 (83)
Total gains   580.4590   701.7302   813.9633   923.9696   996.6107   981.7954   937.0462   868.5171   790.3444   677.4738   580.1774   543.1031 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          45.8071    46.0485    46.2924    47.5518    47.8120    49.1567    49.1567    49.4347    48.6098    47.8120    47.2945    46.7881
alpha         4.0538     4.0699     4.0862     4.1701     4.1875     4.2771     4.2771     4.2956     4.2407     4.1875     4.1530     4.1192
util living area
               0.9963     0.9916     0.9796     0.9435     0.8572     0.6970     0.5381     0.5932     0.8292     0.9655     0.9927     0.9972 (86)

MIT           19.3744    19.5865    19.9140    20.3477    20.6990    20.9166    20.9785    20.9681    20.8132    20.3455    19.7942    19.3608 (87)
Th 2          19.8284    19.8338    19.8392    19.8663    19.8717    19.8991    19.8991    19.9046    19.8881    19.8717    19.8608    19.8500 (88)
util rest of house
               0.9952     0.9890     0.9731     0.9246     0.8092     0.6048     0.4136     0.4675     0.7556     0.9503     0.9901     0.9963 (89)
MIT 2         17.6755    17.9878    18.4656    19.0996    19.5704    19.8402    19.8903    19.8901    19.7322    19.1109    18.3099    17.6698 (90)
Living area fraction                                                                                        fLA = Living area / (4) =      0.2037 (91)
MIT           18.0216    18.3134    18.7606    19.3538    19.8003    20.0595    20.1120    20.1097    19.9524    19.3624    18.6123    18.0143 (92)
Temperature adjustment                                                                                                                0.0000
adjusted MIT  18.0216    18.3134    18.7606    19.3538    19.8003    20.0595    20.1120    20.1097    19.9524    19.3624    18.6123    18.0143 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9924     0.9840     0.9646     0.9138     0.8056     0.6193     0.4387     0.4924     0.7606     0.9409     0.9857     0.9942 (94)
Useful gains 576.0631   690.5077   785.1684   844.3159   802.8801   608.0661   411.1114   427.6847   601.1279   637.4596   571.8829   539.9417 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1755.0709  1706.6653  1551.7673  1288.0463   992.6342   650.7148   418.5951   439.6686   705.4027  1073.7617  1426.1803  1729.8818 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              877.1818   682.8580   570.3496   319.4859   141.1770     0.0000     0.0000     0.0000     0.0000   324.6088   615.0941   885.3154 (98)
Space heating                                                                                                                      4416.0707 (98)
Space heating per m2                                                                                                 (98) / (4) =     45.4328 (99)
```

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4753.5745	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	877.1818	682.8580	570.3496	319.4859	141.1770	0.0000	0.0000	0.0000	0.0000	324.6088	615.0941	885.3154	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	944.2215	735.0462	613.9393	343.9030	151.9667	0.0000	0.0000	0.0000	0.0000	349.4174	662.1035	952.9768	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6885	151.3661	156.9835	137.9669	133.2029	116.1522	108.8283	123.1796	124.1453	143.2052	154.8849	167.6052	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3575	89.3019	89.1895	88.9103	88.3175	86.7000	86.7000	86.7000	86.7000	88.8956	89.2375	89.3749	(217)
Fuel for water heating, kWh/month													
	193.2557	169.4992	176.0112	155.1755	150.8228	133.9703	125.5228	142.0756	143.1895	161.0936	173.5649	187.5305	(219)
Water heating fuel used												1911.7115	(219)
Annual totals kWh/year													
Space heating fuel - main system												4753.5745	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.3156	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1004 * 1.00) =											-1951.7686	-1951.7686	(233)
Total delivered energy for all uses												5184.8328	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4753.5745	0.2160	1026.7721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.7115	0.2160	412.9297	(264)
Space and water heating			1439.7018	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.3156	0.5190	205.6878	(268)
Energy saving/generation technologies				
PV Unit	-1951.7686	0.5190	-1012.9679	(269)
Total CO2, kg/year			671.3466	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.9100	ZC1
Total Floor Area	TFA	97.2000	
Assumed number of occupants	N	2.7120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3461	ZC2
CO2 emissions from cooking, equation (L16)		1.8939	ZC3
Total CO2 emissions		24.1500	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1500	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.2800 (1b)	x	2.3900 (2b)	=	117.7792	(1b) - (3b)
First floor	47.9200 (1c)	x	2.6300 (2c)	=	126.0296	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	243.8088	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1230	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3730	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2891	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397	(22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.0500	1.3258	26.5814			(27)
Ground floor			49.2800	0.1300	6.4064			(28a)
External Wall	142.9500	24.2900	118.6600	0.1800	21.3588			(29a)
Main Roof	47.9200		47.9200	0.1300	6.2296			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			241.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.8254			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.2437	(36)
Total fabric heat loss (33) + (36) =	78.0691	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.6946	45.4824	45.2743	44.2971	44.1143	43.2631	43.2631	43.1055	43.5910	44.1143	44.4841	44.8708	(38)
Heat transfer coeff	123.7638	123.5515	123.3435	122.3662	122.1834	121.3323	121.3323	121.1746	121.6601	122.1834	122.5533	122.9400	(39)
Average = Sum(39)m / 12 =												122.3654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2733	1.2711	1.2690	1.2589	1.2570	1.2483	1.2483	1.2467	1.2516	1.2570	1.2608	1.2648	(40)
HLP (average)												1.2589	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7120 (42)
Average daily hot water use (litres/day)	98.6112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4723	104.5278	100.5834	96.6390	92.6945	88.7501	88.7501	92.6945	96.6390	100.5834	104.5278	108.4723	(44)
Energy conte	160.8613	140.6903	145.1798	126.5713	121.4481	104.8005	97.1131	111.4387	112.7696	131.4221	143.4575	155.7856	(45)
Energy content (annual)										Total = Sum(45)m =		1551.5378	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1292	21.1035	21.7770	18.9857	18.2172	15.7201	14.5670	16.7158	16.9154	19.7133	21.5186	23.3678	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6576	47.2361	43.7672	45.2261	47.2361	47.6576	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445 (64)
								Total per year (kWh/year) = Sum(64)m =				2129.4964 (64)
Heat gains from water heating, kWh/month												
	66.2261	58.2864	61.0120	53.9993	52.1905	45.7880	43.5966	48.8624	49.4103	56.4376	60.0284	64.5384 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	135.6025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5335	20.0141	16.2766	12.3224	9.2111	7.7764	8.4027	10.9222	14.6597	18.6138	21.7251	23.1598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	251.7201	254.3321	247.7498	233.7368	216.0479	199.4229	188.3163	185.7043	192.2866	206.2996	223.9885	240.6135	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	36.5602	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	-108.4820	(71)
Water heating gains (Table 5)													
	89.0136	86.7357	82.0054	74.9991	70.1486	63.5944	58.5976	65.6752	68.6254	75.8570	83.3728	86.7452	(72)
Total internal gains													
	429.9479	427.7626	412.7125	387.7390	362.0884	337.4744	321.9974	328.9824	342.2524	367.4511	395.7671	417.1993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.2600	11.2829	0.6300	0.7000	0.7700	4.3447	(75)
East	0.9800	19.6403	0.6300	0.7000	0.7700	5.8823	(76)
Southeast	4.8600	36.7938	0.6300	0.7000	0.7700	54.6491	(77)
South	0.9800	46.7521	0.6300	0.7000	0.7700	14.0023	(78)
Southwest	6.2600	36.7938	0.6300	0.7000	0.7700	70.3917	(79)
Northwest	5.7100	11.2829	0.6300	0.7000	0.7700	19.6893	(81)

Solar gains	168.9594	296.3518	427.7268	566.4950	667.3015	676.7467	646.5281	569.2381	475.5068	333.5751	203.9431	143.5728 (83)
Total gains	598.9073	724.1144	840.4393	954.2340	1029.3899	1014.2211	968.5255	898.2205	817.7592	701.0262	599.7101	560.7721 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5394	54.6331	54.7252	55.1623	55.2448	55.6324	55.6324	55.7047	55.4824	55.2448	55.0781	54.9048	
alpha	4.6360	4.6422	4.6483	4.6775	4.6830	4.7088	4.7088	4.7136	4.6988	4.6830	4.6719	4.6603	
util living area													
	0.9977	0.9941	0.9839	0.9504	0.8621	0.7004	0.5357	0.5940	0.8351	0.9714	0.9951	0.9983	(86)
MIT	19.6115	19.8000	20.0906	20.4564	20.7642	20.9372	20.9858	20.9773	20.8515	20.4411	19.9518	19.5751	(87)
Th 2	19.8618	19.8635	19.8652	19.8732	19.8746	19.8816	19.8816	19.8829	19.8789	19.8746	19.8716	19.8685	(88)
util rest of house													
	0.9969	0.9921	0.9781	0.9316	0.8114	0.6030	0.4074	0.4627	0.7571	0.9570	0.9930	0.9977	(89)
MIT 2	18.0225	18.2984	18.7204	19.2435	19.6476	19.8409	19.8766	19.8739	19.7622	19.2328	18.5265	17.9739	(90)
Living area fraction										fLA = Living area / (4) =		0.2037	(91)
MIT	18.3462	18.6043	18.9996	19.4906	19.8750	20.0642	20.1025	20.0987	19.9841	19.4790	18.8169	18.3001	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3462	18.6043	18.9996	19.4906	19.8750	20.0642	20.1025	20.0987	19.9841	19.4790	18.8169	18.3001	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9888	0.9720	0.9236	0.8114	0.6201	0.4336	0.4894	0.7656	0.9500	0.9901	0.9965	(94)
Useful gains	596.0921	716.0128	816.8954	881.2911	835.2516	628.9628	419.9940	439.5469	626.0753	666.0040	593.7581	558.7968	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1738.4075	1693.1877	1541.7394	1295.9277	998.8543	662.9823	424.9697	448.1847	715.8645	1084.8623	1435.9384	1733.4630	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	849.8827	656.6616	539.2839	298.5383	121.7204	0.0000	0.0000	0.0000	0.0000	311.6306	606.3698	873.9516	(98)
Space heating												4258.0389	(98)
Space heating per m2											(98) / (4) =	43.8070	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4558.9282	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	849.8827	656.6616	539.2839	298.5383	121.7204	0.0000	0.0000	0.0000	0.0000	311.6306	606.3698	873.9516	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	909.9386	703.0638	577.3918	319.6342	130.3217	0.0000	0.0000	0.0000	0.0000	333.6516	649.2182	935.7084	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.8202	186.7177	196.1387	174.2288	168.6842	148.5677	142.3391	158.6748	160.4272	182.3810	192.7726	206.7445	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1870	87.9509	87.4659	86.3953	84.2451	80.3000	80.3000	80.3000	80.3000	86.3885	87.7380	88.2759	(217)
Fuel for water heating, kWh/month													
	240.1942	212.2977	224.2458	201.6647	200.2303	185.0158	177.2592	197.6025	199.7848	211.1172	219.7140	234.2027	(219)
Water heating fuel used												2503.3288	(219)
Annual totals kWh/year													
Space heating fuel - main system												4558.9282	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												397.9493	(232)
Total delivered energy for all uses												7535.2062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4558.9282	0.2160	984.7285	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2503.3288	0.2160	540.7190	(264)
Space and water heating			1525.4475	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	397.9493	0.5190	206.5357	(268)
Total CO2, kg/m2/year			1770.9082	(272)
Emissions per m2 for space and water heating			15.6939	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1249	(272b)
Emissions per m2 for pumps and fans			0.4005	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6939 * 1.00) + 2.1249 + 0.4005, rounded to 2 d.p.			18.2200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 291 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 291	**Prop Type Ref**	
Property	Moorgreen Det, Plot 291, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.91	**TER**	18.22
Environmental	95 A	**% DER<TER**	62.07		
CO_2 Emissions (t/year)	0.22	**DFEE**	46.86	**TFEE**	57.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	6.91	$kgCO_2/m^2$	Pass
	-11.31 (-62.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.86	$kWh/m^2/yr$	
	-10.1 (-17.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	1.31 m², No overhang
Windows facing East	1.02 m², No overhang
Windows facing South East	5.07 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	6.53 m², No overhang
Windows facing North West	5.94 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.024	W/m²K
Photovoltaic array	2.43	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 291 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 291	**Prop Type Ref**	
Property	Moorgreen Det, Plot 291, Boorley Gardens, Southampton, SO32		

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Environmental	95 A	**% DER<TER**	62.07		
CO_2 Emissions (t/year)	0.22	**DFEE**	46.86	**TFEE**	57.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	28.84 m	49.28 m²	2.39 m
1st Storey:	28.25 m	47.92 m²	2.63 m

7.0 Living Area	19.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	217.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	142.95	117.82

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	47.92	47.92
Bay Roof	External Flat Roof	0.16	1.24	1.24

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.15	49.28

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 14	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.50	10
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.02	10
W4	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					2.25	10
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.02	10
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	10
W7	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	10
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.71	10
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.41	10
W10	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	10
W11	Window	[1] External Wall	South East	Dark-coloured curtain or roller blind	0.00					1.41	10
W12	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					1.31	10
W13	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.31	10

D1	Half Glazed Door	[1] External Wall	South West			2.12	10
D2*	Half Glazed Door	[1] External Wall	North East			2.12	10
D3 (W14)	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00	3.32	10

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.40	0.052	No
Independently assessed	E3 Sill	14.79	0.004	No
Independently assessed	E4 Jamb	44.40	0.005	No
Independently assessed	E5 Ground floor (normal)	28.84	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	17.70	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.55	0.051	No
Independently assessed	E14 Flat roof	3.14	0.029	No
Independently assessed	E16 Corner (normal)	20.04	0.037	No

Y-value	0.024	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0

Number of flueless gas fires	0	
21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 291 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 291	**Prop Type Ref**	
Property	Moorgreen Det, Plot 291, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.91	**TER**	18.22
Environmental	95 A	**% DER<TER**	62.07		
CO_2 Emissions (t/year)	0.22	**DFEE**	46.86	**TFEE**	57.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	97.2	m^2	
DER	6.91	$kgCO_2/yr/m^2$	
TER	18.22	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.07	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.86	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	97.2	m^2	
DER	19.71	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.95	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.95	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.29	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.35	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.89	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.53	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.53	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 292 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 292	**Prop Type Ref**	
Property	2BMW GF , Plot 292, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	10.26	**TER**	18.70
Environmental	93 A	**% DER<TER**	45.15		
CO_2 Emissions (t/year)	0.43	**DFEE**	42.94	**TFEE**	52.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 76 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.26 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.83 m², No overhang
Windows facing East: 2.22 m², No overhang
Windows facing South: 3.67 m², No overhang
Windows facing West: 6.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0800 (1b)	x	2.3100 (2b)	=	175.7448	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.7448	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1707	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3957	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3363	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6788	0.6704	0.6620	0.6200	0.6116	0.5695	0.5695	0.5611	0.5863	0.6116	0.6284	0.6452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.3300	1.2357	16.4724			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			76.0800	0.1400	10.6512			(28a)
External Wall	78.8200	15.4500	63.3700	0.2100	13.3077			(29a)
Low Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			171.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2321			(33)
Party Wall			12.4900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							282.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7026	(36)
Total fabric heat loss					(33) + (36) =		50.9348	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3700	38.8823	38.3946	35.9563	35.4686	33.0303	33.0303	32.5426	34.0056	35.4686	36.4440	37.4193	(38)
Heat transfer coeff	90.3048	89.8171	89.3294	86.8911	86.4034	83.9651	83.9651	83.4774	84.9404	86.4034	87.3787	88.3541	(39)
Average = Sum(39)m / 12 =												86.7692	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1870	1.1806	1.1742	1.1421	1.1357	1.1036	1.1036	1.0972	1.1165	1.1357	1.1485	1.1613	(40)
HLP (average)												1.1405	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3843	(42)
Average daily hot water use (litres/day)												90.8266	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.9093	96.2762	92.6431	89.0101	85.3770	81.7439	81.7439	85.3770	89.0101	92.6431	96.2762	99.9093	(44)
Energy conte	148.1625	129.5839	133.7190	116.5794	111.8608	96.5273	89.4468	102.6415	103.8673	121.0474	132.1327	143.4875	(45)
Energy content (annual)										Total = Sum(45)m =		1429.0560	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2244	19.4376	20.0578	17.4869	16.7791	14.4791	13.4170	15.3962	15.5801	18.1571	19.8199	21.5231	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 11.8080	10.6519	11.7718	11.3679	11.7292	11.3306	11.6956	11.7174	11.3509	11.7542	11.4030	11.8010	(61)

Total heat required for water heating calculated for each month

159.9705	140.2358	145.4907	127.9473	123.5899	107.8579	101.1424	114.3588	115.2182	132.8015	143.5357	155.2885	(62)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

159.9705	140.2358	145.4907	127.9473	123.5899	107.8579	101.1424	114.3588	115.2182	132.8015	143.5357	155.2885	(64)
							Total per year (kWh/year) = Sum(64)m =				1567.4372	(64)

Heat gains from water heating, kWh/month

52.2160	45.7496	47.4045	41.6046	40.1260	34.9280	32.6650	37.0576	37.3736	43.1868	46.7849	50.6598	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

18.8156	16.7118	13.5910	10.2892	7.6913	6.4933	7.0163	9.1200	12.2409	15.5426	18.1405	19.3385	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

211.0534	213.2435	207.7246	195.9755	181.1443	167.2051	157.8929	155.7028	161.2217	172.9708	187.8020	201.7412	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	(71)

Water heating gains (Table 5)

70.1828	68.0798	63.7157	57.7842	53.9328	48.5111	43.9045	49.8086	51.9078	58.0468	64.9790	68.0912	(72)

Total internal gains

361.8160	359.7993	346.7954	325.8131	304.5326	283.9737	270.5778	276.3956	287.1346	308.3244	332.6857	350.9350	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.8300	10.6334	0.4100	1.0000	0.7700	2.5077	(74)
East	2.2200	19.6403	0.4100	1.0000	0.7700	12.3885	(76)
South	3.6700	46.7521	0.4100	1.0000	0.7700	48.7510	(78)
West	6.6100	19.6403	0.4100	1.0000	0.7700	36.8864	(80)

Solar gains	100.5335	181.0259	268.5912	359.5463	421.1373	424.5902	406.7640	360.8806	300.6585	206.1985	122.3200	84.7371	(83)
Total gains	462.3495	540.8252	615.3867	685.3594	725.6699	708.5639	677.3419	637.2763	587.7930	514.5229	455.0057	435.6722	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.9943	66.3526	66.7149	68.5870	68.9741	70.9771	70.9771	71.3918	70.1621	68.9741	68.2042	67.4513	
alpha	5.3996	5.4235	5.4477	5.5725	5.5983	5.7318	5.7318	5.7595	5.6775	5.5983	5.5469	5.4968	
util living area	0.9988	0.9970	0.9908	0.9659	0.8881	0.7139	0.5376	0.5892	0.8490	0.9807	0.9973	0.9992	(86)
MIT	19.8342	19.9885	20.2346	20.5629	20.8213	20.9644	20.9940	20.9904	20.9019	20.5573	20.1469	19.8262	(87)
Th 2	19.9304	19.9356	19.9407	19.9666	19.9718	19.9979	19.9979	20.0031	19.9874	19.9718	19.9614	19.9511	(88)
util rest of house	0.9984	0.9958	0.9870	0.9512	0.8419	0.6209	0.4195	0.4687	0.7739	0.9697	0.9960	0.9988	(89)
MIT 2	18.3803	18.6092	18.9706	19.4575	19.8010	19.9759	19.9959	19.9996	19.9128	19.4602	18.8601	18.3835	(90)
Living area fraction									fLA = Living area / (4) =			0.3523	(91)
MIT	18.8925	19.0951	19.4158	19.8469	20.1604	20.3241	20.3475	20.3486	20.2612	19.8467	19.3134	18.8917	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8925	19.0951	19.4158	19.8469	20.1604	20.3241	20.3475	20.3486	20.2612	19.8467	19.3134	18.8917	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9845	0.9491	0.8515	0.6529	0.4615	0.5116	0.7968	0.9679	0.9949	0.9984	(94)
Useful gains	461.2982	537.8387	605.8655	650.4799	617.9353	462.5922	312.5687	326.0062	468.3346	498.0245	452.6900	434.9549	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1317.7687	1274.9633	1153.7640	951.1866	731.0094	480.6263	314.6607	329.6187	523.3384	798.9444	1067.1910	1298.0751	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	637.2140	495.3478	407.6365	216.5088	84.1271	0.0000	0.0000	0.0000	0.0000	223.8844	442.4407	642.1614	(98)
Space heating												3149.3208	(98)
Space heating per m2											(98) / (4) =	41.3949	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3390.0116	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	637.2140	495.3478	407.6365	216.5088	84.1271	0.0000	0.0000	0.0000	0.0000	223.8844	442.4407	642.1614	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	685.9139	533.2053	438.7906	233.0558	90.5566	0.0000	0.0000	0.0000	0.0000	240.9951	476.2548	691.2394	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9705	140.2358	145.4907	127.9473	123.5899	107.8579	101.1424	114.3588	115.2182	132.8015	143.5357	155.2885	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2391	89.1738	89.0356	88.6842	87.9682	86.7000	86.7000	86.7000	86.7000	88.6813	89.0945	89.2585	(217)
Fuel for water heating, kWh/month													
	179.2607	157.2612	163.4073	144.2730	140.4939	124.4036	116.6579	131.9018	132.8930	149.7513	161.1050	173.9762	(219)
Water heating fuel used												1775.3848	(219)
Annual totals kWh/year													
Space heating fuel - main system												3390.0116	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.2888	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =										-1053.6160		-1053.6160	(233)
Total delivered energy for all uses												4519.0691	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3390.0116	0.2160	732.2425	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.3848	0.2160	383.4831	(264)
Space and water heating			1115.7256	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.2888	0.5190	172.4579	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			780.2818	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.2600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		10.2600	ZC1
Total Floor Area	TFA	76.0800	
Assumed number of occupants	N	2.3843	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4387	ZC2
CO2 emissions from cooking, equation (L16)		2.3163	ZC3
Total CO2 emissions		29.0150	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.0150	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0800 (1b)	x	2.3100 (2b)	=	175.7448	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.7448	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1707	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4207	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3576	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4559	0.4470	0.4381	0.3934	0.3844	0.3397	0.3397	0.3308	0.3576	0.3844	0.4023	0.4202	(22b)
Effective ac	0.6039	0.5999	0.5959	0.5774	0.5739	0.5577	0.5577	0.5547	0.5639	0.5739	0.5809	0.5883	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.3300	1.3258	17.6723			(27)
Ground floor			76.0800	0.1300	9.8904			(28a)
External Wall	78.8200	15.4500	63.3700	0.1800	11.4066			(29a)
Low Roof	16.3800		16.3800	0.1300	2.1294			(30)
Total net area of external elements Aum(A, m2)			171.2800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.6427			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2157	(36)
Total fabric heat loss (33) + (36) =	54.8584	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.0259	34.7918	34.5624	33.4847	33.2831	32.3445	32.3445	32.1707	32.7060	33.2831	33.6910	34.1174	(38)
Heat transfer coeff	89.8844	89.6503	89.4208	88.3432	88.1415	87.2029	87.2029	87.0291	87.5645	88.1415	88.5494	88.9759	(39)
Average = Sum(39)m / 12 =												88.3422	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1814	1.1784	1.1754	1.1612	1.1585	1.1462	1.1462	1.1439	1.1510	1.1585	1.1639	1.1695	(40)
HLP (average)												1.1612	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3843 (42)
Average daily hot water use (litres/day)	90.8266 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.9093	96.2762	92.6431	89.0101	85.3770	81.7439	81.7439	85.3770	89.0101	92.6431	96.2762	99.9093	(44)
Energy conte	148.1625	129.5839	133.7190	116.5794	111.8608	96.5273	89.4468	102.6415	103.8673	121.0474	132.1327	143.4875	(45)
Energy content (annual)										Total = Sum(45)m =		1429.0560	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2244	19.4376	20.0578	17.4869	16.7791	14.4791	13.4170	15.3962	15.5801	18.1571	19.8199	21.5231	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9127	44.3134	47.2099	43.8954	43.5072	40.3121	41.6558	43.5072	43.8954	47.2099	47.4787	50.9127	(61)
Total heat required for water heating calculated for each month													
	199.0752	173.8973	180.9289	160.4748	155.3679	136.8394	131.1026	146.1486	147.7627	168.2573	179.6113	194.4002	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.0752	173.8973	180.9289	160.4748	155.3679	136.8394	131.1026	146.1486	147.7627	168.2573	179.6113	194.4002	(64)
									Total per year (kWh/year) = Sum(64)m =			1973.8663	(64)
Heat gains from water heating, kWh/month													
	61.9922	54.1650	56.2640	49.7365	48.0705	42.1734	40.1550	45.0051	45.5097	52.0507	55.8038	60.4378	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	119.2139	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3031	17.1449	13.9432	10.5559	7.8906	6.6616	7.1981	9.3564	12.5581	15.9454	18.6106	19.8396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.0534	213.2435	207.7246	195.9755	181.1443	167.2051	157.8929	155.7028	161.2217	172.9708	187.8020	201.7412	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	34.9214	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	-95.3711	(71)
Water heating gains (Table 5)													
	83.3229	80.6027	75.6237	69.0785	64.6109	58.5741	53.9718	60.4907	63.2080	69.9607	77.5052	81.2335	(72)
Total internal gains													
	375.4436	372.7552	359.0556	337.3740	315.4100	294.2050	280.8269	287.3140	298.7519	320.6410	345.6820	364.5785	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.8300	10.6334	0.6300	0.7000	0.7700	2.6973	(74)
East	2.2200	19.6403	0.6300	0.7000	0.7700	13.3252	(76)
South	3.6700	46.7521	0.6300	0.7000	0.7700	52.4371	(78)
West	6.6100	19.6403	0.6300	0.7000	0.7700	39.6753	(80)

Solar gains	108.1348	194.7132	288.8993	386.7315	452.9794	456.6934	437.5194	388.1667	323.3912	221.7891	131.5686	91.1441	(83)
Total gains	483.5784	567.4685	647.9549	724.1055	768.3894	750.8983	718.3463	675.4808	622.1431	542.4302	477.2506	455.7226	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.7792	58.9327	59.0839	59.8047	59.9415	60.5867	60.5867	60.7077	60.3365	59.9415	59.6654	59.3794	
alpha	4.9186	4.9288	4.9389	4.9870	4.9961	5.0391	5.0391	5.0472	5.0224	4.9961	4.9777	4.9586	
util living area	0.9974	0.9939	0.9835	0.9488	0.8590	0.6919	0.5233	0.5747	0.8215	0.9690	0.9945	0.9981	(86)
MIT	19.7496	19.9201	20.1898	20.5295	20.8032	20.9524	20.9904	20.9850	20.8851	20.5180	20.0689	19.7208	(87)
Th 2	19.9349	19.9373	19.9398	19.9512	19.9533	19.9633	19.9633	19.9651	19.9594	19.9533	19.9490	19.9445	(88)
util rest of house	0.9965	0.9918	0.9776	0.9301	0.8096	0.5999	0.4056	0.4544	0.7447	0.9540	0.9923	0.9974	(89)
MIT 2	18.2748	18.5248	18.9169	19.4048	19.7631	19.9321	19.9598	19.9591	19.8695	19.3992	18.7511	18.2396	(90)
Living area fraction									fLA = Living area / (4) =			0.3523	(91)
MIT	18.7943	19.0163	19.3653	19.8010	20.1295	20.2915	20.3229	20.3205	20.2273	19.7933	19.2153	18.7613	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7943	19.0163	19.3653	19.8010	20.1295	20.2915	20.3229	20.3205	20.2273	19.7933	19.2153	18.7613	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9893	0.9735	0.9269	0.8189	0.6307	0.4474	0.4970	0.7668	0.9511	0.9901	0.9963	(94)
Useful gains	481.2494	561.4088	630.7737	671.1680	629.2442	473.5644	321.3656	335.7314	477.0373	515.8973	472.5129	454.0584	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1302.8127	1265.5321	1150.4270	963.0294	742.9881	496.3175	324.6445	341.1953	536.5304	810.3151	1072.8038	1295.6073	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	611.2431	473.1708	386.6220	210.1401	84.6255	0.0000	0.0000	0.0000	0.0000	219.0468	432.2094	626.1124	(98)
Space heating												3043.1703	(98)
Space heating per m2											(98) / (4) =	39.9996	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3258.2123	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	611.2431	473.1708	386.6220	210.1401	84.6255	0.0000	0.0000	0.0000	0.0000	219.0468	432.2094	626.1124	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	654.4359	506.6069	413.9422	224.9895	90.6055	0.0000	0.0000	0.0000	0.0000	234.5255	462.7510	670.3559	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.0752	173.8973	180.9289	160.4748	155.3679	136.8394	131.1026	146.1486	147.7627	168.2573	179.6113	194.4002	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6903	87.4442	86.9150	85.7310	83.5933	80.3000	80.3000	80.3000	80.3000	85.7163	87.1809	87.7840	(217)
Fuel for water heating, kWh/month													
	227.0207	198.8667	208.1677	187.1842	185.8618	170.4102	163.2660	182.0033	184.0133	196.2956	206.0215	221.4528	(219)
Water heating fuel used												2330.5637	(219)
Annual totals kWh/year													
Space heating fuel - main system												3258.2123	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												340.8994	(232)
Total delivered energy for all uses												6004.6754	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3258.2123	0.2160	703.7739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2330.5637	0.2160	503.4018	(264)
Space and water heating			1207.1756	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	340.8994	0.5190	176.9268	(268)
Total CO2, kg/m2/year			1423.0274	(272)
Emissions per m2 for space and water heating			15.8672	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3255	(272b)
Emissions per m2 for pumps and fans			0.5116	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8672 * 1.00) + 2.3255 + 0.5116, rounded to 2 d.p.			18.7000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 292 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 292	**Prop Type Ref**	
Property	2BMW GF , Plot 292, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	10.26	**TER**	18.70
Environmental	93 A	**% DER<TER**	45.15		
CO_2 Emissions (t/year)	0.43	**DFEE**	42.94	**TFEE**	52.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.70	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.26	$kgCO_2/m^2$	Pass
	-8.44 (-45.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.31	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	42.94	$kWh/m^2/yr$	
	-9.4 (-18.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	0.83 m², No overhang 2.22 m², No overhang 3.67 m², No overhang 6.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	1.22	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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General Requirements Compliance	Pass	**% DFEE<TFEE**	17.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	34.12 m	76.08 m²	2.31 m

7.0 Living Area	26.80	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	282.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	78.82	63.37

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	12.49

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Low Roof	External Plane Roof	0.16	16.38	16.38

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	76.08

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
D2 (W8)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.80	100
D1	Half Glazed Door	[1] External Wall	South							2.12	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.99	0.052	No
Independently assessed	E3 Sill	8.17	0.004	No
Independently assessed	E4 Jamb	24.30	0.005	No
Independently assessed	E5 Ground floor (normal)	34.12	0.061	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	34.12	0.043	No
Independently assessed	E16 Corner (normal)	6.93	0.037	No
Independently assessed	E18 Party wall between dwellings	2.31	0.030	No
Independently assessed	P1 Party wall - Ground floor	5.41	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	5.41	0.000	No

Y-value	0.027	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	6	
Total number of L.E.L. fittings	6	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 292 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 292	**Prop Type Ref**	
Property	2BMW GF , Plot 292, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	10.26	**TER**	18.70
Environmental	93 A	**% DER<TER**	45.15		
CO_2 Emissions (t/year)	0.43	**DFEE**	42.94	**TFEE**	52.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	76.08	m^2	
DER	10.26	$kgCO_2/yr/m^2$	
TER	18.70	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	10.26	$kgCO_2/yr/m^2$	
Reduction DER/TER	45.15	%	
CfSH ENE1 credits achieved	5.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	42.94	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	5.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	76.08	m^2	
DER	19.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.32	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.57	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.57	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.62	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.44	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.32	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.38	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.38	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 293 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 293	**Prop Type Ref**	
Property	2BMW FF RITR, Plot 293, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.91	**TER**	19.41
Environmental	93 A	**% DER<TER**	48.95		
CO_2 Emissions (t/year)	0.42	**DFEE**	43.46	**TFEE**	54.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 71 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 2.13 m², No overhang
Windows facing South: 4.72 m², No overhang
Windows facing West: 4.13 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 1.22 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.2600	(1b)	x 2.8300	(2b) =	9.2258	(1b) - (3b)
First floor	67.9300	(1c)	x 2.3100	(2c) =	156.9183	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1900					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	166.1441	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1806	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4056	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3447	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4395	0.4309	0.4223	0.3792	0.3706	0.3275	0.3275	0.3189	0.3447	0.3706	0.3878	0.4051	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6895	0.6809	0.6723	0.6292	0.6206	0.5775	0.5775	0.5689	0.5947	0.6206	0.6378	0.6551	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9800	1.2357	13.5684			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.2600	0.1600	0.5216			(28a)
External Wall	103.3700	11.2000	92.1700	0.2100	19.3557			(29a)
Dormer wall	11.4400	1.9000	9.5400	0.1900	1.8126			(29a)
Main Roof	64.4000		64.4000	0.0700	4.5080			(30)
Sloping roof	8.3400		8.3400	0.1300	1.0842			(30)
Dormer roof	3.7700		3.7700	0.1600	0.6032			(30)
Total net area of external elements Aum(A, m2)			194.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.6337			(33)
Party Wall			12.6000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	158.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9961	(36)
Total fabric heat loss (33) + (36) =	49.6298	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8054	37.3329	36.8603	34.4977	34.0252	31.6626	31.6626	31.1901	32.6077	34.0252	34.9703	35.9153	(38)
Heat transfer coeff	87.4352	86.9627	86.4902	84.1276	83.6550	81.2925	81.2925	80.8199	82.2375	83.6550	84.6001	85.5451	(39)
Average = Sum(39)m / 12 =												84.0094	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2282	1.2216	1.2149	1.1817	1.1751	1.1419	1.1419	1.1353	1.1552	1.1751	1.1884	1.2016	(40)
HLP (average)												1.1801	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2747 (42)
Average daily hot water use (litres/day)	88.2233 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0456	93.5167	89.9878	86.4588	82.9299	79.4010	79.4010	82.9299	86.4588	89.9878	93.5167	97.0456	(44)
Energy conte	143.9159	125.8697	129.8863	113.2380	108.6546	93.7606	86.8830	99.6995	100.8903	117.5779	128.3454	139.3748	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1388.0960	(45)
Distribution loss (46)m = 0.15 x (45)m													
	21.5874	18.8805	19.4829	16.9857	16.2982	14.0641	13.0325	14.9549	15.1335	17.6367	19.2518	20.9062	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7954	10.6413	11.7613	11.3591	11.7211	11.3239	11.6894	11.7100	11.3430	11.7446	11.3922	11.7888	(61)
Total heat required for water heating calculated for each month													
	155.7113	136.5110	141.6475	124.5971	120.3757	105.0845	98.5724	111.4095	112.2333	129.3225	139.7377	151.1637	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	155.7113	136.5110	141.6475	124.5971	120.3757	105.0845	98.5724	111.4095	112.2333	129.3225	139.7377	151.1637	(64)
									Total per year (kWh/year) = Sum(64)m =			1526.3661	(64)
Heat gains from water heating, kWh/month													
	50.8009	44.5120	46.1275	40.4914	39.0579	34.0064	31.8110	36.0776	36.3818	42.0308	45.5229	49.2893	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.8406	15.8459	12.8868	9.7561	7.2928	6.1569	6.6527	8.6475	11.6066	14.7373	17.2006	18.3365	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	200.0583	202.1343	196.9029	185.7659	171.7074	158.4944	149.6673	147.5913	152.8227	163.9597	178.0182	191.2312	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	(71)
Water heating gains (Table 5)													
	68.2808	66.2381	61.9993	56.2381	52.4972	47.2311	42.7567	48.4914	50.5302	56.4930	63.2263	66.2491	(72)
Total internal gains													
	346.2997	344.3383	331.9090	311.8800	291.6174	272.0023	259.1966	264.8501	275.0795	295.3100	318.5651	335.9368	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.1300	19.6403	0.4100	1.0000	0.7700	11.8862	(76)
South	4.7200	46.7521	0.4100	1.0000	0.7700	62.6989	(78)
West	4.1300	19.6403	0.4100	1.0000	0.7700	23.0470	(80)

Solar gains	97.6321	171.0214	243.3430	311.9690	355.2056	354.1706	340.8942	309.0689	267.5280	191.8424	117.8772	82.9050	(83)
Total gains	443.9318	515.3598	575.2520	623.8490	646.8230	626.1729	600.0908	573.9190	542.6075	487.1524	436.4423	418.8418	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.7345	35.9286	36.1249	37.1394	37.3492	38.4347	38.4347	38.6594	37.9930	37.3492	36.9320	36.5240	
alpha	3.3823	3.3952	3.4083	3.4760	3.4899	3.5623	3.5623	3.5773	3.5329	3.4899	3.4621	3.4349	
util living area													
	0.9875	0.9785	0.9607	0.9205	0.8429	0.7036	0.5540	0.5918	0.7965	0.9372	0.9794	0.9897	(86)
MIT	19.1364	19.3634	19.7164	20.1812	20.5697	20.8514	20.9529	20.9401	20.7487	20.2357	19.6211	19.1223	(87)
Th 2	19.8975	19.9028	19.9081	19.9346	19.9400	19.9668	19.9668	19.9721	19.9560	19.9400	19.9293	19.9187	(88)
util rest of house													
	0.9847	0.9737	0.9516	0.9009	0.8013	0.6245	0.4405	0.4807	0.7308	0.9177	0.9740	0.9874	(89)
MIT 2	17.4223	17.7545	18.2671	18.9446	19.4770	19.8433	19.9412	19.9370	19.7245	19.0350	18.1477	17.4147	(90)
Living area fraction										fLA = Living area / (4) =		0.2635	(91)
MIT	17.8740	18.1785	18.6490	19.2705	19.7650	20.1089	20.2078	20.2013	19.9944	19.3514	18.5360	17.8647	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8740	18.1785	18.6490	19.2705	19.7650	20.1089	20.2078	20.2013	19.9944	19.3514	18.5360	17.8647	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9772	0.9632	0.9376	0.8857	0.7934	0.6364	0.4685	0.5071	0.7335	0.9038	0.9641	0.9809	(94)
Useful gains	433.8106	496.3709	539.3302	552.5573	513.1695	398.5014	281.1216	291.0299	398.0182	440.2924	420.7703	410.8458	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1186.8438	1154.7343	1050.7692	872.4410	674.6741	447.8354	293.2901	307.2242	484.7421	732.0983	967.4851	1168.9498	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	560.2567	442.4202	380.5106	230.3162	120.1594	0.0000	0.0000	0.0000	0.0000	217.1035	393.6347	564.0294	(98)
Space heating												2908.4307	(98)
Space heating per m2											(98) / (4) =	40.8545	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3130.7112	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	560.2567	442.4202	380.5106	230.3162	120.1594	0.0000	0.0000	0.0000	0.0000	217.1035	393.6347	564.0294	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	603.0750	476.2327	409.5916	247.9184	129.3427	0.0000	0.0000	0.0000	0.0000	233.6960	423.7187	607.1360	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	155.7113	136.5110	141.6475	124.5971	120.3757	105.0845	98.5724	111.4095	112.2333	129.3225	139.7377	151.1637	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1841	89.1243	89.0088	88.7500	88.2696	86.7000	86.7000	86.7000	86.7000	88.6782	89.0390	89.2041	(217)
Fuel for water heating, kWh/month													
	174.5953	153.1692	159.1388	140.3910	136.3728	121.2047	113.6937	128.5000	129.4502	145.8335	156.9398	169.4582	(219)
Water heating fuel used												1728.7472	(219)
Annual totals kWh/year													
Space heating fuel - main system												3130.7112	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												315.0713	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.22 * 1080 * 1.00) =											-1053.6160	-1053.6160	(233)
Total delivered energy for all uses												4195.9136	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3130.7112	0.2160	676.2336	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1728.7472	0.2160	373.4094	(264)
Space and water heating			1049.6430	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	315.0713	0.5190	163.5220	(268)
Energy saving/generation technologies				
PV Unit	-1053.6160	0.5190	-546.8267	(269)
Total CO2, kg/year			705.2633	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.9100	ZC1
Total Floor Area	TFA	71.1900	
Assumed number of occupants	N	2.2747	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6527	ZC2
CO2 emissions from cooking, equation (L16)		2.4384	ZC3
Total CO2 emissions		29.0011	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.0011	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.2600	(1b)	x 2.8300	(2b) =	9.2258	(1b) - (3b)
First floor	67.9300	(1c)	x 2.3100	(2c) =	156.9183	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		166.1441	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1806	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4306	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4666	0.4575	0.4483	0.4026	0.3934	0.3477	0.3477	0.3385	0.3660	0.3934	0.4117	0.4300	(22b)
Effective ac	0.6089	0.6046	0.6005	0.5810	0.5774	0.5604	0.5604	0.5573	0.5670	0.5774	0.5848	0.5925	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.9800	1.3258	14.5568			(27)
Ground floor			3.2600	0.1300	0.4238			(28a)
External Wall	103.3700	11.2000	92.1700	0.1800	16.5906			(29a)
Dormer wall	11.4400	1.9000	9.5400	0.1800	1.7172			(29a)
Main Roof	64.4000		64.4000	0.1300	8.3720			(30)
Sloping roof	8.3400		8.3400	0.1300	1.0842			(30)
Dormer roof	3.7700		3.7700	0.1300	0.4901			(30)
Total net area of external elements Aum(A, m2)			194.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7787			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0521	(36)
Total fabric heat loss					(33) + (36) =		53.8308	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3828	33.1511	32.9239	31.8567	31.6571	30.7276	30.7276	30.5555	31.0856	31.6571	32.0610	32.4832	(38)
Heat transfer coeff	87.2137	86.9819	86.7547	85.6875	85.4879	84.5585	84.5585	84.3863	84.9165	85.4879	85.8918	86.3141	(39)
Average = Sum(39)m / 12 =												85.6866	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2251	1.2218	1.2186	1.2036	1.2008	1.1878	1.1878	1.1854	1.1928	1.2008	1.2065	1.2124	(40)
HLP (average)												1.2036	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2747	(42)
Average daily hot water use (litres/day)	88.2233	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0456	93.5167	89.9878	86.4588	82.9299	79.4010	79.4010	82.9299	86.4588	89.9878	93.5167	97.0456	(44)
Energy conte	143.9159	125.8697	129.8863	113.2380	108.6546	93.7606	86.8830	99.6995	100.8903	117.5779	128.3454	139.3748	(45)
Energy content (annual)										Total = Sum(45)m =		1388.0960	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5874	18.8805	19.4829	16.9857	16.2982	14.0641	13.0325	14.9549	15.1335	17.6367	19.2518	20.9062	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	49.4534	43.0433	45.8568	42.6372	42.2602	39.1566	40.4619	42.2602	42.6372	45.8568	46.1178	49.4534	(61)

Total heat required for water heating calculated for each month

	193.3692	168.9130	175.7431	155.8752	150.9147	132.9173	127.3449	141.9597	143.5275	163.4346	174.4633	188.8282	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	193.3692	168.9130	175.7431	155.8752	150.9147	132.9173	127.3449	141.9597	143.5275	163.4346	174.4633	188.8282	(64)
								Total per year (kWh/year) = Sum(64)m =				1917.2907	(64)

Heat gains from water heating, kWh/month

	60.2154	52.6125	54.6514	48.3109	46.6927	40.9646	39.0041	43.7151	44.2053	50.5588	54.2043	58.7055	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	113.7333	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	18.7452	16.6493	13.5401	10.2507	7.6625	6.4690	6.9900	9.0859	12.1951	15.4845	18.0727	19.2662	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	200.0583	202.1343	196.9029	185.7659	171.7074	158.4944	149.6673	147.5913	152.8227	163.9597	178.0182	191.2312	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	34.3733	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	-90.9866	(71)

Water heating gains (Table 5)

	80.9346	78.2924	73.4562	67.0985	62.7590	56.8952	52.4248	58.7569	61.3963	67.9554	75.2838	78.9052	(72)

Total internal gains

	359.8581	357.1960	344.0192	323.2351	302.2489	281.9786	269.2021	275.5541	286.5340	307.5196	331.4946	349.5226	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.1300	19.6403	0.6300	0.7000	0.7700	12.7849	(76)
South	4.7200	46.7521	0.6300	0.7000	0.7700	67.4395	(78)
West	4.1300	19.6403	0.6300	0.7000	0.7700	24.7896	(80)

Solar gains	105.0141	183.9523	261.7421	335.5569	382.0627	380.9493	366.6691	332.4376	287.7557	206.3475	126.7899	89.1734	(83)
Total gains	464.8722	541.1484	605.7613	658.7920	684.3116	662.9280	635.8712	607.9916	574.2897	513.8671	458.2845	438.6960	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6855	56.8365	56.9854	57.6951	57.8298	58.4655	58.4655	58.5847	58.2190	57.8298	57.5579	57.2763	
alpha	4.7790	4.7891	4.7990	4.8463	4.8553	4.8977	4.8977	4.9056	4.8813	4.8553	4.8372	4.8184	
util living area	0.9971	0.9935	0.9842	0.9564	0.8850	0.7368	0.5667	0.6110	0.8382	0.9693	0.9940	0.9978	(86)
MIT	19.7077	19.8765	20.1378	20.4686	20.7524	20.9309	20.9847	20.9781	20.8631	20.4889	20.0358	19.6795	(87)
Th 2	19.9000	19.9026	19.9051	19.9171	19.9193	19.9298	19.9298	19.9317	19.9258	19.9193	19.9148	19.9101	(88)
util rest of house	0.9961	0.9913	0.9786	0.9398	0.8400	0.6432	0.4382	0.4825	0.7627	0.9543	0.9915	0.9971	(89)
MIT 2	18.1893	18.4368	18.8170	19.2954	19.6746	19.8832	19.9242	19.9228	19.8171	19.3329	18.6788	18.1551	(90)
Living area fraction									fLA = Living area / (4) =			0.2635	(91)
MIT	18.5894	18.8162	19.1651	19.6046	19.9586	20.1593	20.2036	20.2009	20.0928	19.6375	19.0364	18.5568	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5894	18.8162	19.1651	19.6046	19.9586	20.1593	20.2036	20.2009	20.0928	19.6375	19.0364	18.5568	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9882	0.9734	0.9338	0.8419	0.6650	0.4723	0.5165	0.7762	0.9491	0.9886	0.9957	(94)
Useful gains	462.2459	534.7556	589.6479	615.1619	576.1174	440.8385	300.3369	314.0100	445.7682	487.7041	453.0808	436.7887	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1246.2335	1210.4587	1098.7542	917.2482	706.0105	470.0836	304.7182	320.7408	508.8837	772.5985	1025.2370	1239.1947	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	583.2868	454.0725	378.7751	217.5022	96.6405	0.0000	0.0000	0.0000	0.0000	211.9615	411.9525	596.9901	(98)
Space heating												2951.1811	(98)
Space heating per m2											(98) / (4) =	41.4550	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3159.7228	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	583.2868	454.0725	378.7751	217.5022	96.6405	0.0000	0.0000	0.0000	0.0000	211.9615	411.9525	596.9901	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	624.5040	486.1590	405.5408	232.8717	103.4694	0.0000	0.0000	0.0000	0.0000	226.9395	441.0626	639.1757	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.3692	168.9130	175.7431	155.8752	150.9147	132.9173	127.3449	141.9597	143.5275	163.4346	174.4633	188.8282	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6550	87.4188	86.9345	85.8900	83.9620	80.3000	80.3000	80.3000	80.3000	85.7067	87.1392	87.7479	(217)
Fuel for water heating, kWh/month													
	220.6026	193.2228	202.1556	181.4824	179.7416	165.5259	158.5864	176.7867	178.7391	190.6905	200.2120	215.1940	(219)
Water heating fuel used												2262.9397	(219)
Annual totals kWh/year													
Space heating fuel - main system												3159.7228	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.0456	(232)
Total delivered energy for all uses												5828.7081	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3159.7228	0.2160	682.5001	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2262.9397	0.2160	488.7950	(264)
Space and water heating			1171.2951	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.0456	0.5190	171.8127	(268)
Total CO2, kg/m2/year			1382.0328	(272)
Emissions per m2 for space and water heating			16.4531	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4134	(272b)
Emissions per m2 for pumps and fans			0.5468	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4531 * 1.00) + 2.4134 + 0.5468, rounded to 2 d.p.			19.4100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 293 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 293	**Prop Type Ref**	
Property	2BMW FF RITR, Plot 293, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.91	**TER**	19.41
Environmental	93 A	**% DER<TER**	48.95		
CO_2 Emissions (t/year)	0.42	**DFEE**	43.46	**TFEE**	54.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	9.91	$kgCO_2/m^2$	Pass
	-9.50 (-48.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.14	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.46	$kWh/m^2/yr$	
	-10.6 (-19.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	2.13 m², No overhang 4.72 m², No overhang 4.13 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	1.22	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 293 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 293	**Prop Type Ref**	
Property	2BMW FF RITR, Plot 293, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.91	**TER**	19.41
Environmental	93 A	**% DER<TER**	48.95		
CO_2 Emissions (t/year)	0.42	**DFEE**	43.46	**TFEE**	54.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	4.46 m	3.26 m²	2.83 m
1st Storey:	39.38 m	67.93 m²	2.31 m

7.0 Living Area	18.76	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	158.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	103.37	92.17
Dormer wall	Cavity Wall	0.19	11.44	9.54

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	12.60

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	64.40	64.40
Sloping roof	External Slope Roof	0.13	8.34	8.34
Dormer roof	External Plane Roof	0.16	3.77	3.77

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.16	3.26

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W6	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.00	0.052	No
Independently assessed	E3 Sill	9.98	0.004	No
Independently assessed	E4 Jamb	21.75	0.005	No
Independently assessed	E5 Ground floor (normal)	4.46	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	39.38	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	23.87	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	3.85	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.66	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	7.07	0.060	No
Independently assessed	E16 Corner (normal)	17.70	0.037	No
Independently assessed	E18 Party wall between dwellings	2.83	0.030	No
Independently assessed	P1 Party wall - Ground floor	4.46	0.019	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	4.46	0.000	No
Table K1 - Default	R6 Flat ceiling	3.85	0.060	No

Y-value	0.026	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	8
Total number of L.E.L. fittings	8

Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.22	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 293 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 293	**Prop Type Ref**	
Property	2BMW FF RITR, Plot 293, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.91	**TER**	19.41
Environmental	93 A	**% DER<TER**	48.95		
CO_2 Emissions (t/year)	0.42	**DFEE**	43.46	**TFEE**	54.14
General Requirements Compliance	Pass	**% DFEE<TFEE**	19.73		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	71.19	m^2	
DER	9.91	$kgCO_2/yr/m^2$	
TER	19.41	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	48.95	%	
CfSH ENE1 credits achieved	5.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	Maisonette, Semi-Detached		
Fabric energy efficiency (F.E.E.)	43.46	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	4.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	71.19	m^2	
DER	20.50	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.65	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.44	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	39.59	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	39.59	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	12.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.65	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.44	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	31.91	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	31.91	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	19	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 294 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 294	**Prop Type Ref**	
Property	3A Semi RITR, Plot 294, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.68 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.57 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.03 m², No overhang
Windows facing South: 1.55 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1534.9896 (45)
Distribution loss (46)m = 0.15 x (45)m

	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186 (46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)

Total heat required for water heating calculated for each month

	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)

Total per year (kWh/year) = Sum(64)m = 1673.6243 (64)
Heat gains from water heating, kWh/month

	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501 (72)
Total internal gains												
	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.4100	1.0000	0.7700	22.4890	(76)
South	1.5500	46.7521	0.4100	1.0000	0.7700	20.5897	(78)
West	7.6600	19.6403	0.4100	1.0000	0.7700	42.7458	(80)

Solar gains	85.8244	161.3336	253.1145	355.0538	426.2245	433.2148	413.6563	360.6596	289.2958	187.7944	105.7458	71.4373 (83)
Total gains	493.8475	567.1869	644.2345	722.3123	769.1004	752.6905	717.9861	671.2454	612.1844	534.7674	480.4084	467.0161 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9967	0.9934	0.9841	0.9534	0.8749	0.7156	0.5516	0.6041	0.8456	0.9719	0.9938	0.9974	(86)
MIT	19.5402	19.7117	20.0044	20.4049	20.7271	20.9287	20.9832	20.9750	20.8347	20.4057	19.9187	19.5352	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9958	0.9916	0.9795	0.9392	0.8365	0.6379	0.4455	0.4977	0.7857	0.9608	0.9919	0.9967	(89)
MIT 2	18.0572	18.3106	18.7393	19.3300	19.7702	20.0295	20.0769	20.0770	19.9249	19.3423	18.6312	18.0637	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4536	18.6852	19.0775	19.6173	20.0260	20.2699	20.3192	20.3170	20.1681	19.6266	18.9754	18.4571	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4536	18.6852	19.0775	19.6173	20.0260	20.2699	20.3192	20.3170	20.1681	19.6266	18.9754	18.4571	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9881	0.9735	0.9312	0.8349	0.6547	0.4736	0.5254	0.7926	0.9541	0.9886	0.9950	(94)
Useful gains	490.7220	560.4391	627.1379	672.5816	642.1458	492.8034	340.0236	352.6668	485.2183	510.2259	474.9334	464.6970	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.8552	1378.7939	1250.7101	1034.6708	798.9789	527.6620	346.1216	362.2635	571.7555	866.2078	1153.3548	1401.2014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	694.2511	549.9344	463.9378	260.7042	116.6838	0.0000	0.0000	0.0000	0.0000	264.8505	488.4634	696.7593	(98)
Space heating												3535.5844	(98)
Space heating per m2											(98) / (4) =	37.9110	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3805.7959	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	694.2511	549.9344	463.9378	260.7042	116.6838	0.0000	0.0000	0.0000	0.0000	264.8505	488.4634	696.7593	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	747.3101	591.9638	499.3948	280.6289	125.6015	0.0000	0.0000	0.0000	0.0000	285.0920	525.7948	750.0100	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2491	89.1950	89.0750	88.7734	88.1732	86.7000	86.7000	86.7000	86.7000	88.7577	89.1141	89.2663	(217)
Fuel for water heating, kWh/month													
	191.5653	168.0176	174.4954	153.8896	149.5965	132.6776	124.3250	140.7009	141.7982	159.7613	172.0856	185.8946	(219)
Water heating fuel used												1894.8075	(219)
Annual totals kWh/year													
Space heating fuel - main system												3805.7959	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4689.0792	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3805.7959	0.2160	822.0519	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.8075	0.2160	409.2784	(264)
Space and water heating			1231.3304	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			706.3493	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5700	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.0967	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.0967	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)

Heat gains from water heating, kWh/month

	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
South	1.5500	46.7521	0.6300	0.7000	0.7700	22.1465	(78)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	92.3136	173.5320	272.2524	381.8994	458.4513	465.9701	444.9327	387.9290	311.1694	201.9935	113.7413	76.8386	(83)
Total gains	514.8826	593.7777	677.4552	762.3371	813.6522	797.0218	760.8823	710.9504	647.3888	563.2008	502.9060	487.0048	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9987	0.9969	0.9909	0.9676	0.8956	0.7398	0.5673	0.6248	0.8698	0.9825	0.9971	0.9990	(86)
MIT	19.7688	19.9142	20.1656	20.4970	20.7801	20.9449	20.9889	20.9820	20.8639	20.4877	20.0674	19.7445	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9982	0.9958	0.9876	0.9549	0.8550	0.6519	0.4481	0.5039	0.8049	0.9735	0.9960	0.9987	(89)
MIT 2	18.3443	18.5583	18.9256	19.4072	19.7883	19.9806	20.0143	20.0125	19.9014	19.4017	18.7901	18.3149	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7251	18.9208	19.2571	19.6985	20.0534	20.2384	20.2748	20.2717	20.1587	19.6920	19.1316	18.6971	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7251	18.9208	19.2571	19.6985	20.0534	20.2384	20.2748	20.2717	20.1587	19.6920	19.1316	18.6971	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9942	0.9842	0.9499	0.8571	0.6731	0.4802	0.5364	0.8159	0.9695	0.9944	0.9980	(94)
Useful gains	513.5099	590.3044	666.7436	724.1364	697.3926	536.4775	365.3808	381.3214	528.2110	546.0497	500.1092	486.0269	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1492.3964	1447.0302	1313.4635	1099.2846	848.5596	567.0645	369.5845	388.6570	611.6964	923.5899	1227.4782	1485.6643	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	728.2916	575.7198	481.1596	270.1067	112.4682	0.0000	0.0000	0.0000	0.0000	280.8899	523.7057	743.7303	(98)
Space heating												3716.0717	(98)
Space heating per m2											(98) / (4) =	39.8464	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3978.6635	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	728.2916	575.7198	481.1596	270.1067	112.4682	0.0000	0.0000	0.0000	0.0000	280.8899	523.7057	743.7303	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	779.7554	616.4023	515.1602	289.1935	120.4156	0.0000	0.0000	0.0000	0.0000	300.7387	560.7127	796.2851	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9239	87.7146	87.2430	86.1775	84.0821	80.3000	80.3000	80.3000	80.3000	86.1573	87.4575	88.0074	(217)
Fuel for water heating, kWh/month													
	238.9617	211.1589	222.7581	200.0181	198.4788	183.0424	175.3686	195.4949	197.6539	209.7674	218.6690	233.0292	(219)
Water heating fuel used												2484.4010	(219)
Annual totals kWh/year													
Space heating fuel - main system												3978.6635	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												6950.5500	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3978.6635	0.2160	859.3913	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.4010	0.2160	536.6306	(264)
Space and water heating			1396.0219	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1649.0269	(272)
Emissions per m2 for space and water heating			14.9691	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9691 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.6800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 294 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 294	**Prop Type Ref**	
Property	3A Semi RITR, Plot 294, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.68	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.57	$kgCO_2/m^2$	Pass
	-10.11 (-57.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.49	$kWh/m^2/yr$	
	-11.0 (-21.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.03 m², No overhang 1.55 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 294 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 294	**Prop Type Ref**	
Property	3A Semi RITR, Plot 294, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 294 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 294	**Prop Type Ref**	
Property	3A Semi RITR, Plot 294, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.57	$kgCO_2/yr/m^2$	
TER	17.68	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.57	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.19	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.49	kWh/m^2/yr	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.48	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.48	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.75	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.28	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.28	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 295 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 295	**Prop Type Ref**	
Property	3A Semi RITR, Plot 295, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.79 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.55 m², No overhang
Windows facing East: 4.03 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.4100	1.0000	0.7700	4.6830	(74)
East	4.0300	19.6403	0.4100	1.0000	0.7700	22.4890	(76)
West	7.6600	19.6403	0.4100	1.0000	0.7700	42.7458	(80)

Solar gains	69.9177	136.5624	225.3676	330.9331	408.5400	419.7551	398.9753	340.5561	262.7092	162.0766	87.1171	57.5498	(83)
Total gains	477.9407	542.4157	616.4877	698.1916	751.4160	739.2307	703.3052	651.1419	585.5978	509.0496	461.7796	453.1287	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9971	0.9945	0.9865	0.9584	0.8824	0.7245	0.5617	0.6194	0.8619	0.9765	0.9947	0.9977	(86)
MIT	19.5210	19.6821	19.9725	20.3807	20.7149	20.9249	20.9819	20.9723	20.8185	20.3775	19.8963	19.5183	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9963	0.9929	0.9826	0.9455	0.8454	0.6471	0.4543	0.5117	0.8052	0.9670	0.9930	0.9971	(89)
MIT 2	18.0291	18.2677	18.6936	19.2967	19.7554	20.0262	20.0763	20.0754	19.9076	19.3030	18.5986	18.0390	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4279	18.6458	19.0355	19.5865	20.0119	20.2664	20.3184	20.3151	20.1511	19.5902	18.9455	18.4344	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4279	18.6458	19.0355	19.5865	20.0119	20.2664	20.3184	20.3151	20.1511	19.5902	18.9455	18.4344	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9898	0.9770	0.9375	0.8432	0.6636	0.4827	0.5396	0.8106	0.9606	0.9901	0.9956	(94)
Useful gains	475.2579	536.9026	602.3208	654.5679	633.6226	490.5235	339.4538	351.3858	474.6970	489.0037	457.2165	451.1209	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1421.2684	1374.8530	1246.5349	1031.6960	797.6286	527.3391	346.0432	362.0879	570.1545	862.7234	1150.4560	1398.9741	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	703.8318	563.1026	479.2953	271.5323	122.0204	0.0000	0.0000	0.0000	0.0000	278.0475	499.1324	705.2028	(98)
Space heating												3622.1651	(98)
Space heating per m2											(98) / (4) =	38.8394	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3898.9936	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	703.8318	563.1026	479.2953	271.5323	122.0204	0.0000	0.0000	0.0000	0.0000	278.0475	499.1324	705.2028	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	757.6230	606.1384	515.9260	292.2845	131.3460	0.0000	0.0000	0.0000	0.0000	299.2976	537.2793	759.0988	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2562	89.2079	89.0947	88.8029	88.2088	86.7000	86.7000	86.7000	86.7000	88.7931	89.1269	89.2724	(217)
Fuel for water heating, kWh/month													
	191.5501	167.9932	174.4566	153.8385	149.5361	132.6776	124.3250	140.7009	141.7982	159.6975	172.0610	185.8819	(219)
Water heating fuel used												1894.5166	(219)
Annual totals kWh/year													
Space heating fuel - main system												3898.9936	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4781.9860	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3898.9936	0.2160	842.1826	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.5166	0.2160	409.2156	(264)
Space and water heating			1251.3982	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			726.4171	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.7900	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.3167	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.3167	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)

Heat gains from water heating, kWh/month

	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.6300	0.7000	0.7700	5.0370	(74)
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	75.2042	146.8878	242.4076	355.9548	439.4297	451.4927	429.1418	366.3054	282.5726	174.3312	93.7040	61.9012	(83)
Total gains	497.7732	567.1336	647.6104	736.3926	794.6306	782.5444	745.0914	689.3269	618.7920	535.5385	482.8687	472.0673	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9989	0.9975	0.9926	0.9717	0.9031	0.7492	0.5780	0.6411	0.8860	0.9859	0.9976	0.9991	(86)
MIT	19.7516	19.8876	20.1367	20.4746	20.7687	20.9414	20.9879	20.9798	20.8487	20.4618	20.0473	19.7294	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9985	0.9966	0.9898	0.9604	0.8643	0.6617	0.4573	0.5187	0.8254	0.9784	0.9967	0.9989	(89)
MIT 2	18.3192	18.5195	18.8839	19.3764	19.7750	19.9779	20.0139	20.0114	19.8860	19.3655	18.7609	18.2928	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7021	18.8852	19.2188	19.6699	20.0406	20.2355	20.2742	20.2702	20.1433	19.6586	19.1048	18.6768	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7021	18.8852	19.2188	19.6699	20.0406	20.2355	20.2742	20.2702	20.1433	19.6586	19.1048	18.6768	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9952	0.9868	0.9555	0.8657	0.6826	0.4898	0.5515	0.8347	0.9748	0.9953	0.9983	(94)
Useful gains	496.6312	564.4084	639.0515	703.6356	687.8928	534.1537	364.9206	380.1764	516.5058	522.0277	480.6168	471.2442	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1490.0109	1443.3639	1309.5201	1096.3746	847.2602	566.7742	369.5269	388.5153	610.1440	920.1937	1224.7448	1483.5928	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	739.0745	590.6581	498.8286	282.7721	118.5694	0.0000	0.0000	0.0000	0.0000	296.2356	535.7721	753.1874	(98)
Space heating												3815.0977	(98)
Space heating per m2											(98) / (4) =	40.9082	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4084.6871	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.0745	590.6581	498.8286	282.7721	118.5694	0.0000	0.0000	0.0000	0.0000	296.2356	535.7721	753.1874	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	791.3003	632.3962	534.0778	302.7538	126.9479	0.0000	0.0000	0.0000	0.0000	317.1687	573.6318	806.4104	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9513	87.7648	87.3207	86.2896	84.2079	80.3000	80.3000	80.3000	80.3000	86.2876	87.5048	88.0304	(217)
Fuel for water heating, kWh/month													
	238.8873	211.0381	222.5598	199.7581	198.1823	183.0424	175.3686	195.4949	197.6539	209.4507	218.5509	232.9683	(219)
Water heating fuel used												2482.9554	(219)
Annual totals kWh/year													
Space heating fuel - main system												4084.6871	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												7055.1279	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4084.6871	0.2160	882.2924	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2482.9554	0.2160	536.3184	(264)
Space and water heating			1418.6108	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1671.6157	(272)
Emissions per m2 for space and water heating			15.2114	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2114 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.9200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 295 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 295	**Prop Type Ref**	
Property	3A Semi RITR, Plot 295, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.79	$kgCO_2/m^2$	Pass
	-10.13 (-56.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.70	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.41	$kWh/m^2/yr$	
	-11.3 (-21.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.55 m², No overhang 4.03 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 295 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 295	**Prop Type Ref**	
Property	3A Semi RITR, Plot 295, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 295 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 295	**Prop Type Ref**	
Property	3A Semi RITR, Plot 295, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.79	$kgCO_2/yr/m^2$	
TER	17.92	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.79	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.54	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.41	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	18.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.71	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.71	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.97	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.50	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.50	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 296 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 296	**Prop Type Ref**	
Property	3 Semi, Plot 296, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.41 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.03 m², No overhang
Windows facing South: 1.55 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3533	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3003	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3829	0.3754	0.3679	0.3303	0.3228	0.2853	0.2853	0.2778	0.3003	0.3228	0.3378	0.3529	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6329	0.6254	0.6179	0.5803	0.5728	0.5353	0.5353	0.5278	0.5503	0.5728	0.5878	0.6029	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.5800	0.1400	6.5212			(28a)
External Wall	96.8400	15.3600	81.4800	0.2100	17.1108			(29a)
Main Roof	46.5800		46.5800	0.0700	3.2606			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.4338			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3636 (36)
Total fabric heat loss	(33) + (36) = 50.7974 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8363	48.2570	47.6777	44.7811	44.2018	41.3052	41.3052	40.7259	42.4638	44.2018	45.3604	46.5190	(38)
Heat transfer coeff	99.6337	99.0544	98.4751	95.5785	94.9992	92.1026	92.1026	91.5233	93.2612	94.9992	96.1578	97.3165	(39)
Average = Sum(39)m / 12 =												95.4337	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0695	1.0633	1.0571	1.0260	1.0197	0.9886	0.9886	0.9824	1.0011	1.0197	1.0322	1.0446	(40)
HLP (average)												1.0244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6666 (42)
Average daily hot water use (litres/day)	97.5306 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8246   10.6734   11.8002   11.3917   11.7511   11.3487   11.7124   11.7375   11.3721   11.7799   11.4250   11.8171 (61)
Total heat required for water heating calculated for each month
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1673.1694 (64)
Heat gains from water heating, kWh/month
               55.8564   48.9353   50.6934   44.4717   42.8768   37.3015   34.8644   39.5817   39.9280   46.1640   50.0332   54.1853 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9426   19.4892   15.8497   11.9992    8.9696    7.5725    8.1823   10.6357   14.2752   18.1257   21.1553   22.5524 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              244.7727  247.3127  240.9120  227.2858  210.0851  193.9189  183.1189  180.5789  186.9796  200.6058  217.8065  233.9727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 (71)
Water heating gains (Table 5)
               75.0758   72.8203   68.1362   61.7662   57.6301   51.8076   46.8607   53.2012   55.4556   62.0484   69.4905   72.8298 (72)
Total internal gains
              407.7893  405.6204  390.8962  367.0495  342.6830  319.2973  304.1602  310.4141  322.7086  346.7781  374.4506  395.3531 (73)


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6. Solar gains
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[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
East                                  4.0300           19.6403            0.4100           1.0000           0.7700           22.4890 (76)
South                                 1.5500           46.7521            0.4100           1.0000           0.7700           20.5897 (78)
West                                  7.6600           19.6403            0.4100           1.0000           0.7700           42.7458 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    85.8244  161.3336  253.1145  355.0538  426.2245  433.2148  413.6563  360.6596  289.2958  187.7944  105.7458   71.4373 (83)
Total gains   493.6137  566.9540  644.0106  722.1033  768.9075  752.5121  717.8164  671.0737  612.0045  534.5724  480.1964  466.7903 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.0888   49.3759   49.6664   51.1715   51.4836   53.1027   53.1027   53.4389   52.4430   51.4836   50.8633   50.2577
alpha          4.2726    4.2917    4.3111    4.4114    4.4322    4.5402    4.5402    4.5626    4.4962    4.4322    4.3909    4.3505
util living area
               0.9961    0.9924    0.9820    0.9490    0.8677    0.7078    0.5454    0.5973    0.8380    0.9687    0.9928    0.9969 (86)

MIT           19.5088   19.6851   19.9851   20.3945   20.7217   20.9263   20.9822   20.9738   20.8311   20.3950   19.8967   19.5036 (87)
Th 2          20.0258   20.0309   20.0361   20.0618   20.0669   20.0928   20.0928   20.0980   20.0824   20.0669   20.0566   20.0463 (88)
util rest of house
               0.9951    0.9904    0.9771    0.9343    0.8292    0.6314    0.4416    0.4931    0.7783    0.9570    0.9906    0.9961 (89)
MIT 2         18.0216   18.2820   18.7211   19.3236   19.7705   20.0345   20.0839   20.0836   19.9280   19.3361   18.6091   18.0278 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2589 (91)
MIT           18.4067   18.6453   19.0483   19.6009   20.0167   20.2654   20.3165   20.3141   20.1618   19.6102   18.9425   18.4099 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.4067   18.6453   19.0483   19.6009   20.0167   20.2654   20.3165   20.3141   20.1618   19.6102   18.9425   18.4099 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9925    0.9863    0.9702    0.9254    0.8268    0.6470    0.4681    0.5192    0.7842    0.9495    0.9868    0.9941 (94)
Useful gains 489.9359  559.1741  624.8327  668.2018  635.7499  486.8518  335.9852  348.4060  479.9287  507.5666  473.8706  464.0385 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1405.4986 1361.5293 1235.6999 1022.7747  790.0841  521.7950  342.2960  358.2315  565.3306  855.9650 1138.7466 1382.8583 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              681.1786  539.1827  454.4852  255.2925  114.8246    0.0000    0.0000    0.0000    0.0000  259.2084  478.7107  683.6020 (98)
Space heating                                                                                                          3466.4848 (98)
Space heating per m2                                                                                  (98) / (4) =     37.2100 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3731.4153	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	681.1786	539.1827	454.4852	255.2925	114.8246	0.0000	0.0000	0.0000	0.0000	259.2084	478.7107	683.6020	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	733.2386	580.3904	489.2198	274.8036	123.6002	0.0000	0.0000	0.0000	0.0000	279.0187	515.2968	735.8471	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2393	89.1842	89.0625	88.7582	88.1606	86.7000	86.7000	86.7000	86.7000	88.7420	89.1023	89.2567	(217)
Fuel for water heating, kWh/month													
	191.5334	167.9916	174.4720	153.8741	149.5774	132.6422	124.2921	140.6632	141.7600	159.7461	172.0613	185.8634	(219)
Water heating fuel used												1894.4769	(219)
Annual totals kWh/year													
Space heating fuel - main system												3731.4153	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5123	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4614.0492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3731.4153	0.2160	805.9857	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.4769	0.2160	409.2070	(264)
Space and water heating			1215.1927	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.5123	0.5190	201.1189	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			690.0462	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.4100	ZC1
Total Floor Area	TFA	93.1600	
Assumed number of occupants	N	2.6666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5697	ZC2
CO2 emissions from cooking, equation (L16)		1.9643	ZC3
Total CO2 emissions		24.9440	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.9440	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3617	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.5800	0.1300	6.0554			(28a)
External Wall	96.8400	15.3600	81.4800	0.1800	14.6664			(29a)
Main Roof	46.5800		46.5800	0.1300	6.0554			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8742			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9321	(36)
Total fabric heat loss					(33) + (36) =		56.8063	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.0672	44.8154	44.5686	43.4092	43.1923	42.1825	42.1825	41.9955	42.5715	43.1923	43.6311	44.0899	(38)
Heat transfer coeff	101.8736	101.6218	101.3749	100.2155	99.9986	98.9888	98.9888	98.8019	99.3778	99.9986	100.4374	100.8962	(39)
Average = Sum(39)m / 12 =												100.2145	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0935	1.0908	1.0882	1.0757	1.0734	1.0626	1.0626	1.0606	1.0667	1.0734	1.0781	1.0830	(40)
HLP (average)												1.0757	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6666	(42)
Average daily hot water use (litres/day)												97.5306	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6945	47.1353	46.7185	43.2875	44.7305	46.7185	47.1353	50.6945	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.9106	(64)
Heat gains from water heating, kWh/month													
	65.6400	57.7738	60.4169	53.4076	51.6186	45.2862	43.1189	48.3269	48.8688	55.8926	59.5057	63.9708	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3344	20.7254	16.8550	12.7603	9.5385	8.0528	8.7013	11.3103	15.1807	19.2754	22.4972	23.9829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	88.2258	85.9728	81.2056	74.1772	69.3799	62.8975	57.9555	64.9556	67.8734	75.1245	82.6468	85.9823	(72)
Total internal gains													
	422.3311	420.0092	404.9709	380.2216	355.0017	330.8675	315.7740	322.8431	336.0319	361.0040	388.9487	409.9361	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
South	1.5500	46.7521	0.6300	0.7000	0.7700	22.1465	(78)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	92.3136	173.5320	272.2524	381.8994	458.4513	465.9701	444.9327	387.9290	311.1694	201.9935	113.7413	76.8386	(83)
Total gains	514.6447	593.5412	677.2232	762.1210	813.4530	796.8375	760.7067	710.7721	647.2013	562.9974	502.6900	486.7747	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5046	63.6620	63.8170	64.5553	64.6953	65.3553	65.3553	65.4790	65.0995	64.6953	64.4127	64.1198	
alpha	5.2336	5.2441	5.2545	5.3037	5.3130	5.3570	5.3570	5.3653	5.3400	5.3130	5.2942	5.2747	
util living area	0.9987	0.9969	0.9907	0.9666	0.8922	0.7329	0.5599	0.6172	0.8656	0.9820	0.9971	0.9990	(86)
MIT	19.7906	19.9356	20.1854	20.5136	20.7912	20.9493	20.9901	20.9838	20.8715	20.5020	20.0859	19.7664	(87)
Th 2	20.0061	20.0083	20.0105	20.0207	20.0226	20.0315	20.0315	20.0332	20.0281	20.0226	20.0187	20.0147	(88)
util rest of house	0.9982	0.9958	0.9874	0.9536	0.8511	0.6457	0.4432	0.4986	0.8002	0.9729	0.9959	0.9987	(89)
MIT 2	18.3855	18.5989	18.9637	19.4404	19.8130	19.9968	20.0277	20.0263	19.9213	19.4318	18.8265	18.3562	(90)
Living area fraction									fLA = Living area / (4) =			0.2589	(91)
MIT	18.7493	18.9450	19.2800	19.7183	20.0663	20.2434	20.2769	20.2742	20.1673	19.7089	19.1526	18.7213	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7493	18.9450	19.2800	19.7183	20.0663	20.2434	20.2769	20.2742	20.1673	19.7089	19.1526	18.7213	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9839	0.9486	0.8532	0.6661	0.4736	0.5294	0.8110	0.9689	0.9944	0.9980	(94)
Useful gains	513.2749	590.0459	666.3404	722.9609	694.0136	530.8099	360.2799	376.2668	524.8753	545.4730	499.8760	485.8016	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1471.9987	1427.2736	1295.5723	1084.1608	836.6166	558.6324	363.9725	382.7757	602.9532	910.8781	1210.5321	1465.1485	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	713.2905	562.6170	468.1485	260.0640	106.0966	0.0000	0.0000	0.0000	0.0000	271.8614	511.6724	728.6341	(98)
Space heating												3622.3844	(98)
Space heating per m2											(98) / (4) =	38.8835	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3878.3559	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.2905	562.6170	468.1485	260.0640	106.0966	0.0000	0.0000	0.0000	0.0000	271.8614	511.6724	728.6341	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	763.6943	602.3736	501.2296	278.4411	113.5938	0.0000	0.0000	0.0000	0.0000	291.0722	547.8291	780.1222	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8853	87.6694	87.1838	86.0848	83.9458	80.3000	80.3000	80.3000	80.3000	86.0774	87.4093	87.9701	(217)
Fuel for water heating, kWh/month													
	239.0133	211.2208	222.8433	200.1742	198.7421	182.9883	175.3167	195.4371	197.5955	209.8999	218.7417	233.0760	(219)
Water heating fuel used												2485.0489	(219)
Annual totals kWh/year													
Space heating fuel - main system												3878.3559	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.0928	(232)
Total delivered energy for all uses												6850.4976	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3878.3559	0.2160	837.7249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0489	0.2160	536.7706	(264)
Space and water heating			1374.4954	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.0928	0.5190	213.8762	(268)
Total CO2, kg/m2/year			1627.2966	(272)
Emissions per m2 for space and water heating			14.7541	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2958	(272b)
Emissions per m2 for pumps and fans			0.4178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7541 * 1.00) + 2.2958 + 0.4178, rounded to 2 d.p.			17.4700	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 296 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 296	**Prop Type Ref**	
Property	3 Semi, Plot 296, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.41	$kgCO_2/m^2$	Pass
	-10.06 (-57.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.38	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.86	$kWh/m^2/yr$	
	-10.5 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.03 m², No overhang 1.55 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.023	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 296 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 296	**Prop Type Ref**	
Property	3 Semi, Plot 296, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.58 m²	2.39 m
1st Storey:	19.33 m	46.58 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.84	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.58	46.58

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 296 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 296	**Prop Type Ref**	
Property	3 Semi, Plot 296, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.16	m^2	
DER	7.41	$kgCO_2/yr/m^2$	
TER	17.47	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.41	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.58	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.86	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.16	m^2	
DER	17.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.34	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.34	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.13	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.13	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 297 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 297	**Prop Type Ref**	
Property	3 Semi, Plot 297, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.62	**TER**	17.71
Environmental	95 A	**% DER<TER**	56.97		
CO_2 Emissions (t/year)	0.31	**DFEE**	40.76	**TFEE**	51.59
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.62 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.55 m², No overhang
Windows facing East: 4.03 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3533	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3003	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3829	0.3754	0.3679	0.3303	0.3228	0.2853	0.2853	0.2778	0.3003	0.3228	0.3378	0.3529	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6329	0.6254	0.6179	0.5803	0.5728	0.5353	0.5353	0.5278	0.5503	0.5728	0.5878	0.6029	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.5800	0.1400	6.5212			(28a)
External Wall	96.8400	15.3600	81.4800	0.2100	17.1108			(29a)
Main Roof	46.5800		46.5800	0.0700	3.2606			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.4338			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3636 (36)
Total fabric heat loss	(33) + (36) = 50.7974 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8363	48.2570	47.6777	44.7811	44.2018	41.3052	41.3052	40.7259	42.4638	44.2018	45.3604	46.5190	(38)
Heat transfer coeff	99.6337	99.0544	98.4751	95.5785	94.9992	92.1026	92.1026	91.5233	93.2612	94.9992	96.1578	97.3165	(39)
Average = Sum(39)m / 12 =												95.4337	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0695	1.0633	1.0571	1.0260	1.0197	0.9886	0.9886	0.9824	1.0011	1.0197	1.0322	1.0446	(40)
HLP (average)												1.0244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6666 (42)
Average daily hot water use (litres/day)	97.5306 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8246   10.6734   11.8002   11.3917   11.7511   11.3487   11.7124   11.7375   11.3721   11.7799   11.4250   11.8171 (61)
Total heat required for water heating calculated for each month
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1673.1694 (64)
Heat gains from water heating, kWh/month
               55.8564   48.9353   50.6934   44.4717   42.8768   37.3015   34.8644   39.5817   39.9280   46.1640   50.0332   54.1853 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9426   19.4892   15.8497   11.9992    8.9696    7.5725    8.1823   10.6357   14.2752   18.1257   21.1553   22.5524 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              244.7727  247.3127  240.9120  227.2858  210.0851  193.9189  183.1189  180.5789  186.9796  200.6058  217.8065  233.9727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 (71)
Water heating gains (Table 5)
               75.0758   72.8203   68.1362   61.7662   57.6301   51.8076   46.8607   53.2012   55.4556   62.0484   69.4905   72.8298 (72)
Total internal gains
              407.7893  405.6204  390.8962  367.0495  342.6830  319.2973  304.1602  310.4141  322.7086  346.7781  374.4506  395.3531 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                Area        Solar flux          g              FF          Access          Gains
                                     m2          Table 6a      Specific data  Specific data    factor           W
                                                    W/m2       or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                              1.5500          10.6334          0.4100         1.0000       0.7700       4.6830 (74)
East                               4.0300          19.6403          0.4100         1.0000       0.7700      22.4890 (76)
West                               7.6600          19.6403          0.4100         1.0000       0.7700      42.7458 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    69.9177  136.5624  225.3676  330.9331  408.5400  419.7551  398.9753  340.5561  262.7092  162.0766   87.1171   57.5498 (83)
Total gains   477.7070  542.1828  616.2638  697.9826  751.2230  739.0523  703.1355  650.9701  585.4178  508.8547  461.5677  452.9029 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.0888   49.3759   49.6664   51.1715   51.4836   53.1027   53.1027   53.4389   52.4430   51.4836   50.8633   50.2577
alpha          4.2726    4.2917    4.3111    4.4114    4.4322    4.5402    4.5402    4.5626    4.4962    4.4322    4.3909    4.3505
util living area
               0.9965    0.9935    0.9846    0.9543    0.8754    0.7166    0.5554    0.6124    0.8545    0.9737    0.9938    0.9973 (86)

MIT           19.4889   19.6546   19.9524   20.3698   20.7094   20.9225   20.9809   20.9710   20.8148   20.3662   19.8735   19.4861 (87)
Th 2          20.0258   20.0309   20.0361   20.0618   20.0669   20.0928   20.0928   20.0980   20.0824   20.0669   20.0566   20.0463 (88)
util rest of house
               0.9956    0.9918    0.9804    0.9408    0.8382    0.6405    0.4503    0.5070    0.7979    0.9636    0.9919    0.9966 (89)
MIT 2         17.9926   18.2377   18.6742   19.2898   19.7556   20.0310   20.0832   20.0820   19.9104   19.2960   18.5756   18.0023 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2589 (91)
MIT           18.3800   18.6046   19.0052   19.5695   20.0025   20.2618   20.3156   20.3121   20.1446   19.5730   18.9116   18.3864 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3800   18.6046   19.0052   19.5695   20.0025   20.2618   20.3156   20.3121   20.1446   19.5730   18.9116   18.3864 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9934    0.9882    0.9741    0.9320    0.8352    0.6557    0.4770    0.5332    0.8023    0.9564    0.9885    0.9947 (94)
Useful gains 474.5380  535.7933  600.2916  650.5282  627.4366  484.6096  335.4090  347.1241  469.6699  486.6719  456.2705  450.5120 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1402.8466 1357.4969 1231.4459 1019.7705  788.7308  521.4689  342.2149  358.0515  563.7267  852.4317 1135.7807 1380.5738 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             690.6615  552.1848  469.5787  265.8545  120.0029    0.0000    0.0000    0.0000    0.0000  272.1253  489.2473  691.9660 (98)
Space heating                                                                                                       3551.6212 (98)
Space heating per m2                                                                                  (98) / (4) =     38.1239 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3823.0583	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	690.6615	552.1848	469.5787	265.8545	120.0029	0.0000	0.0000	0.0000	0.0000	272.1253	489.2473	691.9660	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	743.4462	594.3863	505.4669	286.1727	129.1743	0.0000	0.0000	0.0000	0.0000	292.9228	526.6387	744.8504	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2465	89.1974	89.0825	88.7878	88.1957	86.7000	86.7000	86.7000	86.7000	88.7777	89.1152	89.2629	(217)
Fuel for water heating, kWh/month													
	191.5179	167.9668	174.4328	153.8228	149.5179	132.6422	124.2921	140.6632	141.7600	159.6818	172.0362	185.8505	(219)
Water heating fuel used												1894.1843	(219)
Annual totals kWh/year													
Space heating fuel - main system												3823.0583	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5123	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =										-1474.3553		-1474.3553	(233)
Total delivered energy for all uses												4705.3997	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3823.0583	0.2160	825.7806	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.1843	0.2160	409.1438	(264)
Space and water heating			1234.9244	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.5123	0.5190	201.1189	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			709.7779	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.6200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.6200	ZC1
Total Floor Area	TFA	93.1600	
Assumed number of occupants	N	2.6666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5697	ZC2
CO2 emissions from cooking, equation (L16)		1.9643	ZC3
Total CO2 emissions		25.1540	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.1540	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3617	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.5800	0.1300	6.0554			(28a)
External Wall	96.8400	15.3600	81.4800	0.1800	14.6664			(29a)
Main Roof	46.5800		46.5800	0.1300	6.0554			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8742			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9321	(36)
Total fabric heat loss					(33) + (36) =		56.8063	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.0672	44.8154	44.5686	43.4092	43.1923	42.1825	42.1825	41.9955	42.5715	43.1923	43.6311	44.0899	(38)
Heat transfer coeff	101.8736	101.6218	101.3749	100.2155	99.9986	98.9888	98.9888	98.8019	99.3778	99.9986	100.4374	100.8962	(39)
Average = Sum(39)m / 12 =												100.2145	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0935	1.0908	1.0882	1.0757	1.0734	1.0626	1.0626	1.0606	1.0667	1.0734	1.0781	1.0830	(40)
HLP (average)												1.0757	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6666	(42)
Average daily hot water use (litres/day)												97.5306	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6945	47.1353	46.7185	43.2875	44.7305	46.7185	47.1353	50.6945	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.9106	(64)
Heat gains from water heating, kWh/month													
	65.6400	57.7738	60.4169	53.4076	51.6186	45.2862	43.1189	48.3269	48.8688	55.8926	59.5057	63.9708	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3344	20.7254	16.8550	12.7603	9.5385	8.0528	8.7013	11.3103	15.1807	19.2754	22.4972	23.9829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	88.2258	85.9728	81.2056	74.1772	69.3799	62.8975	57.9555	64.9556	67.8734	75.1245	82.6468	85.9823	(72)
Total internal gains													
	422.3311	420.0092	404.9709	380.2216	355.0017	330.8675	315.7740	322.8431	336.0319	361.0040	388.9487	409.9361	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.6300	0.7000	0.7700	5.0370	(74)
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	75.2042	146.8878	242.4076	355.9548	439.4297	451.4927	429.1418	366.3054	282.5726	174.3312	93.7040	61.9012	(83)
Total gains	497.5353	566.8970	647.3784	736.1764	794.4314	782.3601	744.9157	689.1485	618.6045	535.3352	482.6527	471.8373	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5046	63.6620	63.8170	64.5553	64.6953	65.3553	65.3553	65.4790	65.0995	64.6953	64.4127	64.1198	
alpha	5.2336	5.2441	5.2545	5.3037	5.3130	5.3570	5.3570	5.3653	5.3400	5.3130	5.2942	5.2747	
util living area													
	0.9989	0.9975	0.9924	0.9709	0.8998	0.7424	0.5705	0.6336	0.8822	0.9855	0.9976	0.9992	(86)
MIT	19.7733	19.9089	20.1563	20.4912	20.7801	20.9460	20.9892	20.9817	20.8567	20.4761	20.0658	19.7512	(87)
Th 2	20.0061	20.0083	20.0105	20.0207	20.0226	20.0315	20.0315	20.0332	20.0281	20.0226	20.0187	20.0147	(88)
util rest of house													
	0.9985	0.9966	0.9896	0.9594	0.8605	0.6555	0.4523	0.5132	0.8210	0.9780	0.9966	0.9989	(89)
MIT 2	18.3602	18.5599	18.9219	19.4097	19.8000	19.9943	20.0274	20.0252	19.9063	19.3956	18.7972	18.3341	(90)
Living area fraction									fLA = Living area / (4) =			0.2589	(91)
MIT	18.7261	18.9092	19.2415	19.6897	20.0538	20.2407	20.2764	20.2729	20.1524	19.6754	19.1256	18.7010	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7261	18.9092	19.2415	19.6897	20.0538	20.2407	20.2764	20.2729	20.1524	19.6754	19.1256	18.7010	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9952	0.9866	0.9544	0.8620	0.6757	0.4831	0.5445	0.8302	0.9742	0.9953	0.9983	(94)
Useful gains	496.3977	564.1603	638.6969	702.6194	684.7631	528.6391	359.8677	375.2281	513.5687	521.5502	480.3913	471.0194	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1469.6337	1423.6398	1291.6690	1081.2995	835.3650	558.3640	363.9213	382.6482	601.4703	907.5254	1207.8234	1463.0949	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	724.0876	577.5702	485.8113	272.6496	112.0478	0.0000	0.0000	0.0000	0.0000	287.1656	523.7512	738.1042	(98)
Space heating												3721.1874	(98)
Space heating per m2											(98) / (4) =	39.9440	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3984.1407	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	724.0876	577.5702	485.8113	272.6496	112.0478	0.0000	0.0000	0.0000	0.0000	287.1656	523.7512	738.1042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	775.2544	618.3836	520.1405	291.9161	119.9656	0.0000	0.0000	0.0000	0.0000	307.4578	560.7614	790.2614	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9135	87.7214	87.2645	86.2012	84.0739	80.3000	80.3000	80.3000	80.3000	86.2123	87.4582	87.9939	(217)
Fuel for water heating, kWh/month													
	238.9364	211.0957	222.6374	199.9039	198.4393	182.9883	175.3167	195.4371	197.5955	209.5716	218.6194	233.0131	(219)
Water heating fuel used												2483.5545	(219)
Annual totals kWh/year													
Space heating fuel - main system												3984.1407	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.0928	(232)
Total delivered energy for all uses												6954.7881	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3984.1407	0.2160	860.5744	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2483.5545	0.2160	536.4478	(264)
Space and water heating			1397.0222	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.0928	0.5190	213.8762	(268)
Total CO2, kg/m2/year			1649.8233	(272)
Emissions per m2 for space and water heating			14.9959	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2958	(272b)
Emissions per m2 for pumps and fans			0.4178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9959 * 1.00) + 2.2958 + 0.4178, rounded to 2 d.p.			17.7100	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 297 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 297	**Prop Type Ref**	
Property	3 Semi, Plot 297, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.62	**TER**	17.71
Environmental	95 A	**% DER<TER**	56.97		
CO_2 Emissions (t/year)	0.31	**DFEE**	40.76	**TFEE**	51.59
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.62	$kgCO_2/m^2$	Pass
	-10.09 (-57.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.59	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.76	$kWh/m^2/yr$	
	-10.8 (-20.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.55 m², No overhang 4.03 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.023	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 297 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 297	**Prop Type Ref**	
Property	3 Semi, Plot 297, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.62	**TER**	17.71
Environmental	95 A	**% DER<TER**	56.97		
CO_2 Emissions (t/year)	0.31	**DFEE**	40.76	**TFEE**	51.59
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.58 m²	2.39 m
1st Storey:	19.33 m	46.58 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.84	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.58	46.58

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 297 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 297	**Prop Type Ref**	
Property	3 Semi, Plot 297, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.62	**TER**	17.71
Environmental	95 A	**% DER<TER**	56.97		
CO_2 Emissions (t/year)	0.31	**DFEE**	40.76	**TFEE**	51.59
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.16	m^2	
DER	7.62	$kgCO_2/yr/m^2$	
TER	17.71	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.62	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.97	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.76	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.16	m^2	
DER	18.03	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.56	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.56	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.82	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.35	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.35	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 298 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 298	**Prop Type Ref**	
Property	3A Semi RITR, Plot 298, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.68 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.57 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.03 m², No overhang
Windows facing South: 1.55 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1534.9896 (45)
Distribution loss (46)m = 0.15 x (45)m

	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186 (46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)

Total heat required for water heating calculated for each month

	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)

Total per year (kWh/year) = Sum(64)m = 1673.6243 (64)
Heat gains from water heating, kWh/month

	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501 (72)
Total internal gains												
	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.4100	1.0000	0.7700	22.4890	(76)
South	1.5500	46.7521	0.4100	1.0000	0.7700	20.5897	(78)
West	7.6600	19.6403	0.4100	1.0000	0.7700	42.7458	(80)

Solar gains	85.8244	161.3336	253.1145	355.0538	426.2245	433.2148	413.6563	360.6596	289.2958	187.7944	105.7458	71.4373 (83)
Total gains	493.8475	567.1869	644.2345	722.3123	769.1004	752.6905	717.9861	671.2454	612.1844	534.7674	480.4084	467.0161 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9967	0.9934	0.9841	0.9534	0.8749	0.7156	0.5516	0.6041	0.8456	0.9719	0.9938	0.9974	(86)
MIT	19.5402	19.7117	20.0044	20.4049	20.7271	20.9287	20.9832	20.9750	20.8347	20.4057	19.9187	19.5352	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9958	0.9916	0.9795	0.9392	0.8365	0.6379	0.4455	0.4977	0.7857	0.9608	0.9919	0.9967	(89)
MIT 2	18.0572	18.3106	18.7393	19.3300	19.7702	20.0295	20.0769	20.0770	19.9249	19.3423	18.6312	18.0637	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4536	18.6852	19.0775	19.6173	20.0260	20.2699	20.3192	20.3170	20.1681	19.6266	18.9754	18.4571	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4536	18.6852	19.0775	19.6173	20.0260	20.2699	20.3192	20.3170	20.1681	19.6266	18.9754	18.4571	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9881	0.9735	0.9312	0.8349	0.6547	0.4736	0.5254	0.7926	0.9541	0.9886	0.9950	(94)
Useful gains	490.7220	560.4391	627.1379	672.5816	642.1458	492.8034	340.0236	352.6668	485.2183	510.2259	474.9334	464.6970	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.8552	1378.7939	1250.7101	1034.6708	798.9789	527.6620	346.1216	362.2635	571.7555	866.2078	1153.3548	1401.2014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	694.2511	549.9344	463.9378	260.7042	116.6838	0.0000	0.0000	0.0000	0.0000	264.8505	488.4634	696.7593	(98)
Space heating												3535.5844	(98)
Space heating per m2											(98) / (4) =	37.9110	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3805.7959	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	694.2511	549.9344	463.9378	260.7042	116.6838	0.0000	0.0000	0.0000	0.0000	264.8505	488.4634	696.7593	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	747.3101	591.9638	499.3948	280.6289	125.6015	0.0000	0.0000	0.0000	0.0000	285.0920	525.7948	750.0100	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2491	89.1950	89.0750	88.7734	88.1732	86.7000	86.7000	86.7000	86.7000	88.7577	89.1141	89.2663	(217)
Fuel for water heating, kWh/month													
	191.5653	168.0176	174.4954	153.8896	149.5965	132.6776	124.3250	140.7009	141.7982	159.7613	172.0856	185.8946	(219)
Water heating fuel used												1894.8075	(219)
Annual totals kWh/year													
Space heating fuel - main system												3805.7959	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4689.0792	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3805.7959	0.2160	822.0519	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.8075	0.2160	409.2784	(264)
Space and water heating			1231.3304	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			706.3493	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.5700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.5700	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.0967	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.0967	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)

Heat gains from water heating, kWh/month

	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
South	1.5500	46.7521	0.6300	0.7000	0.7700	22.1465	(78)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	92.3136	173.5320	272.2524	381.8994	458.4513	465.9701	444.9327	387.9290	311.1694	201.9935	113.7413	76.8386	(83)
Total gains	514.8826	593.7777	677.4552	762.3371	813.6522	797.0218	760.8823	710.9504	647.3888	563.2008	502.9060	487.0048	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9987	0.9969	0.9909	0.9676	0.8956	0.7398	0.5673	0.6248	0.8698	0.9825	0.9971	0.9990	(86)
MIT	19.7688	19.9142	20.1656	20.4970	20.7801	20.9449	20.9889	20.9820	20.8639	20.4877	20.0674	19.7445	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9982	0.9958	0.9876	0.9549	0.8550	0.6519	0.4481	0.5039	0.8049	0.9735	0.9960	0.9987	(89)
MIT 2	18.3443	18.5583	18.9256	19.4072	19.7883	19.9806	20.0143	20.0125	19.9014	19.4017	18.7901	18.3149	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7251	18.9208	19.2571	19.6985	20.0534	20.2384	20.2748	20.2717	20.1587	19.6920	19.1316	18.6971	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7251	18.9208	19.2571	19.6985	20.0534	20.2384	20.2748	20.2717	20.1587	19.6920	19.1316	18.6971	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9942	0.9842	0.9499	0.8571	0.6731	0.4802	0.5364	0.8159	0.9695	0.9944	0.9980	(94)
Useful gains	513.5099	590.3044	666.7436	724.1364	697.3926	536.4775	365.3808	381.3214	528.2110	546.0497	500.1092	486.0269	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1492.3964	1447.0302	1313.4635	1099.2846	848.5596	567.0645	369.5845	388.6570	611.6964	923.5899	1227.4782	1485.6643	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	728.2916	575.7198	481.1596	270.1067	112.4682	0.0000	0.0000	0.0000	0.0000	280.8899	523.7057	743.7303	(98)
Space heating												3716.0717	(98)
Space heating per m2											(98) / (4) =	39.8464	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3978.6635	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	728.2916	575.7198	481.1596	270.1067	112.4682	0.0000	0.0000	0.0000	0.0000	280.8899	523.7057	743.7303	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	779.7554	616.4023	515.1602	289.1935	120.4156	0.0000	0.0000	0.0000	0.0000	300.7387	560.7127	796.2851	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9239	87.7146	87.2430	86.1775	84.0821	80.3000	80.3000	80.3000	80.3000	86.1573	87.4575	88.0074	(217)
Fuel for water heating, kWh/month													
	238.9617	211.1589	222.7581	200.0181	198.4788	183.0424	175.3686	195.4949	197.6539	209.7674	218.6690	233.0292	(219)
Water heating fuel used												2484.4010	(219)
Annual totals kWh/year													
Space heating fuel - main system												3978.6635	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												6950.5500	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3978.6635	0.2160	859.3913	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.4010	0.2160	536.6306	(264)
Space and water heating			1396.0219	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1649.0269	(272)
Emissions per m2 for space and water heating			14.9691	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9691 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.6800	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 298 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 298	**Prop Type Ref**	
Property	3A Semi RITR, Plot 298, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.68	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.57	$kgCO_2/m^2$	Pass
	-10.11 (-57.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.49	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	40.49	$kWh/m^2/yr$	
	-11.0 (-21.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.03 m², No overhang 1.55 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 298 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 298	**Prop Type Ref**	
Property	3A Semi RITR, Plot 298, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 298 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 298	**Prop Type Ref**	
Property	3A Semi RITR, Plot 298, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.57	**TER**	17.68
Environmental	95 A	**% DER<TER**	57.19		
CO_2 Emissions (t/year)	0.30	**DFEE**	40.49	**TFEE**	51.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.57	$kgCO_2/yr/m^2$	
TER	17.68	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.57	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.19	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.49	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.3		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	17.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.48	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.48	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.75	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.28	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.28	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 299 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 299	**Prop Type Ref**	
Property	3A Semi RITR, Plot 299, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.79 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.55 m², No overhang
Windows facing East: 4.03 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3532	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3002	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3827	0.3752	0.3677	0.3302	0.3227	0.2852	0.2852	0.2777	0.3002	0.3227	0.3377	0.3527	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6327	0.6252	0.6177	0.5802	0.5727	0.5352	0.5352	0.5277	0.5502	0.5727	0.5877	0.6027	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1400	6.5282			(28a)
External Wall	93.5500	12.6400	80.9100	0.2100	16.9911			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1900	0.0247			(29a)
Main Roof	41.7300		41.7300	0.0700	2.9211			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1600	0.3584			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7573			(33)
Party Wall			64.5300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9654	(36)
Total fabric heat loss (33) + (36) =	51.7227	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8772	48.2975	47.7178	44.8192	44.2395	41.3409	41.3409	40.7612	42.5004	44.2395	45.3989	46.5583	(38)
Heat transfer coeff	100.5999	100.0202	99.4405	96.5419	95.9622	93.0636	93.0636	92.4839	94.2231	95.9622	97.1216	98.2811	(39)
Average = Sum(39)m / 12 =												96.3970	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0787	1.0725	1.0663	1.0352	1.0290	0.9979	0.9979	0.9917	1.0103	1.0290	1.0414	1.0538	(40)
HLP (average)												1.0336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9606	19.5052	15.8627	12.0091	8.9769	7.5787	8.1891	10.6444	14.2870	18.1406	21.1727	22.5710	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains	408.0230	405.8533	391.1201	367.2585	342.8759	319.4756	304.3298	310.5858	322.8886	346.9730	374.6626	395.5789	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.4100	1.0000	0.7700	4.6830	(74)
East	4.0300	19.6403	0.4100	1.0000	0.7700	22.4890	(76)
West	7.6600	19.6403	0.4100	1.0000	0.7700	42.7458	(80)

Solar gains	69.9177	136.5624	225.3676	330.9331	408.5400	419.7551	398.9753	340.5561	262.7092	162.0766	87.1171	57.5498	(83)
Total gains	477.9407	542.4157	616.4877	698.1916	751.4160	739.2307	703.3052	651.1419	585.5978	509.0496	461.7796	453.1287	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.7296	51.0236	51.3211	52.8620	53.1813	54.8377	54.8377	55.1814	54.1629	53.1813	52.5464	51.9265	
alpha	4.3820	4.4016	4.4214	4.5241	4.5454	4.6558	4.6558	4.6788	4.6109	4.5454	4.5031	4.4618	
util living area													
	0.9971	0.9945	0.9865	0.9584	0.8824	0.7245	0.5617	0.6194	0.8619	0.9765	0.9947	0.9977	(86)
MIT	19.5210	19.6821	19.9725	20.3807	20.7149	20.9249	20.9819	20.9723	20.8185	20.3775	19.8963	19.5183	(87)
Th 2	20.0183	20.0234	20.0285	20.0541	20.0593	20.0851	20.0851	20.0903	20.0747	20.0593	20.0490	20.0387	(88)
util rest of house													
	0.9963	0.9929	0.9826	0.9455	0.8454	0.6471	0.4543	0.5117	0.8052	0.9670	0.9930	0.9971	(89)
MIT 2	18.0291	18.2677	18.6936	19.2967	19.7554	20.0262	20.0763	20.0754	19.9076	19.3030	18.5986	18.0390	(90)
Living area fraction										fLA = Living area / (4) =		0.2673	(91)
MIT	18.4279	18.6458	19.0355	19.5865	20.0119	20.2664	20.3184	20.3151	20.1511	19.5902	18.9455	18.4344	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4279	18.6458	19.0355	19.5865	20.0119	20.2664	20.3184	20.3151	20.1511	19.5902	18.9455	18.4344	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9898	0.9770	0.9375	0.8432	0.6636	0.4827	0.5396	0.8106	0.9606	0.9901	0.9956	(94)
Useful gains	475.2579	536.9026	602.3208	654.5679	633.6226	490.5235	339.4538	351.3858	474.6970	489.0037	457.2165	451.1209	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1421.2684	1374.8530	1246.5349	1031.6960	797.6286	527.3391	346.0432	362.0879	570.1545	862.7234	1150.4560	1398.9741	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	703.8318	563.1026	479.2953	271.5323	122.0204	0.0000	0.0000	0.0000	0.0000	278.0475	499.1324	705.2028	(98)
Space heating												3622.1651	(98)
Space heating per m2											(98) / (4) =	38.8394	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3898.9936	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	703.8318	563.1026	479.2953	271.5323	122.0204	0.0000	0.0000	0.0000	0.0000	278.0475	499.1324	705.2028	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	757.6230	606.1384	515.9260	292.2845	131.3460	0.0000	0.0000	0.0000	0.0000	299.2976	537.2793	759.0988	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2562	89.2079	89.0947	88.8029	88.2088	86.7000	86.7000	86.7000	86.7000	88.7931	89.1269	89.2724	(217)
Fuel for water heating, kWh/month													
	191.5501	167.9932	174.4566	153.8385	149.5361	132.6776	124.3250	140.7009	141.7982	159.6975	172.0610	185.8819	(219)
Water heating fuel used												1894.5166	(219)
Annual totals kWh/year													
Space heating fuel - main system												3898.9936	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.8310	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4781.9860	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3898.9936	0.2160	842.1826	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.5166	0.2160	409.2156	(264)
Space and water heating			1251.3982	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.8310	0.5190	201.2843	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			726.4171	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.7900	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		25.3167	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.3167	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.3900 (2b)	=	111.4457 (1b) - (3b)	
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	234.0826	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1282	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3214	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4098	0.4018	0.3938	0.3536	0.3455	0.3054	0.3054	0.2973	0.3214	0.3455	0.3616	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	93.5500	12.6400	80.9100	0.1800	14.5638			(29a)
Dormer wall	2.8500	2.7200	0.1300	0.1800	0.0234			(29a)
Main Roof	41.7300		41.7300	0.1300	5.4249			(30)
Sloping roof	3.0200		3.0200	0.1300	0.3926			(30)
Dormer roof	2.2400		2.2400	0.1300	0.2912			(30)
Total net area of external elements Aum(A, m2)			190.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8548			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4924	(36)
Total fabric heat loss					(33) + (36) =		58.3472	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1109	44.8590	44.6121	43.4523	43.2353	42.2252	42.2252	42.0381	42.6143	43.2353	43.6743	44.1332	(38)
Heat transfer coeff	103.4581	103.2062	102.9593	101.7995	101.5825	100.5724	100.5724	100.3853	100.9615	101.5825	102.0215	102.4804	(39)
Average = Sum(39)m / 12 =												101.7985	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1094	1.1067	1.1040	1.0916	1.0892	1.0784	1.0784	1.0764	1.0826	1.0892	1.0939	1.0989	(40)
HLP (average)												1.0916	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6678 (42)
Average daily hot water use (litres/day)		97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)

Total heat required for water heating calculated for each month

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)

Heat gains from water heating, kWh/month

	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.3566	20.7452	16.8711	12.7725	9.5476	8.0605	8.7096	11.3211	15.1952	19.2938	22.5187	24.0058	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)

Water heating gains (Table 5)

	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)

Total internal gains

	422.5690	420.2458	405.2028	380.4377	355.2010	331.0517	315.9496	323.0214	336.2194	361.2073	389.1648	410.1662	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5500	10.6334	0.6300	0.7000	0.7700	5.0370	(74)
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	75.2042	146.8878	242.4076	355.9548	439.4297	451.4927	429.1418	366.3054	282.5726	174.3312	93.7040	61.9012	(83)
Total gains	497.7732	567.1336	647.6104	736.3926	794.6306	782.5444	745.0914	689.3269	618.7920	535.5385	482.8687	472.0673	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5991	62.7519	62.9024	63.6190	63.7549	64.3953	64.3953	64.5153	64.1471	63.7549	63.4806	63.1963	
alpha	5.1733	5.1835	5.1935	5.2413	5.2503	5.2930	5.2930	5.3010	5.2765	5.2503	5.2320	5.2131	
util living area	0.9989	0.9975	0.9926	0.9717	0.9031	0.7492	0.5780	0.6411	0.8860	0.9859	0.9976	0.9991	(86)
MIT	19.7516	19.8876	20.1367	20.4746	20.7687	20.9414	20.9879	20.9798	20.8487	20.4618	20.0473	19.7294	(87)
Th 2	19.9932	19.9954	19.9976	20.0077	20.0096	20.0185	20.0185	20.0202	20.0151	20.0096	20.0058	20.0018	(88)
util rest of house	0.9985	0.9966	0.9898	0.9604	0.8643	0.6617	0.4573	0.5187	0.8254	0.9784	0.9967	0.9989	(89)
MIT 2	18.3192	18.5195	18.8839	19.3764	19.7750	19.9779	20.0139	20.0114	19.8860	19.3655	18.7609	18.2928	(90)
Living area fraction									fLA = Living area / (4) =			0.2673	(91)
MIT	18.7021	18.8852	19.2188	19.6699	20.0406	20.2355	20.2742	20.2702	20.1433	19.6586	19.1048	18.6768	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7021	18.8852	19.2188	19.6699	20.0406	20.2355	20.2742	20.2702	20.1433	19.6586	19.1048	18.6768	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9952	0.9868	0.9555	0.8657	0.6826	0.4898	0.5515	0.8347	0.9748	0.9953	0.9983	(94)
Useful gains	496.6312	564.4084	639.0515	703.6356	687.8928	534.1537	364.9206	380.1764	516.5058	522.0277	480.6168	471.2442	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1490.0109	1443.3639	1309.5201	1096.3746	847.2602	566.7742	369.5269	388.5153	610.1440	920.1937	1224.7448	1483.5928	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	739.0745	590.6581	498.8286	282.7721	118.5694	0.0000	0.0000	0.0000	0.0000	296.2356	535.7721	753.1874	(98)
Space heating												3815.0977	(98)
Space heating per m2											(98) / (4) =	40.9082	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4084.6871	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.0745	590.6581	498.8286	282.7721	118.5694	0.0000	0.0000	0.0000	0.0000	296.2356	535.7721	753.1874	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	791.3003	632.3962	534.0778	302.7538	126.9479	0.0000	0.0000	0.0000	0.0000	317.1687	573.6318	806.4104	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9513	87.7648	87.3207	86.2896	84.2079	80.3000	80.3000	80.3000	80.3000	86.2876	87.5048	88.0304	(217)
Fuel for water heating, kWh/month													
	238.8873	211.0381	222.5598	199.7581	198.1823	183.0424	175.3686	195.4949	197.6539	209.4507	218.5509	232.9683	(219)
Water heating fuel used												2482.9554	(219)
Annual totals kWh/year													
Space heating fuel - main system												4084.6871	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4855	(232)
Total delivered energy for all uses												7055.1279	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4084.6871	0.2160	882.2924	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2482.9554	0.2160	536.3184	(264)
Space and water heating			1418.6108	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4855	0.5190	214.0800	(268)
Total CO2, kg/m2/year			1671.6157	(272)
Emissions per m2 for space and water heating			15.2114	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2955	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2114 * 1.00) + 2.2955 + 0.4174, rounded to 2 d.p.			17.9200	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 299 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 299	**Prop Type Ref**	
Property	3A Semi RITR, Plot 299, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.79	$kgCO_2/m^2$	Pass
	-10.13 (-56.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.70	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.41	$kWh/m^2/yr$	
	-11.3 (-21.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.55 m², No overhang 4.03 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 299 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 299	**Prop Type Ref**	
Property	3A Semi RITR, Plot 299, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.63 m²	2.39 m
1st Storey:	19.33 m	46.63 m²	2.63 m

7.0 Living Area	24.93	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	197.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	93.55	80.91
Dormer wall	Cavity Wall	0.19	2.85	0.13

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	64.53

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	41.73	41.73
Sloping roof	External Slope Roof	0.13	3.02	3.02
Dormer roof	External Plane Roof	0.16	2.24	2.24

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.63

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[2] Dormer wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
D2 (W7)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	38.66	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	6.91	0.087	No
Independently assessed	E11 Eaves (insulation at rafter level)	5.04	0.023	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.64	0.051	No
Independently assessed	E13 Gable (insulation at rafter level)	4.56	0.060	No
Independently assessed	E16 Corner (normal)	9.95	0.037	No
Independently assessed	E18 Party wall between dwellings	9.95	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	18.49	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	11.64	0.037	No
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	4.56	0.000	No
Table K1 - Default	R6 Flat ceiling	5.04	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	2.40	0.040	No

Y-value	0.026	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No

22.0 Lighting

Internal		
Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 299 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 299	**Prop Type Ref**	
Property	3A Semi RITR, Plot 299, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.79	**TER**	17.92
Environmental	95 A	**% DER<TER**	56.54		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.41	**TFEE**	52.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.26	m^2	
DER	7.79	$kgCO_2/yr/m^2$	
TER	17.92	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.79	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.54	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.41	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.26	m^2	
DER	18.18	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.71	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.71	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.97	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.56	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.50	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.50	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 300 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 300	**Prop Type Ref**	
Property	3 Semi, Plot 300, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.41 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.03 m², No overhang
Windows facing South: 1.55 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3533	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3003	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3829	0.3754	0.3679	0.3303	0.3228	0.2853	0.2853	0.2778	0.3003	0.3228	0.3378	0.3529	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6329	0.6254	0.6179	0.5803	0.5728	0.5353	0.5353	0.5278	0.5503	0.5728	0.5878	0.6029	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.2400	1.2357	16.3612			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.5800	0.1400	6.5212			(28a)
External Wall	96.8400	15.3600	81.4800	0.2100	17.1108			(29a)
Main Roof	46.5800		46.5800	0.0700	3.2606			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.4338			(33)
Party Wall			46.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	189.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3636 (36)
Total fabric heat loss	(33) + (36) = 50.7974 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8363	48.2570	47.6777	44.7811	44.2018	41.3052	41.3052	40.7259	42.4638	44.2018	45.3604	46.5190	(38)
Heat transfer coeff	99.6337	99.0544	98.4751	95.5785	94.9992	92.1026	92.1026	91.5233	93.2612	94.9992	96.1578	97.3165	(39)
Average = Sum(39)m / 12 =												95.4337	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0695	1.0633	1.0571	1.0260	1.0197	0.9886	0.9886	0.9824	1.0011	1.0197	1.0322	1.0446	(40)
HLP (average)												1.0244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6666 (42)
Average daily hot water use (litres/day)	97.5306 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8246   10.6734   11.8002   11.3917   11.7511   11.3487   11.7124   11.7375   11.3721   11.7799   11.4250   11.8171 (61)
Total heat required for water heating calculated for each month
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              170.9231  149.8220  155.3891  136.5759  131.8684  115.0008  107.7613  121.9550  122.9060  141.7618  153.3105  165.8955 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1673.1694 (64)
Heat gains from water heating, kWh/month
               55.8564   48.9353   50.6934   44.4717   42.8768   37.3015   34.8644   39.5817   39.9280   46.1640   50.0332   54.1853 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275  133.3275 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.9426   19.4892   15.8497   11.9992    8.9696    7.5725    8.1823   10.6357   14.2752   18.1257   21.1553   22.5524 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              244.7727  247.3127  240.9120  227.2858  210.0851  193.9189  183.1189  180.5789  186.9796  200.6058  217.8065  233.9727 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328   36.3328 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 -106.6620 (71)
Water heating gains (Table 5)
               75.0758   72.8203   68.1362   61.7662   57.6301   51.8076   46.8607   53.2012   55.4556   62.0484   69.4905   72.8298 (72)
Total internal gains
              407.7893  405.6204  390.8962  367.0495  342.6830  319.2973  304.1602  310.4141  322.7086  346.7781  374.4506  395.3531 (73)


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6. Solar gains
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[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
East                                  4.0300           19.6403            0.4100           1.0000           0.7700           22.4890 (76)
South                                 1.5500           46.7521            0.4100           1.0000           0.7700           20.5897 (78)
West                                  7.6600           19.6403            0.4100           1.0000           0.7700           42.7458 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    85.8244  161.3336  253.1145  355.0538  426.2245  433.2148  413.6563  360.6596  289.2958  187.7944  105.7458   71.4373 (83)
Total gains   493.6137  566.9540  644.0106  722.1033  768.9075  752.5121  717.8164  671.0737  612.0045  534.5724  480.1964  466.7903 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.0888   49.3759   49.6664   51.1715   51.4836   53.1027   53.1027   53.4389   52.4430   51.4836   50.8633   50.2577
alpha          4.2726    4.2917    4.3111    4.4114    4.4322    4.5402    4.5402    4.5626    4.4962    4.4322    4.3909    4.3505
util living area
               0.9961    0.9924    0.9820    0.9490    0.8677    0.7078    0.5454    0.5973    0.8380    0.9687    0.9928    0.9969 (86)

MIT           19.5088   19.6851   19.9851   20.3945   20.7217   20.9263   20.9822   20.9738   20.8311   20.3950   19.8967   19.5036 (87)
Th 2          20.0258   20.0309   20.0361   20.0618   20.0669   20.0928   20.0928   20.0980   20.0824   20.0669   20.0566   20.0463 (88)
util rest of house
               0.9951    0.9904    0.9771    0.9343    0.8292    0.6314    0.4416    0.4931    0.7783    0.9570    0.9906    0.9961 (89)
MIT 2         18.0216   18.2820   18.7211   19.3236   19.7705   20.0345   20.0839   20.0836   19.9280   19.3361   18.6091   18.0278 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2589 (91)
MIT           18.4067   18.6453   19.0483   19.6009   20.0167   20.2654   20.3165   20.3141   20.1618   19.6102   18.9425   18.4099 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.4067   18.6453   19.0483   19.6009   20.0167   20.2654   20.3165   20.3141   20.1618   19.6102   18.9425   18.4099 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9925    0.9863    0.9702    0.9254    0.8268    0.6470    0.4681    0.5192    0.7842    0.9495    0.9868    0.9941 (94)
Useful gains 489.9359  559.1741  624.8327  668.2018  635.7499  486.8518  335.9852  348.4060  479.9287  507.5666  473.8706  464.0385 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1405.4986 1361.5293 1235.6999 1022.7747  790.0841  521.7950  342.2960  358.2315  565.3306  855.9650 1138.7466 1382.8583 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              681.1786  539.1827  454.4852  255.2925  114.8246    0.0000    0.0000    0.0000    0.0000  259.2084  478.7107  683.6020 (98)
Space heating                                                                                                          3466.4848 (98)
Space heating per m2                                                                                  (98) / (4) =     37.2100 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3731.4153	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	681.1786	539.1827	454.4852	255.2925	114.8246	0.0000	0.0000	0.0000	0.0000	259.2084	478.7107	683.6020	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	733.2386	580.3904	489.2198	274.8036	123.6002	0.0000	0.0000	0.0000	0.0000	279.0187	515.2968	735.8471	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2393	89.1842	89.0625	88.7582	88.1606	86.7000	86.7000	86.7000	86.7000	88.7420	89.1023	89.2567	(217)
Fuel for water heating, kWh/month													
	191.5334	167.9916	174.4720	153.8741	149.5774	132.6422	124.2921	140.6632	141.7600	159.7461	172.0613	185.8634	(219)
Water heating fuel used												1894.4769	(219)
Annual totals kWh/year													
Space heating fuel - main system												3731.4153	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.5123	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =											-1474.3553	-1474.3553	(233)
Total delivered energy for all uses												4614.0492	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3731.4153	0.2160	805.9857	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.4769	0.2160	409.2070	(264)
Space and water heating			1215.1927	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.5123	0.5190	201.1189	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			690.0462	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.4100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.4100	ZC1
Total Floor Area	TFA	93.1600	
Assumed number of occupants	N	2.6666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5697	ZC2
CO2 emissions from cooking, equation (L16)		1.9643	ZC3
Total CO2 emissions		24.9440	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.9440	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3617	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.2400	1.3258	17.5530			(27)
Ground floor			46.5800	0.1300	6.0554			(28a)
External Wall	96.8400	15.3600	81.4800	0.1800	14.6664			(29a)
Main Roof	46.5800		46.5800	0.1300	6.0554			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8742			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.9321	(36)
Total fabric heat loss					(33) + (36) =		56.8063	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.0672	44.8154	44.5686	43.4092	43.1923	42.1825	42.1825	41.9955	42.5715	43.1923	43.6311	44.0899	(38)
Heat transfer coeff	101.8736	101.6218	101.3749	100.2155	99.9986	98.9888	98.9888	98.8019	99.3778	99.9986	100.4374	100.8962	(39)
Average = Sum(39)m / 12 =												100.2145	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0935	1.0908	1.0882	1.0757	1.0734	1.0626	1.0626	1.0606	1.0667	1.0734	1.0781	1.0830	(40)
HLP (average)												1.0757	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6666	(42)
Average daily hot water use (litres/day)												97.5306	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6945	47.1353	46.7185	43.2875	44.7305	46.7185	47.1353	50.6945	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.9106	(64)
Heat gains from water heating, kWh/month													
	65.6400	57.7738	60.4169	53.4076	51.6186	45.2862	43.1189	48.3269	48.8688	55.8926	59.5057	63.9708	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3344	20.7254	16.8550	12.7603	9.5385	8.0528	8.7013	11.3103	15.1807	19.2754	22.4972	23.9829	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	88.2258	85.9728	81.2056	74.1772	69.3799	62.8975	57.9555	64.9556	67.8734	75.1245	82.6468	85.9823	(72)
Total internal gains													
	422.3311	420.0092	404.9709	380.2216	355.0017	330.8675	315.7740	322.8431	336.0319	361.0040	388.9487	409.9361	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
South	1.5500	46.7521	0.6300	0.7000	0.7700	22.1465	(78)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	92.3136	173.5320	272.2524	381.8994	458.4513	465.9701	444.9327	387.9290	311.1694	201.9935	113.7413	76.8386	(83)
Total gains	514.6447	593.5412	677.2232	762.1210	813.4530	796.8375	760.7067	710.7721	647.2013	562.9974	502.6900	486.7747	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5046	63.6620	63.8170	64.5553	64.6953	65.3553	65.3553	65.4790	65.0995	64.6953	64.4127	64.1198	
alpha	5.2336	5.2441	5.2545	5.3037	5.3130	5.3570	5.3570	5.3653	5.3400	5.3130	5.2942	5.2747	
util living area	0.9987	0.9969	0.9907	0.9666	0.8922	0.7329	0.5599	0.6172	0.8656	0.9820	0.9971	0.9990	(86)
MIT	19.7906	19.9356	20.1854	20.5136	20.7912	20.9493	20.9901	20.9838	20.8715	20.5020	20.0859	19.7664	(87)
Th 2	20.0061	20.0083	20.0105	20.0207	20.0226	20.0315	20.0315	20.0332	20.0281	20.0226	20.0187	20.0147	(88)
util rest of house	0.9982	0.9958	0.9874	0.9536	0.8511	0.6457	0.4432	0.4986	0.8002	0.9729	0.9959	0.9987	(89)
MIT 2	18.3855	18.5989	18.9637	19.4404	19.8130	19.9968	20.0277	20.0263	19.9213	19.4318	18.8265	18.3562	(90)
Living area fraction									fLA = Living area / (4) =			0.2589	(91)
MIT	18.7493	18.9450	19.2800	19.7183	20.0663	20.2434	20.2769	20.2742	20.1673	19.7089	19.1526	18.7213	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7493	18.9450	19.2800	19.7183	20.0663	20.2434	20.2769	20.2742	20.1673	19.7089	19.1526	18.7213	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9839	0.9486	0.8532	0.6661	0.4736	0.5294	0.8110	0.9689	0.9944	0.9980	(94)
Useful gains	513.2749	590.0459	666.3404	722.9609	694.0136	530.8099	360.2799	376.2668	524.8753	545.4730	499.8760	485.8016	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1471.9987	1427.2736	1295.5723	1084.1608	836.6166	558.6324	363.9725	382.7757	602.9532	910.8781	1210.5321	1465.1485	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	713.2905	562.6170	468.1485	260.0640	106.0966	0.0000	0.0000	0.0000	0.0000	271.8614	511.6724	728.6341	(98)
Space heating												3622.3844	(98)
Space heating per m2											(98) / (4) =	38.8835	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3878.3559	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.2905	562.6170	468.1485	260.0640	106.0966	0.0000	0.0000	0.0000	0.0000	271.8614	511.6724	728.6341	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	763.6943	602.3736	501.2296	278.4411	113.5938	0.0000	0.0000	0.0000	0.0000	291.0722	547.8291	780.1222	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8853	87.6694	87.1838	86.0848	83.9458	80.3000	80.3000	80.3000	80.3000	86.0774	87.4093	87.9701	(217)
Fuel for water heating, kWh/month													
	239.0133	211.2208	222.8433	200.1742	198.7421	182.9883	175.3167	195.4371	197.5955	209.8999	218.7417	233.0760	(219)
Water heating fuel used												2485.0489	(219)
Annual totals kWh/year													
Space heating fuel - main system												3878.3559	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.0928	(232)
Total delivered energy for all uses												6850.4976	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3878.3559	0.2160	837.7249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0489	0.2160	536.7706	(264)
Space and water heating			1374.4954	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.0928	0.5190	213.8762	(268)
Total CO2, kg/m2/year			1627.2966	(272)
Emissions per m2 for space and water heating			14.7541	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2958	(272b)
Emissions per m2 for pumps and fans			0.4178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7541 * 1.00) + 2.2958 + 0.4178, rounded to 2 d.p.			17.4700	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 300 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 300	**Prop Type Ref**	
Property	3 Semi, Plot 300, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.47	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.41	$kgCO_2/m^2$	Pass
	-10.06 (-57.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.38	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	39.86	$kWh/m^2/yr$	
	-10.5 (-20.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.03 m², No overhang 1.55 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.023	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 300 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 300	**Prop Type Ref**	
Property	3 Semi, Plot 300, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.58 m²	2.39 m
1st Storey:	19.33 m	46.58 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.84	81.48

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.58	46.58

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.46	0.052	No
Independently assessed	E3 Sill	8.86	0.004	No
Independently assessed	E4 Jamb	26.25	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 300 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 300	**Prop Type Ref**	
Property	3 Semi, Plot 300, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.41	**TER**	17.47
Environmental	95 A	**% DER<TER**	57.58		
CO_2 Emissions (t/year)	0.29	**DFEE**	39.86	**TFEE**	50.38
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.16	m^2	
DER	7.41	$kgCO_2/yr/m^2$	
TER	17.47	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.41	$kgCO_2/yr/m^2$	
Reduction DER/TER	57.58	%	
CfSH ENE1 credits achieved	6.1		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.86	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.16	m^2	
DER	17.81	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.34	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.34	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.13	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.13	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 301 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 301	**Prop Type Ref**	
Property	3 AW Semi, Plot 301, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.71	**TER**	17.80
Environmental	95 A	**% DER<TER**	56.69		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.36	**TFEE**	52.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.17		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.05 m², No overhang
Windows facing East: 4.03 m², No overhang
Windows facing West: 7.66 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 2.03 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3533	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3003	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3829	0.3754	0.3679	0.3303	0.3228	0.2853	0.2853	0.2778	0.3003	0.3228	0.3378	0.3529	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6329	0.6254	0.6179	0.5803	0.5728	0.5353	0.5353	0.5278	0.5503	0.5728	0.5878	0.6029	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.7400	1.2357	18.2148			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			46.5800	0.1400	6.5212			(28a)
External Wall	96.8400	16.8600	79.9800	0.2100	16.7958			(29a)
Main Roof	46.5800		46.5800	0.0700	3.2606			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.9724			(33)
Party Wall			46.3100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							189.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4451	(36)
Total fabric heat loss					(33) + (36) =		52.4175	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8363	48.2570	47.6777	44.7811	44.2018	41.3052	41.3052	40.7259	42.4638	44.2018	45.3604	46.5190	(38)
Heat transfer coeff	101.2538	100.6745	100.0952	97.1986	96.6193	93.7227	93.7227	93.1434	94.8813	96.6193	97.7779	98.9365	(39)
Average = Sum(39)m / 12 =												97.0538	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0869	1.0807	1.0744	1.0434	1.0371	1.0060	1.0060	0.9998	1.0185	1.0371	1.0496	1.0620	(40)
HLP (average)												1.0418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6666	(42)
Average daily hot water use (litres/day)												97.5306	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8246	10.6734	11.8002	11.3917	11.7511	11.3487	11.7124	11.7375	11.3721	11.7799	11.4250	11.8171 (61)

Total heat required for water heating calculated for each month

	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955 (64)

Total per year (kWh/year) = Sum(64)m = 1673.1694 (64)

Heat gains from water heating, kWh/month

	55.8564	48.9353	50.6934	44.4717	42.8768	37.3015	34.8644	39.5817	39.9280	46.1640	50.0332	54.1853 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.8177	19.3783	15.7595	11.9309	8.9185	7.5294	8.1358	10.5752	14.1940	18.0225	21.0349	22.4241	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)

Water heating gains (Table 5)

	75.0758	72.8203	68.1362	61.7662	57.6301	51.8076	46.8607	53.2012	55.4556	62.0484	69.4905	72.8298	(72)

Total internal gains

	407.6645	405.5095	390.8060	366.9812	342.6320	319.2542	304.1136	310.3535	322.6274	346.6749	374.3302	395.2248	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0500	10.6334	0.4100	1.0000	0.7700	9.2149	(74)
East	4.0300	19.6403	0.4100	1.0000	0.7700	22.4890	(76)
West	7.6600	19.6403	0.4100	1.0000	0.7700	42.7458	(80)

Solar gains	74.4496	145.2231	240.0842	354.5717	440.3835	453.8445	430.8021	365.8066	280.4034	172.3860	92.7078	61.3278	(83)
Total gains	482.1141	550.7326	630.8902	721.5530	783.0155	773.0986	734.9157	676.1601	603.0308	519.0610	467.0380	456.5526	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.3034	48.5813	48.8625	50.3186	50.6203	52.1848	52.1848	52.5094	51.5476	50.6203	50.0205	49.4347	
alpha	4.2202	4.2388	4.2575	4.3546	4.3747	4.4790	4.4790	4.5006	4.4365	4.3747	4.3347	4.2956	
util living area	0.9964	0.9932	0.9835	0.9503	0.8653	0.7016	0.5418	0.6012	0.8479	0.9723	0.9936	0.9972	(86)
MIT	19.4661	19.6373	19.9442	20.3724	20.7167	20.9258	20.9817	20.9717	20.8155	20.3590	19.8561	19.4620	(87)
Th 2	20.0116	20.0167	20.0218	20.0474	20.0525	20.0783	20.0783	20.0835	20.0680	20.0525	20.0422	20.0320	(88)
util rest of house	0.9955	0.9914	0.9789	0.9358	0.8260	0.6242	0.4370	0.4953	0.7895	0.9617	0.9916	0.9964	(89)
MIT 2	17.9499	18.2030	18.6522	19.2821	19.7517	20.0200	20.0692	20.0680	19.8980	19.2751	18.5403	17.9575	(90)
Living area fraction										fLA = Living area / (4) =		0.2589	(91)
MIT	18.3424	18.5744	18.9867	19.5644	20.0016	20.2545	20.3054	20.3020	20.1355	19.5558	18.8810	18.3471	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3424	18.5744	18.9867	19.5644	20.0016	20.2545	20.3054	20.3020	20.1355	19.5558	18.8810	18.3471	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9876	0.9723	0.9267	0.8236	0.6400	0.4637	0.5218	0.7944	0.9543	0.9880	0.9945	(94)
Useful gains	478.7830	543.8760	613.4005	668.6722	644.8946	494.8009	340.7991	352.8103	479.0295	495.3329	461.4459	454.0453	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1421.8497	1376.6593	1249.8578	1036.5625	802.0913	529.9553	347.2843	363.4427	572.6588	865.2985	1151.9216	1399.6604	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	701.6416	559.6303	473.5242	264.8810	116.9543	0.0000	0.0000	0.0000	0.0000	275.2544	497.1425	703.5377	(98)
Space heating												3592.5661	(98)
Space heating per m2											(98) / (4) =	38.5634	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3867.1325	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	701.6416	559.6303	473.5242	264.8810	116.9543	0.0000	0.0000	0.0000	0.0000	275.2544	497.1425	703.5377	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	755.2654	602.4008	509.7139	285.1249	125.8927	0.0000	0.0000	0.0000	0.0000	296.2911	535.1372	757.3064	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9231	149.8220	155.3891	136.5759	131.8684	115.0008	107.7613	121.9550	122.9060	141.7618	153.3105	165.8955	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2547	89.2047	89.0876	88.7852	88.1752	86.7000	86.7000	86.7000	86.7000	88.7860	89.1247	89.2713	(217)
Fuel for water heating, kWh/month													
	191.5004	167.9531	174.4228	153.8274	149.5526	132.6422	124.2921	140.6632	141.7600	159.6669	172.0180	185.8329	(219)
Water heating fuel used												1894.1317	(219)
Annual totals kWh/year													
Space heating fuel - main system												3867.1325	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												385.3072	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.03 * 908 * 1.00) =										-1474.3553		-1474.3553	(233)
Total delivered energy for all uses												4747.2162	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3867.1325	0.2160	835.3006	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1894.1317	0.2160	409.1325	(264)
Space and water heating			1244.4331	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	385.3072	0.5190	199.9745	(268)
Energy saving/generation technologies				
PV Unit	-1474.3553	0.5190	-765.1904	(269)
Total CO2, kg/year			718.1421	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.7100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.7100	ZC1
Total Floor Area	TFA	93.1600	
Assumed number of occupants	N	2.6666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5697	ZC2
CO2 emissions from cooking, equation (L16)		1.9643	ZC3
Total CO2 emissions		25.2440	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		25.2440	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5800 (1b)	x	2.3900 (2b)	=	111.3262	(1b) - (3b)
First floor	46.5800 (1c)	x	2.6300 (2c)	=	122.5054	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	233.8316	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1283	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3783	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3216	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4100	0.4019	0.3939	0.3537	0.3457	0.3055	0.3055	0.2974	0.3216	0.3457	0.3617	0.3778	(22b)
Effective ac	0.5840	0.5808	0.5776	0.5626	0.5597	0.5467	0.5467	0.5442	0.5517	0.5597	0.5654	0.5714	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.7400	1.3258	19.5417			(27)
Ground floor			46.5800	0.1300	6.0554			(28a)
External Wall	96.8400	16.8600	79.9800	0.1800	14.3964			(29a)
Main Roof	46.5800		46.5800	0.1300	6.0554			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5929			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1766	(36)
Total fabric heat loss (33) + (36) =	58.7695	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.0672	44.8154	44.5686	43.4092	43.1923	42.1825	42.1825	41.9955	42.5715	43.1923	43.6311	44.0899	(38)
Heat transfer coeff	103.8367	103.5849	103.3381	102.1787	101.9618	100.9520	100.9520	100.7650	101.3409	101.9618	102.4006	102.8593	(39)
Average = Sum(39)m / 12 =												102.1776	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1146	1.1119	1.1093	1.0968	1.0945	1.0836	1.0836	1.0816	1.0878	1.0945	1.0992	1.1041	(40)
HLP (average)												1.0968	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6666	(42)
Average daily hot water use (litres/day)	97.5306	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2836	103.3824	99.4812	95.5800	91.6787	87.7775	87.7775	91.6787	95.5800	99.4812	103.3824	107.2836	(44)
Energy conte	159.0985	139.1486	143.5889	125.1843	120.1173	103.6521	96.0489	110.2175	111.5338	129.9819	141.8855	154.0784	(45)
Energy content (annual)										Total = Sum(45)m =		1534.5357	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8648	20.8723	21.5383	18.7776	18.0176	15.5478	14.4073	16.5326	16.7301	19.4973	21.2828	23.1118	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6945	47.1353	46.7185	43.2875	44.7305	46.7185	47.1353	50.6945	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.9106	(64)
Heat gains from water heating, kWh/month													
	65.6400	57.7738	60.4169	53.4076	51.6186	45.2862	43.1189	48.3269	48.8688	55.8926	59.5057	63.9708	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	133.3275	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8167	20.2656	16.4811	12.4772	9.3269	7.8741	8.5083	11.0594	14.8439	18.8477	21.9981	23.4508	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.7727	247.3127	240.9120	227.2858	210.0851	193.9189	183.1189	180.5789	186.9796	200.6058	217.8065	233.9727	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	36.3328	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	-106.6620	(71)
Water heating gains (Table 5)													
	88.2258	85.9728	81.2056	74.1772	69.3799	62.8975	57.9555	64.9556	67.8734	75.1245	82.6468	85.9823	(72)
Total internal gains													
	421.8134	419.5493	404.5969	379.9385	354.7901	330.6888	315.5809	322.5921	335.6951	360.5763	388.4496	409.4040	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.0500	10.6334	0.6300	0.7000	0.7700	9.9116	(74)
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893	(76)
West	7.6600	19.6403	0.6300	0.7000	0.7700	45.9778	(80)

Solar gains	80.0787	156.2033	258.2369	381.3808	473.6808	488.1595	463.3750	393.4651	301.6046	185.4201	99.7174	65.9648	(83)
Total gains	501.8921	575.7527	662.8338	761.3193	828.4709	818.8483	778.9559	716.0572	637.2997	545.9964	488.1670	475.3688	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3040	62.4555	62.6047	63.3150	63.4497	64.0844	64.0844	64.2033	63.8384	63.4497	63.1778	62.8960	
alpha	5.1536	5.1637	5.1736	5.2210	5.2300	5.2723	5.2723	5.2802	5.2559	5.2300	5.2119	5.1931	
util living area													
	0.9988	0.9973	0.9917	0.9679	0.8904	0.7273	0.5572	0.6228	0.8764	0.9847	0.9975	0.9991	(86)
MIT	19.7492	19.8899	20.1458	20.4915	20.7856	20.9485	20.9896	20.9820	20.8565	20.4676	20.0472	19.7261	(87)
Th 2	19.9889	19.9911	19.9933	20.0034	20.0053	20.0142	20.0142	20.0159	20.0108	20.0053	20.0015	19.9975	(88)
util rest of house													
	0.9984	0.9964	0.9887	0.9553	0.8485	0.6389	0.4391	0.5017	0.8130	0.9767	0.9965	0.9988	(89)
MIT 2	18.3126	18.5198	18.8939	19.3962	19.7908	19.9792	20.0103	20.0082	19.8900	19.3703	18.7576	18.2850	(90)
Living area fraction										fLA = Living area / (4) =		0.2589	(91)
MIT	18.6845	18.8745	19.2180	19.6798	20.0483	20.2302	20.2638	20.2603	20.1403	19.6544	19.0915	18.6581	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6845	18.8745	19.2180	19.6798	20.0483	20.2302	20.2638	20.2603	20.1403	19.6544	19.0915	18.6581	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9948	0.9854	0.9501	0.8506	0.6597	0.4699	0.5331	0.8227	0.9728	0.9951	0.9982	(94)
Useful gains	500.6833	572.7744	653.1737	723.3191	704.7239	540.1563	366.0084	381.7454	524.3381	531.1281	485.7570	474.5021	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1493.6422	1447.5505	1314.2580	1101.4660	851.2124	568.3749	369.8726	388.9866	612.1259	923.2044	1227.9315	1487.1502	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	738.7614	587.8496	491.8467	272.2657	108.9875	0.0000	0.0000	0.0000	0.0000	291.7048	534.3656	753.4102	(98)
Space heating												3779.1915	(98)
Space heating per m2											(98) / (4) =	40.5667	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4046.2436	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	738.7614	587.8496	491.8467	272.2657	108.9875	0.0000	0.0000	0.0000	0.0000	291.7048	534.3656	753.4102	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	790.9651	629.3893	526.6025	291.5051	116.6889	0.0000	0.0000	0.0000	0.0000	312.3178	572.1259	806.6490	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.0574	185.1760	194.2834	172.3196	166.8358	146.9396	140.7793	156.9360	158.6692	180.6765	191.2005	205.0373	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9509	87.7559	87.2911	86.1978	84.0087	80.3000	80.3000	80.3000	80.3000	86.2507	87.4998	88.0313	(217)
Fuel for water heating, kWh/month													
	238.8348	211.0125	222.5695	199.9119	198.5934	182.9883	175.3167	195.4371	197.5955	209.4783	218.5153	232.9141	(219)
Water heating fuel used												2483.1675	(219)
Annual totals kWh/year													
Space heating fuel - main system												4046.2436	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												402.9494	(232)
Total delivered energy for all uses												7007.3604	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4046.2436	0.2160	873.9886	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2483.1675	0.2160	536.3642	(264)
Space and water heating			1410.3528	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	402.9494	0.5190	209.1307	(268)
Total CO2, kg/m2/year			1658.4085	(272)
Emissions per m2 for space and water heating			15.1390	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2449	(272b)
Emissions per m2 for pumps and fans			0.4178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1390 * 1.00) + 2.2449 + 0.4178, rounded to 2 d.p.			17.8000	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 301 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 301	**Prop Type Ref**	
Property	3 AW Semi, Plot 301, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.71	**TER**	17.80
Environmental	95 A	**% DER<TER**	56.69		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.36	**TFEE**	52.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.17		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.80	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	7.71	$kgCO_2/m^2$	Pass
	-10.09 (-56.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.47	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.36	$kWh/m^2/yr$	
	-11.1 (-21.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Continuous extract system (decentralised)			
Specific fan power			
Maximum	0.7		Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	3.05 m², No overhang 4.03 m², No overhang 7.66 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.023	W/m²K
Photovoltaic array	2.03	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

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Assessment Reference	Plot 301	**Prop Type Ref**	
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Environmental	95 A	**% DER<TER**	56.69		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.36	**TFEE**	52.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.17		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.33 m	46.58 m²	2.39 m
1st Storey:	19.33 m	46.58 m²	2.63 m

7.0 Living Area	24.12	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	189.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	96.84	79.98

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.31

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.58	46.58

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.14	46.58

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.41		1.00	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.83	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D2 (W10)	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.34	100
D1	Half Glazed Door	[1] External Wall	East							2.12	100
W7	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W9*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	12.70	0.052	No
Independently assessed	E3 Sill	10.11	0.004	No
Independently assessed	E4 Jamb	28.65	0.005	No
Independently assessed	E5 Ground floor (normal)	19.33	0.061	No
Independently assessed	E6 Intermediate floor within a dwelling	19.33	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.09	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.24	0.051	No
Independently assessed	E16 Corner (normal)	10.02	0.037	No
Independently assessed	E18 Party wall between dwellings	10.02	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.24	0.019	No
Independently assessed	P2 Party wall - Intermediate floor within a dwelling	9.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.24	0.037	No

Y-value	0.023	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18738	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	89.9	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.03	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 94	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 301 B2	**Issued on Date**	04/04/2025
Assessment Reference	Plot 301	**Prop Type Ref**	
Property	3 AW Semi, Plot 301, Boorley Gardens, Southampton, SO32		

SAP Rating	93 A	**DER**	7.71	**TER**	17.80
Environmental	95 A	**% DER<TER**	56.69		
CO_2 Emissions (t/year)	0.32	**DFEE**	41.36	**TFEE**	52.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.17		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.16	m^2	
DER	7.71	$kgCO_2/yr/m^2$	
TER	17.80	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.71	$kgCO_2/yr/m^2$	
Reduction DER/TER	56.69	%	
CfSH ENE1 credits achieved	6.0		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.36	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.16	m^2	
DER	18.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.67	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.67	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.93	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.96	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	27.46	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	27.46	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	23	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 355 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.69	**TER**	19.23
Environmental	88 B	**% DER<TER**	23.62		
CO_2 Emissions (t/year)	1.02	**DFEE**	57.98	**TFEE**	62.27
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.23 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.69 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)62.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)58.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.47 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.67 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 5.23 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 1.30 m², No overhang
Windows facing West: 7.18 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 0.98 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.4721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5116	0.5016	0.4916	0.4414	0.4314	0.3812	0.3812	0.3712	0.4013	0.4314	0.4514	0.4715	(22b)
Effective ac	0.6309	0.6258	0.6208	0.5974	0.5930	0.5727	0.5727	0.5689	0.5805	0.5930	0.6019	0.6112	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4172	51.9950	51.5811	49.6370	49.2732	47.5800	47.5800	47.2664	48.2322	49.2732	50.0091	50.7783	(38)
Heat transfer coeff	142.3789	141.9567	141.5428	139.5987	139.2349	137.5417	137.5417	137.2281	138.1939	139.2349	139.9708	140.7400	(39)
Average = Sum(39)m / 12 =												139.5969	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4615	1.4572	1.4529	1.4330	1.4292	1.4118	1.4118	1.4086	1.4185	1.4292	1.4368	1.4447	(40)
HLP (average)												1.4329	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	417.1807	415.0021	399.9443	375.5234	350.5213	326.5507	311.0480	317.3593	329.9595	354.6058	382.9520	404.4103	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	565.4384	694.1510	844.2198	1016.8358	1141.8775	1141.6719	1084.8348	976.4429	842.9520	680.7379	565.5792	527.9116	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5160	47.6573	47.7967	48.4623	48.5889	49.1871	49.1871	49.2995	48.9550	48.5889	48.3335	48.0693	
alpha	4.1677	4.1772	4.1864	4.2308	4.2393	4.2791	4.2791	4.2866	4.2637	4.2393	4.2222	4.2046	
util living area													
	0.9981	0.9952	0.9856	0.9500	0.8563	0.6933	0.5366	0.6074	0.8564	0.9780	0.9961	0.9986	(86)
MIT	19.3457	19.5441	19.8851	20.3370	20.7091	20.9184	20.9788	20.9648	20.7871	20.2823	19.7337	19.3190	(87)
Th 2	19.7165	19.7198	19.7230	19.7382	19.7410	19.7543	19.7543	19.7567	19.7491	19.7410	19.7353	19.7293	(88)
util rest of house													
	0.9974	0.9935	0.9801	0.9302	0.8011	0.5876	0.3951	0.4616	0.7777	0.9659	0.9945	0.9981	(89)
MIT 2	17.5372	17.8288	18.3257	18.9767	19.4657	19.7030	19.7473	19.7434	19.5807	18.9144	18.1168	17.5065	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	17.9048	18.1774	18.6426	19.2532	19.7185	19.9500	19.9976	19.9916	19.8259	19.1924	18.4454	17.8749	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9048	18.1774	18.6426	19.2532	19.7185	19.9500	19.9976	19.9916	19.8259	19.1924	18.4454	17.8749	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9902	0.9734	0.9204	0.7999	0.6057	0.4240	0.4911	0.7836	0.9584	0.9917	0.9968	(94)
Useful gains	563.0696	687.3538	821.7564	935.8683	913.4027	691.5577	459.9797	479.4862	660.5029	652.3868	560.9001	526.2453	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1937.0324	1884.8226	1718.7027	1445.2876	1116.4486	735.8482	467.3058	492.8722	791.2873	1196.3666	1588.0258	1924.6070	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1022.2283	804.6990	667.3280	366.7819	151.0661	0.0000	0.0000	0.0000	0.0000	404.7210	739.5306	1040.3811	(98)
Space heating												5196.7361	(98)
Space heating per m2											(98) / (4) =	53.3436	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5593.9032	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1022.2283	804.6990	667.3280	366.7819	151.0661	0.0000	0.0000	0.0000	0.0000	404.7210	739.5306	1040.3811	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1100.3534	866.1992	718.3294	394.8137	162.6116	0.0000	0.0000	0.0000	0.0000	435.6523	796.0501	1119.8935	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4228	89.3775	89.2722	89.0018	88.3712	86.7000	86.7000	86.7000	86.7000	89.0408	89.3288	89.4418	(217)
Fuel for water heating, kWh/month													
	193.2133	169.4422	175.9373	155.0941	150.8066	134.0367	125.5844	142.1462	143.2609	160.9120	173.4755	187.4858	(219)
Water heating fuel used												1911.3950	(219)
Annual totals kWh/year													
Space heating fuel - main system												5593.9032	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.98 * 1068 * 1.00) =										-837.3673		-837.3673	(233)
Total delivered energy for all uses												7139.8259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5593.9032	0.2160	1208.2831	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.3950	0.2160	412.8613	(264)
Space and water heating			1621.1444	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-837.3673	0.5190	-434.5936	(269)
Total CO2, kg/year			1431.4643	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.6900	ZC1
Total Floor Area	TFA	97.4200	
Assumed number of occupants	N	2.7143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3338	ZC2
CO2 emissions from cooking, equation (L16)		1.8902	ZC3
Total CO2 emissions		31.9140	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.9140	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3922	0.3844	0.3452	0.3373	0.2981	0.2981	0.2902	0.3138	0.3373	0.3530	0.3687	(22b)
Effective ac	0.5800	0.5769	0.5739	0.5596	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.1921	47.9339	47.6808	46.4921	46.2696	45.2343	45.2343	45.0426	45.6331	46.2696	46.7196	47.1900	(38)
Heat transfer coeff	127.5423	127.2841	127.0310	125.8422	125.6198	124.5845	124.5845	124.3928	124.9833	125.6198	126.0698	126.5401	(39)
Average = Sum(39)m / 12 =												125.8412	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3092	1.3065	1.3040	1.2917	1.2895	1.2788	1.2788	1.2769	1.2829	1.2895	1.2941	1.2989	(40)
HLP (average)												1.2917	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6837	47.2620	43.7911	45.2508	47.2620	47.6837	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (64)
								Total per year (kWh/year) = Sum(64)m =				2130.4990 (64)
Heat gains from water heating, kWh/month												
	66.2554	58.3120	61.0384	54.0289	52.2191	45.8130	43.6205	48.8892	49.4374	56.4615	60.0545	64.5668 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	89.0530	86.7738	82.0409	75.0402	70.1870	63.6292	58.6297	65.7112	68.6630	75.8891	83.4090	86.7833	(72)
Total internal gains													
	430.4164	428.2307	413.1638	388.1707	362.4878	337.8443	322.3490	329.3371	342.6228	367.8413	396.1910	417.6510	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
Northeast	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(75)
East	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	1.1700	46.7521	0.6300	0.7000	0.7700	16.7170	(78)
West	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(80)

Solar gains	116.6585	219.6404	349.5456	504.5533	622.5964	641.2941	608.7739	518.5325	403.6038	256.6016	143.7003	97.1802 (83)
Total gains	547.0750	647.8711	762.7095	892.7240	985.0843	979.1384	931.1229	847.8695	746.2266	624.4429	539.8913	514.8313 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0434	53.1510	53.2569	53.7600	53.8552	54.3027	54.3027	54.3864	54.1295	53.8552	53.6630	53.4635	
alpha	4.5362	4.5434	4.5505	4.5840	4.5903	4.6202	4.6202	4.6258	4.6086	4.5903	4.5775	4.5642	
util living area													
	0.9984	0.9963	0.9893	0.9623	0.8834	0.7288	0.5667	0.6349	0.8756	0.9821	0.9968	0.9988	(86)
MIT	19.5163	19.6842	19.9803	20.3764	20.7198	20.9212	20.9806	20.9681	20.8033	20.3483	19.8594	19.4873	(87)
Th 2	19.8336	19.8357	19.8377	19.8473	19.8491	19.8574	19.8574	19.8590	19.8542	19.8491	19.8455	19.8417	(88)
util rest of house													
	0.9979	0.9950	0.9853	0.9471	0.8365	0.6304	0.4305	0.4964	0.8062	0.9724	0.9955	0.9984	(89)
MIT 2	17.8642	18.1109	18.5428	19.1149	19.5742	19.8053	19.8506	19.8460	19.6921	19.0853	18.3742	17.8274	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2000	18.4306	18.8350	19.3713	19.8070	20.0321	20.0803	20.0741	19.9180	19.3420	18.6760	18.1648	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2000	18.4306	18.8350	19.3713	19.8070	20.0321	20.0803	20.0741	19.9180	19.3420	18.6760	18.1648	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9926	0.9803	0.9389	0.8345	0.6469	0.4583	0.5243	0.8109	0.9662	0.9933	0.9975	(94)
Useful gains	545.2463	643.0922	747.6481	838.2110	822.0528	633.3827	426.7107	444.5610	605.1158	603.3659	536.2895	513.5192	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1772.8315	1722.2347	1566.9236	1317.7298	1018.4040	676.7563	433.5856	457.0280	727.1502	1098.1708	1459.3886	1767.1030	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	913.3234	725.1838	609.5409	345.2535	146.0853	0.0000	0.0000	0.0000	0.0000	368.1349	664.6313	932.6664	(98)
Space heating												4704.8196	(98)
Space heating per m2											(98) / (4) =	48.2942	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5037.2800	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	913.3234	725.1838	609.5409	345.2535	146.0853	0.0000	0.0000	0.0000	0.0000	368.1349	664.6313	932.6664	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	977.8623	776.4280	652.6134	369.6504	156.4083	0.0000	0.0000	0.0000	0.0000	394.1487	711.5967	998.5721	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3082	88.1296	87.7134	86.7396	84.6901	80.3000	80.3000	80.3000	80.3000	86.7829	87.9131	88.3822	(217)
Fuel for water heating, kWh/month													
	239.9644	211.9547	223.7039	200.9743	199.2874	185.1171	177.3563	197.7107	199.8942	210.2408	219.3656	234.0174	(219)
Water heating fuel used												2499.5867	(219)
Annual totals kWh/year													
Space heating fuel - main system												5037.2800	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.4259	(232)
Total delivered energy for all uses												8010.2927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5037.2800	0.2160	1088.0525	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2499.5867	0.2160	539.9107	(264)
Space and water heating			1627.9632	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.4259	0.5190	206.7830	(268)
Total CO2, kg/m2/year			1873.6713	(272)
Emissions per m2 for space and water heating			16.7108	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1226	(272b)
Emissions per m2 for pumps and fans			0.3996	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7108 * 1.00) + 2.1226 + 0.3996, rounded to 2 d.p.			19.2300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.3927	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3338	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4255	0.4172	0.4089	0.3671	0.3588	0.3171	0.3171	0.3087	0.3338	0.3588	0.3755	0.3922	(22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5644	0.5503	0.5503	0.5477	0.5557	0.5644	0.5705	0.5769	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.0656	48.7735	48.4871	47.1422	46.8906	45.7193	45.7193	45.5023	46.1704	46.8906	47.3996	47.9318	(38)
Heat transfer coeff	139.0273	138.7352	138.4488	137.1039	136.8523	135.6810	135.6810	135.4640	136.1321	136.8523	137.3614	137.8935	(39)
Average = Sum(39)m / 12 =												137.1027	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4271	1.4241	1.4212	1.4073	1.4048	1.3927	1.3927	1.3905	1.3974	1.4048	1.4100	1.4155	(40)
HLP (average)												1.4073	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.2469	382.8934	369.5490	347.4597	323.9722	302.1328	288.4394	292.4302	304.2044	326.4377	352.0614	372.2982 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	532.5046	662.0423	813.8246	988.7721	1115.3285	1117.2540	1062.2262	951.5138	817.1968	652.5698	534.6886	495.7995	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.6615	48.7640	48.8648	49.3442	49.4349	49.8617	49.8617	49.9415	49.6964	49.4349	49.2517	49.0616	
alpha	4.2441	4.2509	4.2577	4.2896	4.2957	4.3241	4.3241	4.3294	4.3131	4.2957	4.2834	4.2708	
util living area	0.9985	0.9960	0.9872	0.9531	0.8605	0.6984	0.5407	0.6145	0.8636	0.9807	0.9969	0.9989	(86)
MIT	19.3572	19.5545	19.8938	20.3401	20.7117	20.9187	20.9790	20.9645	20.7846	20.2784	19.7332	19.3251	(87)
Th 2	19.7426	19.7449	19.7472	19.7577	19.7597	19.7689	19.7689	19.7706	19.7653	19.7597	19.7557	19.7515	(88)
util rest of house	0.9980	0.9945	0.9823	0.9344	0.8066	0.5937	0.3999	0.4693	0.7876	0.9700	0.9956	0.9985	(89)
MIT 2	18.2600	18.4584	18.7966	19.2377	19.5724	19.7338	19.7641	19.7613	19.6476	19.1880	18.6455	18.2348	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.4830	18.6812	19.0196	19.4617	19.8039	19.9746	20.0111	20.0058	19.8787	19.4096	18.8666	18.4564	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4830	18.6812	19.0196	19.4617	19.8039	19.9746	20.0111	20.0058	19.8787	19.4096	18.8666	18.4564	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9928	0.9784	0.9288	0.8089	0.6128	0.4289	0.4990	0.7960	0.9658	0.9941	0.9979	(94)
Useful gains	531.0011	657.2558	796.2277	918.3698	902.1509	684.5983	455.5378	474.8183	650.4998	630.2753	531.5475	494.7657	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1971.8292	1911.9394	1733.3292	1448.0567	1109.0398	729.2312	462.8153	488.4615	786.6647	1205.6167	1616.2765	1965.8634	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1071.9761	843.1474	697.2035	381.3746	153.9254	0.0000	0.0000	0.0000	0.0000	428.0540	781.0049	1094.4967	(98)
Space heating												5451.1825	(98)
Space heating per m2											(98) / (4) =	55.9555	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1275.4010	1004.0391	1029.5267	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8504	0.9089	0.8730	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1084.5766	912.5348	898.7764	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1409.4443	1342.8965	1215.2994	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	233.9048	320.1891	235.4931	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												789.5869 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.4762	80.0473	58.8733	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												197.3967 (107)
Space cooling per m2												2.0262 (108)
Energy for space heating												55.9555 (99)
Energy for space cooling												2.0262 (108)
Total												57.9817 (109)
Dwelling Fabric Energy Efficiency (DFEE)												58.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3922	0.3844	0.3452	0.3373	0.2981	0.2981	0.2902	0.3138	0.3373	0.3530	0.3687	(22b)
Effective ac	0.5800	0.5769	0.5739	0.5596	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.1921	47.9339	47.6808	46.4921	46.2696	45.2343	45.2343	45.0426	45.6331	46.2696	46.7196	47.1900	(38)
Heat transfer coeff	127.5423	127.2841	127.0310	125.8422	125.6198	124.5845	124.5845	124.3928	124.9833	125.6198	126.0698	126.5401	(39)
Average = Sum(39)m / 12 =												125.8412	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3092	1.3065	1.3040	1.2917	1.2895	1.2788	1.2788	1.2769	1.2829	1.2895	1.2941	1.2989	(40)
HLP (average)												1.2917	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.3336	382.9704	369.6116	347.5071	324.0076	302.1627	288.4717	292.4722	304.2607	326.5093	352.1450	372.3873 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
Northeast	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(75)
East	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	1.1700	46.7521	0.6300	0.7000	0.7700	16.7170	(78)
West	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(80)

Solar gains	116.6585	219.6404	349.5456	504.5533	622.5964	641.2941	608.7739	518.5325	403.6038	256.6016	143.7003	97.1802	(83)
Total gains	500.9921	602.6108	719.1573	852.0604	946.6041	943.4568	897.2457	811.0047	707.8645	583.1109	495.8453	469.5675	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0434	53.1510	53.2569	53.7600	53.8552	54.3027	54.3027	54.3864	54.1295	53.8552	53.6630	53.4635	
alpha	4.5362	4.5434	4.5505	4.5840	4.5903	4.6202	4.6202	4.6258	4.6086	4.5903	4.5775	4.5642	
util living area	0.9989	0.9973	0.9915	0.9680	0.8956	0.7468	0.5849	0.6574	0.8923	0.9862	0.9978	0.9992	(86)
MIT	19.4734	19.6425	19.9414	20.3441	20.6987	20.9126	20.9780	20.9632	20.7828	20.3124	19.8186	19.4451	(87)
Th 2	19.8336	19.8357	19.8377	19.8473	19.8491	19.8574	19.8574	19.8590	19.8542	19.8491	19.8455	19.8417	(88)
util rest of house	0.9985	0.9963	0.9882	0.9547	0.8517	0.6491	0.4459	0.5169	0.8282	0.9785	0.9968	0.9989	(89)
MIT 2	18.4462	18.6166	18.9154	19.3171	19.6446	19.8173	19.8520	19.8486	19.7291	19.2932	18.8004	18.4242	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.6550	18.8251	19.1239	19.5259	19.8589	20.0399	20.0809	20.0751	19.9432	19.5003	19.0073	18.6317	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6550	18.8251	19.1239	19.5259	19.8589	20.0399	20.0809	20.0751	19.9432	19.5003	19.0073	18.6317	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9855	0.9500	0.8521	0.6664	0.4745	0.5456	0.8343	0.9752	0.9958	0.9985	(94)
Useful gains	499.9730	599.6463	708.7181	809.4505	806.6293	628.6902	425.7405	442.5056	590.5585	568.6762	493.7561	468.8585	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1830.8644	1772.4398	1603.6274	1337.1833	1024.9142	677.7329	433.6630	457.1561	730.3075	1118.0590	1501.1524	1826.1893	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	990.1832	788.1172	665.8126	379.9676	162.4040	0.0000	0.0000	0.0000	0.0000	408.7408	725.3253	1009.8541	(98)
Space heating												5130.4048	(98)
Space heating per m2											(98) / (4) =	52.6627	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1171.0943	921.9253	945.3850	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8340	0.8996	0.8629	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	976.7365	829.3781	815.7522	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.3446	1150.1052	1051.1239	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	165.3178	238.6209	175.1165	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												579.0552 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	41.3295	59.6552	43.7791	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												144.7638 (107)
Space cooling per m2												1.4860 (108)
Energy for space heating												52.6627 (99)
Energy for space cooling												1.4860 (108)
Total												54.1487 (109)
Target Fabric Energy Efficiency (TFEE)												62.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.4721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4213	0.3912	0.4013	0.3812	0.3812	0.3712	0.3611	0.3511	0.3411	0.3712	0.3511	0.3712	(22b)
Effective ac	0.5888	0.5765	0.5805	0.5727	0.5727	0.5689	0.5652	0.5616	0.5582	0.5689	0.5616	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0662	(36)
Total fabric heat loss					(33) + (36) =		89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9179	47.9019	48.2322	47.5800	47.5800	47.2664	46.9612	46.6644	46.3759	47.2664	46.6644	47.2664	(38)
Heat transfer coeff	138.8796	137.8636	138.1939	137.5417	137.5417	137.2281	136.9229	136.6261	136.3376	137.2281	136.6261	137.2281	(39)
Average = Sum(39)m / 12 =												137.3515	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4256	1.4151	1.4185	1.4118	1.4118	1.4086	1.4055	1.4024	1.3995	1.4086	1.4024	1.4086	(40)
HLP (average)												1.4099	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143	(42)
Average daily hot water use (litres/day)	98.6652	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602 (64)
RHI water heating demand												1691 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539	(83)
Total gains	807.3078	916.5597	1076.2718	1259.1846	1342.2399	1405.7124	1332.1275	1230.6601	1083.4051	909.3990	801.1438	755.8682	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7133	49.0722	48.9550	49.1871	49.1871	49.2995	49.4094	49.5167	49.6215	49.2995	49.5167	49.2995	
alpha	4.2476	4.2715	4.2637	4.2791	4.2791	4.2866	4.2940	4.3011	4.3081	4.2866	4.3011	4.2866	
util living area													
	0.9915	0.9852	0.9619	0.8902	0.7508	0.5355	0.3961	0.4262	0.7075	0.9264	0.9823	0.9932	(86)
MIT	19.6823	19.8399	20.1733	20.5760	20.8515	20.9729	20.9941	20.9923	20.9148	20.5627	20.0758	19.6697	(87)
Th 2	19.7438	19.7517	19.7491	19.7543	19.7543	19.7567	19.7591	19.7615	19.7637	19.7567	19.7615	19.7567	(88)
util rest of house													
	0.9886	0.9801	0.9486	0.8535	0.6756	0.4280	0.2726	0.2944	0.6007	0.8916	0.9750	0.9908	(89)
MIT 2	18.0451	18.2781	18.7518	19.3019	19.6316	19.7434	19.7578	19.7596	19.7103	19.3037	18.6282	18.0359	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9734	0.9387	0.8467	0.6839	0.4493	0.2978	0.3214	0.6189	0.8846	0.9679	0.9867	(94)
Useful gains	794.2483	892.1930	1010.2989	1066.1974	917.9589	631.5559	396.7478	395.5123	670.4898	804.4404	775.4037	745.8407	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1871.8017	1832.9716	1663.9487	1383.7852	1014.9999	644.0525	398.3155	397.6044	716.4689	1119.7262	1505.9524	1834.4626	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.6997	632.2032	486.3155	228.6632	72.1985	0.0000	0.0000	0.0000	0.0000	234.5727	525.9950	809.9347	(98)
Space heating												3791.5825	(98)
RHI space heating demand												3792	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.4721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5116	0.5016	0.4916	0.4414	0.4314	0.3812	0.3812	0.3712	0.4013	0.4314	0.4514	0.4715	(22b)
Effective ac	0.6309	0.6258	0.6208	0.5974	0.5930	0.5727	0.5727	0.5689	0.5805	0.5930	0.6019	0.6112	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4172	51.9950	51.5811	49.6370	49.2732	47.5800	47.5800	47.2664	48.2322	49.2732	50.0091	50.7783	(38)
Heat transfer coeff	142.3789	141.9567	141.5428	139.5987	139.2349	137.5417	137.5417	137.2281	138.1939	139.2349	139.9708	140.7400	(39)
Average = Sum(39)m / 12 =												139.5969	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4615	1.4572	1.4529	1.4330	1.4292	1.4118	1.4118	1.4086	1.4185	1.4292	1.4368	1.4447	(40)
HLP (average)												1.4329	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013 (83)
Total gains	767.8838	894.1157	1035.3463	1195.1347	1306.7968	1296.2444	1234.8658	1128.9546	1004.3019	854.9154	753.1363	725.8156 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5160	47.6573	47.7967	48.4623	48.5889	49.1871	49.1871	49.2995	48.9550	48.5889	48.3335	48.0693	
alpha	4.1677	4.1772	4.1864	4.2308	4.2393	4.2791	4.2791	4.2866	4.2637	4.2393	4.2222	4.2046	
util living area													
	0.9939	0.9878	0.9709	0.9191	0.8054	0.6313	0.4780	0.5378	0.7884	0.9532	0.9888	0.9952	(86)
MIT	19.5271	19.7198	20.0433	20.4584	20.7776	20.9430	20.9863	20.9778	20.8514	20.4191	19.8998	19.4976	(87)
Th 2	19.7165	19.7198	19.7230	19.7382	19.7410	19.7543	19.7543	19.7567	19.7491	19.7410	19.7353	19.7293	(88)
util rest of house													
	0.9918	0.9837	0.9607	0.8907	0.7420	0.5274	0.3487	0.4028	0.6968	0.9306	0.9842	0.9935	(89)
MIT 2	17.8013	18.0828	18.5495	19.1360	19.5395	19.7201	19.7499	19.7488	19.6403	19.0999	18.3567	17.7668	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.1520	18.4155	18.8531	19.4047	19.7911	19.9687	20.0012	19.9986	19.8864	19.3680	18.6703	18.1185	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1520	18.4155	18.8531	19.4047	19.7911	19.9687	20.0012	19.9986	19.8864	19.3680	18.6703	18.1185	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9776	0.9513	0.8815	0.7448	0.5464	0.3751	0.4302	0.7083	0.9217	0.9785	0.9903	(94)
Useful gains	758.6144	874.0610	984.9362	1053.5161	973.3209	708.2711	463.2162	485.6969	711.3735	787.9775	736.9441	718.7472	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1972.2361	1918.6144	1748.4949	1466.4490	1126.5660	738.4158	467.8080	493.8240	799.6506	1220.8140	1619.5062	1958.8961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	902.9345	701.9399	568.0876	297.3117	114.0143	0.0000	0.0000	0.0000	0.0000	322.0303	635.4447	922.6708	(98)
Space heating												4464.4340	(98)
Space heating per m2											(98) / (4) =	45.8267	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4805.6340	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	902.9345	701.9399	568.0876	297.3117	114.0143	0.0000	0.0000	0.0000	0.0000	322.0303	635.4447	922.6708	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	971.9425	755.5866	611.5045	320.0341	122.7280	0.0000	0.0000	0.0000	0.0000	346.6419	684.0093	993.1871	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3702	89.3150	89.1870	88.8601	88.1466	86.7000	86.7000	86.7000	86.7000	88.8898	89.2541	89.3926	(217)
Fuel for water heating, kWh/month													
	193.3270	169.5608	176.1054	155.3414	151.1909	134.0367	125.5844	142.1462	143.2609	161.1853	173.6206	187.5890	(219)
Water heating fuel used												1912.9486	(219)
Annual totals kWh/year													
Space heating fuel - main system												4805.6340	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.98 * 1068 * 1.00) =										-837.3673		-837.3673	(233)
Total delivered energy for all uses												6353.1103	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4805.6340	3.4800	167.2361	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1912.9486	3.4800	66.5706	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-837.3673	13.1900	-110.4487	(252)
Total energy cost			305.6009	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9012	(257)
SAP value		87.4279	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4805.6340	0.2160	1038.0169	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.9486	0.2160	413.1969	(264)
Space and water heating			1451.2138	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-837.3673	0.5190	-434.5936	(269)
Total kg/year			1261.5337	(272)
CO2 emissions per m2			12.9500	(273)
EI value			88.1305	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8827 = 3.943, stars = 4
Water heating environmental impact	0.216 / 0.8827 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.4721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4213	0.3912	0.4013	0.3812	0.3812	0.3712	0.3611	0.3511	0.3411	0.3712	0.3511	0.3712	(22b)
Effective ac	0.5888	0.5765	0.5805	0.5727	0.5727	0.5689	0.5652	0.5616	0.5582	0.5689	0.5616	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9179	47.9019	48.2322	47.5800	47.5800	47.2664	46.9612	46.6644	46.3759	47.2664	46.6644	47.2664	(38)
Heat transfer coeff	138.8796	137.8636	138.1939	137.5417	137.5417	137.2281	136.9229	136.6261	136.3376	137.2281	136.6261	137.2281	(39)
Average = Sum(39)m / 12 =												137.3515	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4256	1.4151	1.4185	1.4118	1.4118	1.4086	1.4055	1.4024	1.3995	1.4086	1.4024	1.4086	(40)
HLP (average)												1.4099	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Total per year (kWh/year) = Sum(64)m =												1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539	(83)
Total gains	807.3078	916.5597	1076.2718	1259.1846	1342.2399	1405.7124	1332.1275	1230.6601	1083.4051	909.3990	801.1438	755.8682	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7133	49.0722	48.9550	49.1871	49.1871	49.2995	49.4094	49.5167	49.6215	49.2995	49.5167	49.2995	
alpha	4.2476	4.2715	4.2637	4.2791	4.2791	4.2866	4.2940	4.3011	4.3081	4.2866	4.3011	4.2866	
util living area													
	0.9915	0.9852	0.9619	0.8902	0.7508	0.5355	0.3961	0.4262	0.7075	0.9264	0.9823	0.9932	(86)
MIT	19.6823	19.8399	20.1733	20.5760	20.8515	20.9729	20.9941	20.9923	20.9148	20.5627	20.0758	19.6697	(87)
Th 2	19.7438	19.7517	19.7491	19.7543	19.7543	19.7567	19.7591	19.7615	19.7637	19.7567	19.7615	19.7567	(88)
util rest of house													
	0.9886	0.9801	0.9486	0.8535	0.6756	0.4280	0.2726	0.2944	0.6007	0.8916	0.9750	0.9908	(89)
MIT 2	18.0451	18.2781	18.7518	19.3019	19.6316	19.7434	19.7578	19.7596	19.7103	19.3037	18.6282	18.0359	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9734	0.9387	0.8467	0.6839	0.4493	0.2978	0.3214	0.6189	0.8846	0.9679	0.9867	(94)
Useful gains	794.2483	892.1930	1010.2989	1066.1974	917.9589	631.5559	396.7478	395.5123	670.4898	804.4404	775.4037	745.8407	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1871.8017	1832.9716	1663.9487	1383.7852	1014.9999	644.0525	398.3155	397.6044	716.4689	1119.7262	1505.9524	1834.4626	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	801.6997	632.2032	486.3155	228.6632	72.1985	0.0000	0.0000	0.0000	0.0000	234.5727	525.9950	809.9347	(98)
Space heating												3791.5825	(98)
Space heating per m2											(98) / (4) =	38.9200	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4081.3590	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	801.6997	632.2032	486.3155	228.6632	72.1985	0.0000	0.0000	0.0000	0.0000	234.5727	525.9950	809.9347	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	862.9706	680.5202	523.4827	246.1391	77.7163	0.0000	0.0000	0.0000	0.0000	252.5002	566.1949	871.8350	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3155	89.2633	89.0972	88.6681	87.7981	86.7000	86.7000	86.7000	86.7000	88.6592	89.1512	89.3344	(217)
Fuel for water heating, kWh/month													
	193.4454	169.6590	176.2829	155.6777	151.7910	134.0367	125.5844	142.1462	143.2609	161.6046	173.8211	187.7111	(219)
Water heating fuel used												1915.0210	(219)
Annual totals kWh/year													
Space heating fuel - main system												4081.3590	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.98 * 1187 * 1.00) =										-930.2459		-930.2459	(233)
Total delivered energy for all uses												5538.0290	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4081.3590	7.3800	301.2043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1915.0210	7.3800	141.3285	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-930.2459	28.6600	-266.6085	(252)
Total energy cost			418.1695	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4081.3590	0.2160	881.5735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.0210	0.2160	413.6445	(264)
Space and water heating			1295.2181	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-930.2459	0.5190	-482.7976	(269)
Total kg/year			1057.3340	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4081.3590	1.2200	4979.2579	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.0210	1.2200	2336.3256	(264)
Space and water heating			7315.5835	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-930.2459	3.0700	-2855.8548	(269)
Primary energy kWh/year			5908.4463	(272)
Primary energy kWh/m2/year			60.6492	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-193 kg (18.2%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£60	1.98 kg/m²	B 89	B 90
	Total Savings	£60	1.98 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£135	£150	-£14
Mains gas	£550	£475	£75
Space heating	£430	£430	£0
Water heating	£141	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£267	-£267	£0
Total cost of fuels	£418	£358	£61
Total cost of uses	£418	£358	£60
Delivered energy	57 kWh/m²	47 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	50 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1986	(8)
Pressure test			Yes	
Measured/design AP50			5.4700	
Infiltration rate			0.4721	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5116	0.5016	0.4916	0.4414	0.4314	0.3812	0.3812	0.3712	0.4013	0.4314	0.4514	0.4715	(22b)
Effective ac	0.6309	0.6258	0.6208	0.5974	0.5930	0.5727	0.5727	0.5689	0.5805	0.5930	0.6019	0.6112	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4172	51.9950	51.5811	49.6370	49.2732	47.5800	47.5800	47.2664	48.2322	49.2732	50.0091	50.7783	(38)
Heat transfer coeff	142.3789	141.9567	141.5428	139.5987	139.2349	137.5417	137.5417	137.2281	138.1939	139.2349	139.9708	140.7400	(39)
Average = Sum(39)m / 12 =												139.5969	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4615	1.4572	1.4529	1.4330	1.4292	1.4118	1.4118	1.4086	1.4185	1.4292	1.4368	1.4447	(40)
HLP (average)												1.4329	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1683	(H8)
Utilisation factor												0.5751	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-866.8465	(H17)
Solar input	-25.1368	-41.9461	-71.4391	-95.7424	-118.2817	-116.2897	-114.7529	-100.2602	-78.5238	-53.6225	-29.8159	-21.0352	(63)
								Solar input (sum of months) = Sum(63)m =				-866.8465	(63)
Output from w/h													
	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
								Total per year (kWh/year) = Sum(64)m =				830.1649	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	767.8838	894.1157	1035.3463	1195.1347	1306.7968	1296.2444	1234.8658	1128.9546	1004.3019	854.9154	753.1363	725.8156	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5160	47.6573	47.7967	48.4623	48.5889	49.1871	49.1871	49.2995	48.9550	48.5889	48.3335	48.0693	
alpha	4.1677	4.1772	4.1864	4.2308	4.2393	4.2791	4.2791	4.2866	4.2637	4.2393	4.2222	4.2046	
util living area													
	0.9939	0.9878	0.9709	0.9191	0.8054	0.6313	0.4780	0.5378	0.7884	0.9532	0.9888	0.9952	(86)
MIT	19.5271	19.7198	20.0433	20.4584	20.7776	20.9430	20.9863	20.9778	20.8514	20.4191	19.8998	19.4976	(87)
Th 2	19.7165	19.7198	19.7230	19.7382	19.7410	19.7543	19.7543	19.7567	19.7491	19.7410	19.7353	19.7293	(88)
util rest of house													
	0.9918	0.9837	0.9607	0.8907	0.7420	0.5274	0.3487	0.4028	0.6968	0.9306	0.9842	0.9935	(89)
MIT 2	17.8013	18.0828	18.5495	19.1360	19.5395	19.7201	19.7499	19.7488	19.6403	19.0999	18.3567	17.7668	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.1520	18.4155	18.8531	19.4047	19.7911	19.9687	20.0012	19.9986	19.8864	19.3680	18.6703	18.1185	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1520	18.4155	18.8531	19.4047	19.7911	19.9687	20.0012	19.9986	19.8864	19.3680	18.6703	18.1185	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9776	0.9513	0.8815	0.7448	0.5464	0.3751	0.4302	0.7083	0.9217	0.9785	0.9903	(94)
Useful gains	758.6144	874.0610	984.9362	1053.5161	973.3209	708.2711	463.2162	485.6969	711.3735	787.9775	736.9441	718.7472	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1972.2361	1918.6144	1748.4949	1466.4490	1126.5660	738.4158	467.8080	493.8240	799.6506	1220.8140	1619.5062	1958.8961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	902.9345	701.9399	568.0876	297.3117	114.0143	0.0000	0.0000	0.0000	0.0000	322.0303	635.4447	922.6708	(98)
Space heating												4464.4340	(98)
Space heating per m2											(98) / (4) =	45.8267	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4805.6340	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	902.9345	701.9399	568.0876	297.3117	114.0143	0.0000	0.0000	0.0000	0.0000	322.0303	635.4447	922.6708	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	971.9425	755.5866	611.5045	320.0341	122.7280	0.0000	0.0000	0.0000	0.0000	346.6419	684.0093	993.1871	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4361	89.4545	89.4675	89.4887	89.5161	86.7000	86.7000	86.7000	86.7000	89.1832	89.3573	89.4472	(217)
Fuel for water heating, kWh/month													
	165.0787	122.4054	95.7041	47.2619	16.7433	0.0000	0.0000	26.5058	52.6913	100.5288	140.0531	163.9575	(219)
Water heating fuel used												930.9300	(219)
Annual totals kWh/year													
Space heating fuel - main system												4805.6340	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.98 * 1068 * 1.00) =										-837.3673		-837.3673	(233)
Total delivered energy for all uses												5421.0917	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4805.6340	3.4800	167.2361	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	930.9300	3.4800	32.3964	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-837.3673	13.1900	-110.4487	(252)
Total energy cost			278.0216	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8199	(257)
SAP value	88.5625	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4805.6340	0.2160	1038.0169	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.9300	0.2160	201.0809 (264)
Space and water heating			1239.0978 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.8950	0.5190	205.9885 (268)
Energy saving/generation technologies			
PV Unit	-837.3673	0.5190	-434.5936 (269)
Total kg/year			1075.3677 (272)
CO2 emissions per m2			11.0400 (273)
EI value			89.8821
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.4700	
Infiltration rate		0.4721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4013	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4213	0.3912	0.4013	0.3812	0.3812	0.3712	0.3611	0.3511	0.3411	0.3712	0.3511	0.3712	(22b)
Effective ac	0.5888	0.5765	0.5805	0.5727	0.5727	0.5689	0.5652	0.5616	0.5582	0.5689	0.5616	0.5689	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0662	(36)
Total fabric heat loss					(33) + (36) =		89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9179	47.9019	48.2322	47.5800	47.5800	47.2664	46.9612	46.6644	46.3759	47.2664	46.6644	47.2664	(38)
Heat transfer coeff	138.8796	137.8636	138.1939	137.5417	137.5417	137.2281	136.9229	136.6261	136.3376	137.2281	136.6261	137.2281	(39)
Average = Sum(39)m / 12 =												137.3515	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4256	1.4151	1.4185	1.4118	1.4118	1.4086	1.4055	1.4024	1.3995	1.4086	1.4024	1.4086	(40)
HLP (average)												1.4099	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143	(42)
Average daily hot water use (litres/day)	98.6652	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3075 (H8)
Utilisation factor												0.5346 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6652 (H14)
Volume ratio Veff/V												0.7601 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-901.7521 (H17)
Solar input	-29.4173	-41.8296	-71.8950	-97.0030	-113.9358	-121.7015	-119.1421	-106.6358	-83.4884	-57.7210	-34.7930	-24.1896 (63)
								Solar input (sum of months) = Sum(63)m =				-901.7521 (63)
Output from w/h												
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010 (64)
								Total per year (kWh/year) = Sum(64)m =				805.0602 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539 (83)
Total gains	807.3078	916.5597	1076.2718	1259.1846	1342.2399	1405.7124	1332.1275	1230.6601	1083.4051	909.3990	801.1438	755.8682 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7133	49.0722	48.9550	49.1871	49.1871	49.2995	49.4094	49.5167	49.6215	49.2995	49.5167	49.2995	
alpha	4.2476	4.2715	4.2637	4.2791	4.2791	4.2866	4.2940	4.3011	4.3081	4.2866	4.3011	4.2866	
util living area													
	0.9915	0.9852	0.9619	0.8902	0.7508	0.5355	0.3961	0.4262	0.7075	0.9264	0.9823	0.9932	(86)
MIT	19.6823	19.8399	20.1733	20.5760	20.8515	20.9729	20.9941	20.9923	20.9148	20.5627	20.0758	19.6697	(87)
Th 2	19.7438	19.7517	19.7491	19.7543	19.7543	19.7567	19.7591	19.7615	19.7637	19.7567	19.7615	19.7567	(88)
util rest of house													
	0.9886	0.9801	0.9486	0.8535	0.6756	0.4280	0.2726	0.2944	0.6007	0.8916	0.9750	0.9908	(89)
MIT 2	18.0451	18.2781	18.7518	19.3019	19.6316	19.7434	19.7578	19.7596	19.7103	19.3037	18.6282	18.0359	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3779	18.5955	19.0407	19.5608	19.8796	19.9933	20.0090	20.0102	19.9551	19.5596	18.9224	18.3680	(93)

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8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9734	0.9387	0.8467	0.6839	0.4493	0.2978	0.3214	0.6189	0.8846	0.9679	0.9867	(94)
Useful gains	794.2483	892.1930	1010.2989	1066.1974	917.9589	631.5559	396.7478	395.5123	670.4898	804.4404	775.4037	745.8407	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1871.8017	1832.9716	1663.9487	1383.7852	1014.9999	644.0525	398.3155	397.6044	716.4689	1119.7262	1505.9524	1834.4626	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	801.6997	632.2032	486.3155	228.6632	72.1985	0.0000	0.0000	0.0000	0.0000	234.5727	525.9950	809.9347	(98)
Space heating												3791.5825	(98)
Space heating per m2											(98) / (4) =	38.9200	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4081.3590	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	801.6997	632.2032	486.3155	228.6632	72.1985	0.0000	0.0000	0.0000	0.0000	234.5727	525.9950	809.9347	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	862.9706	680.5202	523.4827	246.1391	77.7163	0.0000	0.0000	0.0000	0.0000	252.5002	566.1949	871.8350	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3995	89.4124	89.4082	89.3980	89.2046	86.7000	86.7000	86.7000	86.7000	89.0219	89.2871	89.4034	(217)
Fuel for water heating, kWh/month	160.3583	122.5934	95.2576	45.8998	21.6736	0.0000	0.0000	19.1523	46.9652	96.1070	134.5890	160.5097	(219)
Water heating fuel used												903.1057	(219)
Annual totals kWh/year													
Space heating fuel - main system												4081.3590	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.98 * 1187 * 1.00) =										-930.2459		-930.2459	(233)
Total delivered energy for all uses												4576.1138	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4081.3590	7.3800	301.2043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	903.1057	7.3800	66.6492	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-930.2459	28.6600	-266.6085	(252)
Total energy cost			357.8201	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4081.3590	0.2160	881.5735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.1057	0.2160	195.0708	(264)
Space and water heating			1076.6444	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-930.2459	0.5190	-482.7976	(269)
Total kg/year			864.7103	(272)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4081.3590	1.2200	4979.2579	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.1057	1.2200	1101.7890	(264)
Space and water heating			6081.0469	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-930.2459	3.0700	-2855.8548	(269)
Primary energy kWh/year			4827.4097	(272)
Primary energy kWh/m2/year			49.5526	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		664.69 (P1)
Transmission heat loss coefficient		89.96 (37)
Summer heat loss coefficient		754.65 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.6700	87.1704	0.7200	0.7000	0.8865	233.8013
North East	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
East	5.2300	125.2818	0.7200	0.7000	0.8865	263.4762
South East	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
South	1.3000	118.5567	0.7200	0.7000	0.8865	61.9757
West	7.1800	125.2818	0.7200	0.7000	0.8865	361.7130
total:						1016.6817

	Jun	Jul	Aug	
Solar gains	1097	1017	885	(P3)
Internal gains	478	458	467	
Total summer gains	1575	1475	1352	(P5)
Summer gain/loss ratio	2.09	1.95	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.74	19.50	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 355 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.69	**TER**	19.23
Environmental	88 B	**% DER<TER**	23.62		
CO_2 Emissions (t/year)	1.02	**DFEE**	57.98	**TFEE**	62.27
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.23	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.69	$kgCO_2/m^2$	Pass
	-4.54 (-23.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.27	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	57.98	$kWh/m^2/yr$	
	-4.3 (-6.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.67 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	5.23 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	1.30 m², No overhang
Windows facing West	7.18 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.98	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 356 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	4 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.49	**TER**	16.82
Environmental	90 B	**% DER<TER**	25.73		
CO_2 Emissions (t/year)	0.98	**DFEE**	46.32	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.54		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.49 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.95 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.13 m², No overhang
Windows facing East: 5.77 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	447.4692	445.0592	428.6678	402.1560	374.9242	349.0444	332.4925	339.1492	353.0155	379.7591	410.4269	433.7250	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	554.8088	655.0213	776.1068	914.0733	1008.5825	1000.8783	951.7357	866.5708	758.5631	629.1804	544.2224	522.0469	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9992	0.9980	0.9929	0.9692	0.8905	0.7276	0.5583	0.6289	0.8849	0.9877	0.9983	0.9994	(86)
MIT	19.6921	19.8419	20.1122	20.4736	20.7797	20.9463	20.9889	20.9803	20.8440	20.4314	19.9941	19.6654	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9989	0.9972	0.9902	0.9570	0.8484	0.6382	0.4386	0.5057	0.8233	0.9810	0.9976	0.9992	(89)
MIT 2	18.2229	18.4432	18.8384	19.3623	19.7732	19.9641	19.9963	19.9934	19.8651	19.3102	18.6721	18.1888	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4542	18.6635	19.0390	19.5374	19.9317	20.1188	20.1527	20.1488	20.0193	19.4868	18.8803	18.4214	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4542	18.6635	19.0390	19.5374	19.9317	20.1188	20.1527	20.1488	20.0193	19.4868	18.8803	18.4214	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9958	0.9866	0.9499	0.8454	0.6496	0.4574	0.5248	0.8249	0.9762	0.9963	0.9987	(94)
Useful gains	553.8526	652.2614	765.6954	868.2512	852.6507	650.2117	435.3355	454.7971	625.7132	614.1979	542.2113	521.3873	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1791.2494	1738.4223	1580.7395	1328.9898	1026.6943	682.8952	439.6090	463.1991	734.6978	1108.4000	1474.3290	1786.1948	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	920.6232	729.9001	606.3928	331.7318	129.4884	0.0000	0.0000	0.0000	0.0000	367.6864	671.1247	941.0168	(98)
Space heating												4697.9643	(98)
Space heating per m2											(98) / (4) =	41.7783	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5057.0121	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	920.6232	729.9001	606.3928	331.7318	129.4884	0.0000	0.0000	0.0000	0.0000	367.6864	671.1247	941.0168	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	990.9830	785.6837	652.7372	357.0848	139.3847	0.0000	0.0000	0.0000	0.0000	395.7872	722.4163	1012.9352	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3675	89.3215	89.2089	88.9184	88.2280	86.7000	86.7000	86.7000	86.7000	88.9625	89.2691	89.3901	(217)
Fuel for water heating, kWh/month	198.3350	173.9267	180.5880	159.2070	154.8902	137.4107	128.7145	145.7334	146.8899	165.1650	178.0600	192.4383	(219)
Water heating fuel used												1961.3588	(219)
Annual totals kWh/year													
Space heating fuel - main system												5057.0121	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6803.8175	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5057.0121	0.2160	1092.3146	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.3588	0.2160	423.6535	(264)
Space and water heating			1515.9681	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1404.6149	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.4900	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.6453	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6453	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3883	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	554.5280	641.9153	745.8218	863.1260	941.7305	931.0687	886.0052	813.0034	720.9193	611.1547	540.6412	524.1460	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9992	0.9981	0.9939	0.9742	0.9055	0.7495	0.5779	0.6455	0.8942	0.9887	0.9983	0.9994	(86)
MIT	19.7320	19.8712	20.1255	20.4721	20.7712	20.9435	20.9885	20.9801	20.8449	20.4482	20.0298	19.7114	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9990	0.9975	0.9916	0.9638	0.8676	0.6629	0.4586	0.5241	0.8364	0.9826	0.9976	0.9992	(89)
MIT 2	18.2986	18.5040	18.8764	19.3829	19.7892	19.9927	20.0275	20.0250	19.8940	19.3559	18.7443	18.2752	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9884	0.9572	0.8639	0.6737	0.4774	0.5429	0.8375	0.9781	0.9965	0.9988	(94)
Useful gains	553.5998	639.4614	737.1881	826.2108	813.5939	627.2333	422.9359	441.3901	603.7916	597.7949	538.7262	523.4952	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1752.3267	1697.8911	1540.7374	1289.5153	995.4331	661.9473	427.4293	449.9845	712.8900	1078.0337	1437.2521	1743.6004	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating												4581.8205	(98)
Space heating per m2											(98) / (4) =	40.7454	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4905.5894	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	954.8745	761.5254	640.0864	357.1512	144.8484	0.0000	0.0000	0.0000	0.0000	382.5457	692.6538	971.9039	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2335	88.0585	87.6346	86.5947	84.4340	80.3000	80.3000	80.3000	80.3000	86.6671	87.8234	88.3042	(217)
Fuel for water heating, kWh/month													
	245.1925	216.5291	228.4708	206.8559	205.3979	190.2164	182.2418	203.1569	205.4005	214.7011	224.0917	239.0864	(219)
Water heating fuel used												2561.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4905.5894	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												8003.0432	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4905.5894	0.2160	1059.6073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2561.3409	0.2160	553.2496	(264)
Space and water heating			1612.8569	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1891.0995	(272)
Emissions per m2 for space and water heating			14.3429	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3429 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.8200	(273)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	521.1475	622.2079	745.0541	885.4146	981.4803	975.9661	928.6829	841.1334	732.2766	600.4162	512.6607	489.2300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9994	0.9984	0.9940	0.9729	0.8993	0.7405	0.5707	0.6446	0.8965	0.9899	0.9987	0.9996	(86)
MIT	19.6639	19.8147	20.0871	20.4530	20.7666	20.9417	20.9878	20.9779	20.8316	20.4087	19.9678	19.6379	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9992	0.9978	0.9918	0.9619	0.8592	0.6515	0.4490	0.5199	0.8384	0.9844	0.9982	0.9994	(89)
MIT 2	18.7523	18.9042	19.1769	19.5426	19.8326	19.9732	19.9973	19.9953	19.8983	19.5049	19.0640	18.7318	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8958	19.0476	19.3202	19.6860	19.9797	20.1257	20.1533	20.1501	20.0453	19.6472	19.2064	18.8745	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8958	19.0476	19.3202	19.6860	19.9797	20.1257	20.1533	20.1501	20.0453	19.6472	19.2064	18.8745	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9971	0.9898	0.9577	0.8586	0.6636	0.4683	0.5395	0.8418	0.9817	0.9975	0.9992	(94)
Useful gains	520.5681	620.3794	737.4253	847.9357	842.6618	647.6967	434.9268	453.8217	616.4071	589.4569	511.3939	488.8391	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1847.1330	1786.9349	1616.1952	1347.5572	1032.6798	683.7549	439.6900	463.3512	737.9268	1128.4114	1515.1401	1843.1109	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	986.9643	783.9253	653.8048	359.7275	141.3734	0.0000	0.0000	0.0000	0.0000	400.9821	722.6973	1007.5782	(98)
Space heating												5057.0530	(98)
Space heating per m2											(98) / (4) =	44.9716	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1163.1604	915.6795	939.0424	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8657	0.9260	0.8940	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.9987	847.9554	839.5351	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.1346	1186.9154	1088.1383	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	170.7378	252.1863	184.9608	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												607.8849	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.6845	63.0466	46.2402	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												151.9712	(107)
Space cooling per m2												1.3515	(108)
Energy for space heating												44.9716	(99)
Energy for space cooling												1.3515	(108)
Total												46.3230	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.3	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	507.7301	595.9626	701.6242	821.4249	902.2730	894.4869	851.2775	775.2057	681.5832	569.2385	495.9363	478.1897	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9995	0.9987	0.9954	0.9790	0.9179	0.7698	0.5986	0.6710	0.9116	0.9918	0.9989	0.9996	(86)
MIT	19.6926	19.8328	20.0893	20.4410	20.7503	20.9357	20.9865	20.9761	20.8251	20.4146	19.9923	19.6727	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9993	0.9982	0.9936	0.9702	0.8832	0.6843	0.4765	0.5476	0.8595	0.9872	0.9984	0.9995	(89)
MIT 2	18.8005	18.9424	19.2000	19.5555	19.8461	20.0008	20.0283	20.0264	19.9220	19.5347	19.1110	18.7880	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9976	0.9920	0.9665	0.8818	0.6956	0.4958	0.5670	0.8619	0.9849	0.9979	0.9993	(94)
Useful gains	507.2456	594.5382	695.9795	793.8985	795.5833	622.2210	422.0985	439.5297	587.4679	560.6556	494.9020	477.8608	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1803.6554	1742.5359	1573.4446	1306.5312	1000.8253	662.6183	427.4721	450.0522	715.3501	1095.5787	1474.0173	1795.5337	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	964.5289	771.4545	652.8340	369.0955	152.7000	0.0000	0.0000	0.0000	0.0000	397.9828	704.9631	980.3486	(98)
Space heating												4993.9073	(98)
Space heating per m2											(98) / (4) =	44.4100	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8527	0.9184	0.8857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	957.2878	811.6788	802.2743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9818	1097.4674	1011.9431	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	138.7397	212.6267	155.9936	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												507.3600	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.6849	53.1567	38.9984	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												126.8400	(107)
Space cooling per m2												1.1280	(108)
Energy for space heating												44.4100	(99)
Energy for space cooling												1.1280	(108)
Total												45.5380	(109)
Target Fabric Energy Efficiency (TFEE)												52.4	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				3.9500	
Infiltration rate				0.3358	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
								Total per year (kWh/year) = Sum(64)m =				1734.2653	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6784	891.8836	1018.0347	1159.3776	1214.7907	1254.2244	1190.7436	1113.2131	998.0339	862.7809	785.7136	760.7001	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9947	0.9906	0.9733	0.9114	0.7730	0.5490	0.4020	0.4286	0.7184	0.9398	0.9879	0.9958	(86)
MIT	19.9871	20.1051	20.3709	20.6913	20.9050	20.9868	20.9979	20.9971	20.9509	20.6836	20.2933	19.9719	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9929	0.9874	0.9642	0.8827	0.7093	0.4587	0.3004	0.3209	0.6277	0.9126	0.9831	0.9943	(89)
MIT 2	18.6638	18.8380	19.2184	19.6598	19.9185	19.9948	20.0025	20.0036	19.9730	19.6617	19.1161	18.6470	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9571	0.8766	0.7144	0.4725	0.3165	0.3379	0.6396	0.9065	0.9783	0.9919	(94)
Useful gains	797.5943	876.8955	974.3897	1016.3345	867.8772	592.6530	376.8155	376.1519	638.3398	782.1161	768.6274	754.5023	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1739.7969	1702.4579	1539.0773	1277.2806	937.1954	599.3847	377.4572	377.0234	667.7413	1040.6893	1404.7620	1711.9821	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.9987	554.7779	420.1276	187.8812	51.5727	0.0000	0.0000	0.0000	0.0000	192.3784	458.0169	712.3649	(98)
Space heating												3278.1184	(98)
RHI space heating demand												3278	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3816	872.6208	983.6679	1107.2207	1186.8030	1167.6584	1113.6274	1031.4359	933.4665	818.4976	748.4664	737.7313	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9962	0.9925	0.9803	0.9373	0.8283	0.6465	0.4828	0.5397	0.8004	0.9638	0.9926	0.9971	(86)
MIT	19.8750	20.0202	20.2749	20.6013	20.8511	20.9688	20.9943	20.9901	20.9080	20.5723	20.1619	19.8451	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9950	0.9900	0.9736	0.9159	0.7755	0.5585	0.3764	0.4284	0.7227	0.9471	0.9897	0.9961	(89)
MIT 2	18.4898	18.7022	19.0710	19.5339	19.8528	19.9806	19.9985	19.9979	19.9269	19.5049	18.9158	18.4512	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7080	18.9098	19.2606	19.7020	20.0100	20.1362	20.1553	20.1542	20.0814	19.6730	19.1120	18.6707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7080	18.9098	19.2606	19.7020	20.0100	20.1362	20.1553	20.1542	20.0814	19.6730	19.1120	18.6707	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9863	0.9672	0.9084	0.7765	0.5710	0.3931	0.4459	0.7300	0.9401	0.9861	0.9942	(94)
Useful gains	769.7282	860.6271	951.4340	1005.7902	921.5027	666.7637	437.8152	459.8714	681.3902	769.4877	738.0397	733.4772	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1823.3626	1769.5251	1608.6835	1349.5611	1036.4670	685.0536	439.9343	463.8585	742.4105	1131.6234	1503.3332	1817.5152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	783.9040	610.7795	488.9936	247.5151	85.5334	0.0000	0.0000	0.0000	0.0000	269.4290	551.0113	806.5243	(98)
Space heating												3843.6902	(98)
Space heating per m2											(98) / (4) =	34.1813	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4137.4491	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	783.9040	610.7795	488.9936	247.5151	85.5334	0.0000	0.0000	0.0000	0.0000	269.4290	551.0113	806.5243	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	843.8148	657.4591	526.3656	266.4317	92.0704	0.0000	0.0000	0.0000	0.0000	290.0204	593.1231	868.1639	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2922	89.2322	89.0852	88.7087	87.9045	86.7000	86.7000	86.7000	86.7000	88.7441	89.1632	89.3205	(217)
Fuel for water heating, kWh/month													
	198.5021	174.1007	180.8388	159.5833	155.4601	137.4107	128.7145	145.7334	146.8899	165.5715	178.2714	192.5883	(219)
Water heating fuel used												1963.6647	(219)
Annual totals kWh/year													
Space heating fuel - main system												4137.4491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5886.5603	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4137.4491	3.4800	143.9832	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.6647	3.4800	68.3355	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			304.0192	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8110	(257)
SAP value		88.6869	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4137.4491	0.2160	893.6890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.6647	0.2160	424.1516	(264)
Space and water heating			1317.8406	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1206.4873	(272)
CO2 emissions per m2			10.7300	(273)
EI value			89.7320	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact                          0.216 / 0.8819 = 0.2449, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6784	891.8836	1018.0347	1159.3776	1214.7907	1254.2244	1190.7436	1113.2131	998.0339	862.7809	785.7136	760.7001	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9947	0.9906	0.9733	0.9114	0.7730	0.5490	0.4020	0.4286	0.7184	0.9398	0.9879	0.9958	(86)
MIT	19.9871	20.1051	20.3709	20.6913	20.9050	20.9868	20.9979	20.9971	20.9509	20.6836	20.2933	19.9719	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9929	0.9874	0.9642	0.8827	0.7093	0.4587	0.3004	0.3209	0.6277	0.9126	0.9831	0.9943	(89)
MIT 2	18.6638	18.8380	19.2184	19.6598	19.9185	19.9948	20.0025	20.0036	19.9730	19.6617	19.1161	18.6470	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9571	0.8766	0.7144	0.4725	0.3165	0.3379	0.6396	0.9065	0.9783	0.9919	(94)
Useful gains	797.5943	876.8955	974.3897	1016.3345	867.8772	592.6530	376.8155	376.1519	638.3398	782.1161	768.6274	754.5023	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1739.7969	1702.4579	1539.0773	1277.2806	937.1954	599.3847	377.4572	377.0234	667.7413	1040.6893	1404.7620	1711.9821	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.9987	554.7779	420.1276	187.8812	51.5727	0.0000	0.0000	0.0000	0.0000	192.3784	458.0169	712.3649	(98)
Space heating												3278.1184	(98)
Space heating per m2											(98) / (4) =	29.1518	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3528.6527	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.9987	554.7779	420.1276	187.8812	51.5727	0.0000	0.0000	0.0000	0.0000	192.3784	458.0169	712.3649	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	754.5734	597.1775	452.2364	202.2402	55.5142	0.0000	0.0000	0.0000	0.0000	207.0812	493.0215	766.8083	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2353	89.1799	88.9896	88.4965	87.5539	86.7000	86.7000	86.7000	86.7000	88.4857	89.0532	89.2592	(217)
Fuel for water heating, kWh/month													
	198.6288	174.2027	181.0330	159.9661	156.0826	137.4107	128.7145	145.7334	146.8899	166.0549	178.4916	192.7205	(219)
Water heating fuel used												1965.9288	(219)
Annual totals kWh/year													
Space heating fuel - main system												3528.6527	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5179.9193	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3528.6527	7.3800	260.4146	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1965.9288	7.3800	145.0855	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			422.3179	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3528.6527	0.2160	762.1890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.9288	0.2160	424.6406	(264)
Space and water heating			1186.8296	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1023.5199	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3528.6527	1.2200	4304.9563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.9288	1.2200	2398.4331	(264)
Space and water heating			6703.3895	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5737.3764 (272)
Primary energy kWh/m2/year 51.0216 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.75 kg/m²	B 90	B 91
Total Savings	£62	1.75 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£513	£437	£76
Space heating	£389	£389	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£423	£361	£62
Total cost of uses	£422	£360	£62
Delivered energy	46 kWh/m²	37 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	41 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.8245	112.9309	88.8495	44.7337	17.0304	1.5237	0.0000	24.9512	47.9372	92.7029	128.7977	150.7465	(64)
								Total per year (kWh/year) = Sum(64)m =				862.0282	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3816	872.6208	983.6679	1107.2207	1186.8030	1167.6584	1113.6274	1031.4359	933.4665	818.4976	748.4664	737.7313	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9962	0.9925	0.9803	0.9373	0.8283	0.6465	0.4828	0.5397	0.8004	0.9638	0.9926	0.9971	(86)
MIT	19.8750	20.0202	20.2749	20.6013	20.8511	20.9688	20.9943	20.9901	20.9080	20.5723	20.1619	19.8451	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9950	0.9900	0.9736	0.9159	0.7755	0.5585	0.3764	0.4284	0.7227	0.9471	0.9897	0.9961	(89)
MIT 2	18.4898	18.7022	19.0710	19.5339	19.8528	19.9806	19.9985	19.9979	19.9269	19.5049	18.9158	18.4512	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7080	18.9098	19.2606	19.7020	20.0100	20.1362	20.1553	20.1542	20.0814	19.6730	19.1120	18.6707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7080	18.9098	19.2606	19.7020	20.0100	20.1362	20.1553	20.1542	20.0814	19.6730	19.1120	18.6707	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9863	0.9672	0.9084	0.7765	0.5710	0.3931	0.4459	0.7300	0.9401	0.9861	0.9942	(94)
Useful gains	769.7282	860.6271	951.4340	1005.7902	921.5027	666.7637	437.8152	459.8714	681.3902	769.4877	738.0397	733.4772	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1823.3626	1769.5251	1608.6835	1349.5611	1036.4670	685.0536	439.9343	463.8585	742.4105	1131.6234	1503.3332	1817.5152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	783.9040	610.7795	488.9936	247.5151	85.5334	0.0000	0.0000	0.0000	0.0000	269.4290	551.0113	806.5243	(98)
Space heating												3843.6902	(98)
Space heating per m2											(98) / (4) =	34.1813	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4137.4491	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	783.9040	610.7795	488.9936	247.5151	85.5334	0.0000	0.0000	0.0000	0.0000	269.4290	551.0113	806.5243	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	843.8148	657.4591	526.3656	266.4317	92.0704	0.0000	0.0000	0.0000	0.0000	290.0204	593.1231	868.1639	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	151.8245	112.9309	88.8495	44.7337	17.0304	1.5237	0.0000	24.9512	47.9372	92.7029	128.7977	150.7465	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3648	89.3852	89.3927	89.3950	89.3524	86.7000	86.7000	86.7000	86.7000	89.0585	89.2757	89.3805	(217)
Fuel for water heating, kWh/month													
	169.8929	126.3419	99.3924	50.0405	19.0598	1.7574	0.0000	28.7787	55.2909	104.0921	144.2696	168.6570	(219)
Water heating fuel used												967.5733	(219)
Annual totals kWh/year													
Space heating fuel - main system												4137.4491	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4940.4689	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4137.4491	3.4800	143.9832	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.5733	3.4800	33.6715	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			275.9502	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7361	(257)
SAP value	89.7314	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4137.4491	0.2160	893.6890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.5733	0.2160	208.9958	(264)
Space and water heating			1102.6848	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1017.2816	(272)
CO2 emissions per m2			9.0500	(273)
EI value			91.3423	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2724	(H8)
Utilisation factor												0.5443	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-912.8396	(H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870	(63)
										Solar input (sum of months) = Sum(63)m =		-912.8396	(63)
Output from w/h													
	147.4680	113.0099	88.3216	43.3686	21.3197	0.0000	0.0000	18.4040	42.8386	88.5042	123.7317	147.5338	(64)
										Total per year (kWh/year) = Sum(64)m =		834.4999	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6784	891.8836	1018.0347	1159.3776	1214.7907	1254.2244	1190.7436	1113.2131	998.0339	862.7809	785.7136	760.7001	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9947	0.9906	0.9733	0.9114	0.7730	0.5490	0.4020	0.4286	0.7184	0.9398	0.9879	0.9958	(86)
MIT	19.9871	20.1051	20.3709	20.6913	20.9050	20.9868	20.9979	20.9971	20.9509	20.6836	20.2933	19.9719	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9929	0.9874	0.9642	0.8827	0.7093	0.4587	0.3004	0.3209	0.6277	0.9126	0.9831	0.9943	(89)
MIT 2	18.6638	18.8380	19.2184	19.6598	19.9185	19.9948	20.0025	20.0036	19.9730	19.6617	19.1161	18.6470	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8722	19.0375	19.4000	19.8223	20.0739	20.1510	20.1593	20.1600	20.1270	19.8227	19.3015	18.8557	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9571	0.8766	0.7144	0.4725	0.3165	0.3379	0.6396	0.9065	0.9783	0.9919	(94)
Useful gains	797.5943	876.8955	974.3897	1016.3345	867.8772	592.6530	376.8155	376.1519	638.3398	782.1161	768.6274	754.5023	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1739.7969	1702.4579	1539.0773	1277.2806	937.1954	599.3847	377.4572	377.0234	667.7413	1040.6893	1404.7620	1711.9821	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.9987	554.7779	420.1276	187.8812	51.5727	0.0000	0.0000	0.0000	0.0000	192.3784	458.0169	712.3649	(98)
Space heating												3278.1184	(98)
Space heating per m2											(98) / (4) =	29.1518	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3528.6527	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.9987	554.7779	420.1276	187.8812	51.5727	0.0000	0.0000	0.0000	0.0000	192.3784	458.0169	712.3649	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	754.5734	597.1775	452.2364	202.2402	55.5142	0.0000	0.0000	0.0000	0.0000	207.0812	493.0215	766.8083	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.4680	113.0099	88.3216	43.3686	21.3197	0.0000	0.0000	18.4040	42.8386	88.5042	123.7317	147.5338	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3270	89.3420	89.3273	89.2820	88.9399	86.7000	86.7000	86.7000	86.7000	88.8665	89.1998	89.3343	(217)
Fuel for water heating, kWh/month													
	165.0878	126.4914	98.8741	48.5748	23.9709	0.0000	0.0000	21.2272	49.4101	99.5923	138.7131	165.1480	(219)
Water heating fuel used												937.0897	(219)
Annual totals kWh/year													
Space heating fuel - main system												3528.6527	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4201.0802	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3528.6527	7.3800	260.4146	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	937.0897	7.3800	69.1572	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			360.7196	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3528.6527	0.2160	762.1890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0897	0.2160	202.4114	(264)
Space and water heating			964.6004	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			827.2407	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3528.6527	1.2200	4304.9563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0897	1.2200	1143.2494	(264)
Space and water heating			5448.2058	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4635.6927	(272)
Primary energy kWh/m2/year			41.2245	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	763.75	(P1)
Transmission heat loss coefficient	72.50	(37)
Summer heat loss coefficient	836.25	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1300	87.1704	0.7200	0.7000	0.7650	64.4293
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						693.3731

	Jun	Jul	Aug	
Solar gains	747	693	605	(P3)
Internal gains	513	491	501	
Total summer gains	1260	1185	1106	(P5)
Summer gain/loss ratio	1.51	1.42	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 356 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	4 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.49	**TER**	16.82
Environmental	90 B	**% DER<TER**	25.73		
CO_2 Emissions (t/year)	0.98	**DFEE**	46.32	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.54		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.49	$kgCO_2/m^2$	Pass
	-4.33 (-25.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.32	$kWh/m^2/yr$	
	-6.1 (-11.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Potterton ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.13 m², No overhang 5.77 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	4.0	m³/m²h
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 357 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Goldcrest Road, Boorley Green, Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.10	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.85		
CO_2 Emissions (t/year)	0.94	**DFEE**	44.63	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.10 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.50 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 5.77 m², No overhang
Windows facing South: 2.13 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.5 m³/m²h
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.5000	
Infiltration rate			0.3133	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3395	0.3328	0.3262	0.2929	0.2862	0.2530	0.2530	0.2463	0.2663	0.2862	0.2996	0.3129	(22b)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5355	0.5410	0.5449	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2363	53.0227	52.8133	51.8297	51.6456	50.7889	50.7889	50.6303	51.1189	51.6456	52.0179	52.4071	(38)
Heat transfer coeff	125.7333	125.5197	125.3103	124.3267	124.1426	123.2859	123.2859	123.1273	123.6159	124.1426	124.5149	124.9041	(39)
Average = Sum(39)m / 12 =												124.3258	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1181	1.1162	1.1144	1.1056	1.1040	1.0964	1.0964	1.0950	1.0993	1.1040	1.1073	1.1108	(40)
HLP (average)												1.1056	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	581.6691	696.8560	822.9682	954.8093	1038.4460	1023.6051	976.5254	900.5207	803.4645	672.6141	575.6810	545.4962	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1078	62.2136	62.3175	62.8106	62.9037	63.3408	63.3408	63.4224	63.1717	62.9037	62.7156	62.5202	
alpha	5.1405	5.1476	5.1545	5.1874	5.1936	5.2227	5.2227	5.2282	5.2114	5.1936	5.1810	5.1680	
util living area													
	0.9990	0.9973	0.9907	0.9632	0.8795	0.7143	0.5437	0.6071	0.8630	0.9835	0.9978	0.9993	(86)
MIT	19.7242	19.8858	20.1579	20.5077	20.7968	20.9512	20.9903	20.9834	20.8655	20.4698	20.0267	19.6934	(87)
Th 2	19.9861	19.9876	19.9891	19.9962	19.9976	20.0038	20.0038	20.0050	20.0014	19.9976	19.9949	19.9921	(88)
util rest of house													
	0.9987	0.9963	0.9873	0.9491	0.8351	0.6249	0.4267	0.4866	0.7959	0.9749	0.9968	0.9991	(89)
MIT 2	18.2741	18.5112	18.9083	19.4126	19.7967	19.9710	20.0002	19.9980	19.8903	19.3674	18.7229	18.2333	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.5025	18.7277	19.1051	19.5850	19.9542	20.1254	20.1561	20.1532	20.0439	19.5410	18.9282	18.4632	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5025	18.7277	19.1051	19.5850	19.9542	20.1254	20.1561	20.1532	20.0439	19.5410	18.9282	18.4632	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9945	0.9831	0.9417	0.8329	0.6367	0.4452	0.5054	0.7993	0.9694	0.9953	0.9985	(94)
Useful gains	580.4394	693.0390	809.0324	899.1806	864.9258	651.6984	434.7089	455.1334	642.2090	652.0343	572.9736	544.6607	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1785.7308	1735.6504	1579.5519	1328.4356	1024.7003	681.2049	438.4212	462.1187	734.7578	1109.9562	1472.7929	1781.5389	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	896.7368	700.6349	573.2665	309.0636	118.8722	0.0000	0.0000	0.0000	0.0000	340.6939	647.8698	920.2374	(98)
Space heating												4507.3752	(98)
Space heating per m2											(98) / (4) =	40.0834	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4851.8570	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	896.7368	700.6349	573.2665	309.0636	118.8722	0.0000	0.0000	0.0000	0.0000	340.6939	647.8698	920.2374	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	965.2710	754.1818	617.0791	332.6842	127.9572	0.0000	0.0000	0.0000	0.0000	366.7319	697.3841	990.5677	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3558	89.3019	89.1780	88.8697	88.1600	86.7000	86.7000	86.7000	86.7000	88.9113	89.2511	89.3805	(217)
Fuel for water heating, kWh/month													
	198.3273	173.9343	180.6167	159.2614	154.9754	137.3772	128.6798	145.6988	146.8563	165.2263	178.0632	192.4253	(219)
Water heating fuel used												1961.4422	(219)
Annual totals kWh/year													
Space heating fuel - main system												4851.8570	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6598.7457	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4851.8570	0.2160	1048.0011	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.4422	0.2160	423.6715	(264)
Space and water heating			1471.6726	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1360.3194	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.1000	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.2553	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.2553	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3883	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	578.0397	678.5296	786.8343	898.7788	967.8699	950.9635	907.7051	842.7183	760.2169	649.1680	568.1763	544.6730	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9991	0.9976	0.9922	0.9696	0.8970	0.7386	0.5655	0.6264	0.8757	0.9853	0.9979	0.9993	(86)
MIT	19.7517	19.9018	20.1588	20.4980	20.7842	20.9474	20.9896	20.9827	20.8628	20.4781	20.0529	19.7287	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9987	0.9967	0.9893	0.9576	0.8569	0.6516	0.4480	0.5068	0.8128	0.9775	0.9970	0.9991	(89)
MIT 2	18.3275	18.5485	18.9245	19.4186	19.8046	19.9957	20.0279	20.0262	19.9125	19.3982	18.7779	18.3005	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9856	0.9508	0.8539	0.6627	0.4665	0.5254	0.8154	0.9725	0.9956	0.9985	(94)
Useful gains	576.8716	675.2250	775.5222	854.5272	826.4284	630.1670	423.4638	442.7830	619.9009	631.2970	565.6688	543.8653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1755.7043	1703.0901	1546.3461	1293.6538	997.2435	662.3243	427.4966	450.1607	715.1020	1082.9026	1441.1271	1746.5299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating												4445.6344	(98)
Space heating per m2											(98) / (4) =	39.5343	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4759.7799	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	939.0273	739.5346	614.0181	338.5130	136.0668	0.0000	0.0000	0.0000	0.0000	359.7373	674.8715	958.0112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2049	88.0054	87.5504	86.4668	84.2822	80.3000	80.3000	80.3000	80.3000	86.5213	87.7732	88.2802	(217)
Fuel for water heating, kWh/month													
	245.2720	216.6598	228.6907	207.1619	205.7679	190.2164	182.2418	203.1569	205.4005	215.0629	224.2199	239.1514	(219)
Water heating fuel used												2563.0022	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.7799	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												7858.8949	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4759.7799	0.2160	1028.1125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2563.0022	0.2160	553.6085	(264)
Space and water heating			1581.7209	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1859.9635	(272)
Emissions per m2 for space and water heating			14.0660	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0660 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.5400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				3.5000	
Infiltration rate				0.3133	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3395	0.3328	0.3262	0.2929	0.2862	0.2530	0.2530	0.2463	0.2663	0.2862	0.2996	0.3129	(22b)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5355	0.5410	0.5449	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2363	53.0227	52.8133	51.8297	51.6456	50.7889	50.7889	50.6303	51.1189	51.6456	52.0179	52.4071	(38)
Heat transfer coeff	125.7333	125.5197	125.3103	124.3267	124.1426	123.2859	123.2859	123.1273	123.6159	124.1426	124.5149	124.9041	(39)
Average = Sum(39)m / 12 =												124.3258	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1181	1.1162	1.1144	1.1056	1.1040	1.0964	1.0964	1.0950	1.0993	1.1040	1.1073	1.1108	(40)
HLP (average)												1.1056	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	548.0180	664.0527	791.9255	926.1606	1011.3538	998.7030	953.4826	875.0933	777.1881	643.8599	544.1294	512.6893	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1078	62.2136	62.3175	62.8106	62.9037	63.3408	63.3408	63.4224	63.1717	62.9037	62.7156	62.5202	
alpha	5.1405	5.1476	5.1545	5.1874	5.1936	5.2227	5.2227	5.2282	5.2114	5.1936	5.1810	5.1680	
util living area													
	0.9993	0.9978	0.9921	0.9673	0.8886	0.7271	0.5556	0.6221	0.8754	0.9863	0.9983	0.9995	(86)
MIT	19.6961	19.8586	20.1331	20.4877	20.7845	20.9470	20.9893	20.9814	20.8545	20.4475	20.0004	19.6659	(87)
Th 2	19.9861	19.9876	19.9891	19.9962	19.9976	20.0038	20.0038	20.0050	20.0014	19.9976	19.9949	19.9921	(88)
util rest of house													
	0.9990	0.9970	0.9892	0.9545	0.8461	0.6379	0.4367	0.4999	0.8113	0.9790	0.9976	0.9993	(89)
MIT 2	18.7892	18.9525	19.2267	19.5790	19.8507	19.9792	20.0011	19.9996	19.9180	19.5459	19.1003	18.7638	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9320	19.0952	19.3695	19.7221	19.9978	20.1317	20.1567	20.1542	20.0655	19.6879	19.2421	18.9059	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9320	19.0952	19.3695	19.7221	19.9978	20.1317	20.1567	20.1542	20.0655	19.6879	19.2421	18.9059	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9961	0.9868	0.9501	0.8461	0.6503	0.4556	0.5192	0.8162	0.9759	0.9968	0.9990	(94)
Useful gains	547.2563	661.4575	781.4830	879.9891	855.7545	649.4486	434.3610	454.3443	634.3358	628.3679	542.3782	512.1838	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1839.7294	1781.7821	1612.6760	1345.4819	1030.1117	681.9751	438.4917	462.2455	737.4278	1128.1945	1511.8671	1836.8226	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	961.6000	752.8582	618.4076	335.1547	129.7217	0.0000	0.0000	0.0000	0.0000	371.8710	698.0320	985.5312	(98)
Space heating												4853.1764	(98)
Space heating per m2											(98) / (4) =	43.1585	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1158.8878	912.3160	935.7674	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8753	0.9331	0.9066	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1014.4045	851.2881	848.4089	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1270.7102	1215.9021	1127.8318	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	184.5401	271.2729	207.8906	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												663.7035	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	46.1350	67.8182	51.9726	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												165.9259	(107)
Space cooling per m2												1.4756	(108)
Energy for space heating												43.1585	(99)
Energy for space cooling												1.4756	(108)
Total												44.6341	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.6	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	531.2417	632.5768	742.6367	857.0777	928.4124	914.3817	872.9773	804.9206	720.8807	607.2518	523.4713	498.7167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9994	0.9983	0.9940	0.9749	0.9098	0.7587	0.5855	0.6509	0.8942	0.9890	0.9986	0.9996	(86)
MIT	19.7124	19.8634	20.1229	20.4676	20.7643	20.9401	20.9878	20.9793	20.8448	20.4451	20.0154	19.6900	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9992	0.9976	0.9917	0.9648	0.8729	0.6726	0.4652	0.5290	0.8364	0.9831	0.9980	0.9994	(89)
MIT 2	18.8202	18.9730	19.2332	19.5808	19.8576	20.0033	20.0287	20.0275	19.9366	19.5643	19.1341	18.8053	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9969	0.9898	0.9608	0.8719	0.6841	0.4842	0.5482	0.8401	0.9804	0.9973	0.9992	(94)
Useful gains	530.6152	630.5957	735.0316	823.4625	809.4985	625.5698	422.7279	441.2274	605.6230	595.3439	522.0713	498.2977	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1806.0882	1746.2898	1577.5250	1309.6182	1002.2563	662.9453	427.5361	450.2212	717.1904	1099.1754	1476.8161	1797.6427	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.9519	749.7464	626.8151	350.0321	143.4118	0.0000	0.0000	0.0000	0.0000	374.8506	687.4163	966.7127	(98)
Space heating												4847.9369	(98)
Space heating per m2											(98) / (4) =	43.1119	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8607	0.9245	0.8970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	966.2755	817.0738	812.5601	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1173.2354	1122.8308	1046.6749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	149.0112	227.4832	174.1814	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.6757	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	37.2528	56.8708	43.5453	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.6689	(107)
Space cooling per m2												1.2243	(108)
Energy for space heating												43.1119	(99)
Energy for space cooling												1.2243	(108)
Total												44.3362	(109)
Target Fabric Energy Efficiency (TFEE)												51.0	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				3.5000	
Infiltration rate				0.3133	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2796	0.2596	0.2663	0.2530	0.2530	0.2463	0.2396	0.2330	0.2263	0.2463	0.2330	0.2463	(22b)
Effective ac	0.5391	0.5337	0.5355	0.5320	0.5320	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.4658	50.9518	51.1189	50.7889	50.7889	50.6303	50.4759	50.3257	50.1797	50.6303	50.3257	50.6303	(38)
Heat transfer coeff	123.9628	123.4488	123.6159	123.2859	123.2859	123.1273	122.9729	122.8227	122.6767	123.1273	122.8227	123.1273	(39)
Average = Sum(39)m / 12 =												123.1897	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1024	1.0978	1.0993	1.0964	1.0964	1.0950	1.0936	1.0922	1.0909	1.0950	1.0922	1.0950	(40)
HLP (average)												1.0955	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9949	63.2572	63.1717	63.3408	63.3408	63.4224	63.5020	63.5797	63.6553	63.4224	63.5797	63.4224	
alpha	5.1997	5.2171	5.2114	5.2227	5.2227	5.2282	5.2335	5.2386	5.2437	5.2282	5.2386	5.2282	
util living area													
	0.9936	0.9884	0.9678	0.9008	0.7609	0.5391	0.3932	0.4151	0.6931	0.9272	0.9852	0.9950	(86)
MIT	20.0199	20.1442	20.4096	20.7149	20.9127	20.9880	20.9981	20.9976	20.9587	20.7143	20.3264	19.9998	(87)
Th 2	19.9989	20.0026	20.0014	20.0038	20.0038	20.0050	20.0061	20.0072	20.0082	20.0050	20.0072	20.0050	(88)
util rest of house													
	0.9915	0.9846	0.9572	0.8699	0.6967	0.4502	0.2940	0.3108	0.6027	0.8961	0.9793	0.9933	(89)
MIT 2	18.7144	18.8968	19.2752	19.6922	19.9291	19.9986	20.0056	20.0065	19.9814	19.7029	19.1654	18.6897	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9798	0.9498	0.8645	0.7023	0.4639	0.3097	0.3273	0.6150	0.8906	0.9740	0.9905	(94)
Useful gains	827.9850	915.1843	1011.0941	1036.1954	871.5701	591.6178	375.9604	375.4194	642.3887	810.1216	801.7500	780.9423	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1737.9586	1702.7623	1539.4970	1276.4092	934.9997	597.7119	376.5281	376.1549	666.7849	1041.9312	1406.1078	1710.9844	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	677.0203	529.2524	393.1318	172.9539	47.1917	0.0000	0.0000	0.0000	0.0000	172.4663	435.1377	691.9513	(98)
Space heating												3119.1053	(98)
RHI space heating demand												3119	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.5000	
Infiltration rate			0.3133	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3395	0.3328	0.3262	0.2929	0.2862	0.2530	0.2530	0.2463	0.2663	0.2862	0.2996	0.3129	(22b)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5355	0.5410	0.5449	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2363	53.0227	52.8133	51.8297	51.6456	50.7889	50.7889	50.6303	51.1189	51.6456	52.0179	52.4071	(38)
Heat transfer coeff	125.7333	125.5197	125.3103	124.3267	124.1426	123.2859	123.2859	123.1273	123.6159	124.1426	124.5149	124.9041	(39)
Average = Sum(39)m / 12 =												124.3258	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1181	1.1162	1.1144	1.1056	1.1040	1.0964	1.0964	1.0950	1.0993	1.1040	1.1073	1.1108	(40)
HLP (average)												1.1056	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1078	62.2136	62.3175	62.8106	62.9037	63.3408	63.3408	63.4224	63.1717	62.9037	62.7156	62.5202	
alpha	5.1405	5.1476	5.1545	5.1874	5.1936	5.2227	5.2227	5.2282	5.2114	5.1936	5.1810	5.1680	
util living area													
	0.9956	0.9907	0.9760	0.9283	0.8158	0.6346	0.4713	0.5223	0.7765	0.9556	0.9911	0.9966	(86)
MIT	19.9071	20.0631	20.3181	20.6306	20.8636	20.9716	20.9950	20.9916	20.9214	20.6063	20.1938	19.8730	(87)
Th 2	19.9861	19.9876	19.9891	19.9962	19.9976	20.0038	20.0038	20.0050	20.0014	19.9976	19.9949	19.9921	(88)
util rest of house													
	0.9942	0.9877	0.9680	0.9047	0.7616	0.5474	0.3673	0.4141	0.6966	0.9360	0.9877	0.9955	(89)
MIT 2	18.5407	18.7683	19.1362	19.5758	19.8700	19.9858	20.0020	20.0017	19.9422	19.5536	18.9651	18.4954	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.7559	18.9723	19.3223	19.7419	20.0265	20.1411	20.1584	20.1576	20.0964	19.7194	19.1586	18.7124	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7559	18.9723	19.3223	19.7419	20.0265	20.1411	20.1584	20.1576	20.0964	19.7194	19.1586	18.7124	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9834	0.9611	0.8976	0.7634	0.5600	0.3837	0.4311	0.7050	0.9290	0.9836	0.9934	(94)
Useful gains	795.5055	899.3070	990.4771	1030.3936	928.7633	666.6047	436.8426	459.2983	689.7813	800.7038	767.1130	756.1735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1817.5888	1766.3448	1606.7685	1347.9363	1033.6714	683.1381	438.7006	462.6588	741.2543	1132.1060	1501.4759	1812.6590	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	760.4300	582.6493	458.5208	228.6308	78.0516	0.0000	0.0000	0.0000	0.0000	246.5632	528.7413	786.0252	(98)
Space heating												3669.6122	(98)
Space heating per m2											(98) / (4) =	32.6333	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3950.0670	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	760.4300	582.6493	458.5208	228.6308	78.0516	0.0000	0.0000	0.0000	0.0000	246.5632	528.7413	786.0252	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	818.5468	627.1791	493.5638	246.1042	84.0168	0.0000	0.0000	0.0000	0.0000	265.4071	569.1510	846.0982	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2772	89.2070	89.0456	88.6490	87.8367	86.7000	86.7000	86.7000	86.7000	88.6780	89.1397	89.3082	(217)
Fuel for water heating, kWh/month													
	198.5019	174.1194	180.8854	159.6580	155.5458	137.3772	128.6798	145.6988	146.8563	165.6610	178.2858	192.5810	(219)
Water heating fuel used												1963.8504	(219)
Annual totals kWh/year													
Space heating fuel - main system												3950.0670	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5699.3639	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3950.0670	3.4800	137.4623	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.8504	3.4800	68.3420	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			297.5047	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7936	(257)
SAP value		88.9293	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3950.0670	0.2160	853.2145	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.8504	0.2160	424.1917	(264)
Space and water heating			1277.4062	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1166.0529	(272)
CO2 emissions per m2			10.3700	(273)
EI value			90.0761	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8816 = 3.947, stars = 4
Water heating environmental impact	0.216 / 0.8816 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.5000	
Infiltration rate			0.3133	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2796	0.2596	0.2663	0.2530	0.2530	0.2463	0.2396	0.2330	0.2263	0.2463	0.2330	0.2463	(22b)
Effective ac	0.5391	0.5337	0.5355	0.5320	0.5320	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.4658	50.9518	51.1189	50.7889	50.7889	50.6303	50.4759	50.3257	50.1797	50.6303	50.3257	50.6303	(38)
Heat transfer coeff	123.9628	123.4488	123.6159	123.2859	123.2859	123.1273	122.9729	122.8227	122.6767	123.1273	122.8227	123.1273	(39)
Average = Sum(39)m / 12 =												123.1897	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1024	1.0978	1.0993	1.0964	1.0964	1.0950	1.0936	1.0922	1.0909	1.0950	1.0922	1.0950	(40)
HLP (average)												1.0955	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9949	63.2572	63.1717	63.3408	63.3408	63.4224	63.5020	63.5797	63.6553	63.4224	63.5797	63.4224	
alpha	5.1997	5.2171	5.2114	5.2227	5.2227	5.2282	5.2335	5.2386	5.2437	5.2282	5.2386	5.2282	
util living area													
	0.9936	0.9884	0.9678	0.9008	0.7609	0.5391	0.3932	0.4151	0.6931	0.9272	0.9852	0.9950	(86)
MIT	20.0199	20.1442	20.4096	20.7149	20.9127	20.9880	20.9981	20.9976	20.9587	20.7143	20.3264	19.9998	(87)
Th 2	19.9989	20.0026	20.0014	20.0038	20.0038	20.0050	20.0061	20.0072	20.0082	20.0050	20.0072	20.0050	(88)
util rest of house													
	0.9915	0.9846	0.9572	0.8699	0.6967	0.4502	0.2940	0.3108	0.6027	0.8961	0.9793	0.9933	(89)
MIT 2	18.7144	18.8968	19.2752	19.6922	19.9291	19.9986	20.0056	20.0065	19.9814	19.7029	19.1654	18.6897	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9798	0.9498	0.8645	0.7023	0.4639	0.3097	0.3273	0.6150	0.8906	0.9740	0.9905	(94)
Useful gains	827.9850	915.1843	1011.0941	1036.1954	871.5701	591.6178	375.9604	375.4194	642.3887	810.1216	801.7500	780.9423	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1737.9586	1702.7623	1539.4970	1276.4092	934.9997	597.7119	376.5281	376.1549	666.7849	1041.9312	1406.1078	1710.9844	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	677.0203	529.2524	393.1318	172.9539	47.1917	0.0000	0.0000	0.0000	0.0000	172.4663	435.1377	691.9513	(98)
Space heating												3119.1053	(98)
Space heating per m2											(98) / (4) =	27.7377	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3357.4869	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	677.0203	529.2524	393.1318	172.9539	47.1917	0.0000	0.0000	0.0000	0.0000	172.4663	435.1377	691.9513	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	728.7624	569.7012	423.1774	186.1721	50.7984	0.0000	0.0000	0.0000	0.0000	185.6473	468.3936	744.8346	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2169	89.1534	88.9459	88.4311	87.4996	86.7000	86.7000	86.7000	86.7000	88.3992	89.0210	89.2443	(217)
Fuel for water heating, kWh/month													
	198.6361	174.2240	181.0882	160.0514	156.1451	137.3772	128.6798	145.6988	146.8563	166.1835	178.5234	192.7191	(219)
Water heating fuel used												1966.1829	(219)
Annual totals kWh/year													
Space heating fuel - main system												3357.4869	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5009.0076	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3357.4869	7.3800	247.7825	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1966.1829	7.3800	145.1043	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			409.7046	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3357.4869	0.2160	725.2172	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.1829	0.2160	424.6955	(264)
Space and water heating			1149.9127	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			986.6030	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3357.4869	1.2200	4096.1340	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.1829	1.2200	2398.7432	(264)
Space and water heating			6494.8772	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5528.8641 (272)
Primary energy kWh/m2/year 49.1673 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.9%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	A 92
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£500	£424	£76
Space heating	£376	£376	-£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£410	£348	£62
Total cost of uses	£409	£347	£62
Delivered energy	45 kWh/m²	36 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	49 kWh/m²	39 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.5000	
Infiltration rate			0.3133	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3395	0.3328	0.3262	0.2929	0.2862	0.2530	0.2530	0.2463	0.2663	0.2862	0.2996	0.3129	(22b)
Effective ac	0.5576	0.5554	0.5532	0.5429	0.5410	0.5320	0.5320	0.5303	0.5355	0.5410	0.5449	0.5489	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.2363	53.0227	52.8133	51.8297	51.6456	50.7889	50.7889	50.6303	51.1189	51.6456	52.0179	52.4071	(38)
Heat transfer coeff	125.7333	125.5197	125.3103	124.3267	124.1426	123.2859	123.2859	123.1273	123.6159	124.1426	124.5149	124.9041	(39)
Average = Sum(39)m / 12 =												124.3258	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1181	1.1162	1.1144	1.1056	1.1040	1.0964	1.0964	1.0950	1.0993	1.1040	1.1073	1.1108	(40)
HLP (average)												1.1056	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1078	62.2136	62.3175	62.8106	62.9037	63.3408	63.3408	63.4224	63.1717	62.9037	62.7156	62.5202	
alpha	5.1405	5.1476	5.1545	5.1874	5.1936	5.2227	5.2227	5.2282	5.2114	5.1936	5.1810	5.1680	
util living area													
	0.9956	0.9907	0.9760	0.9283	0.8158	0.6346	0.4713	0.5223	0.7765	0.9556	0.9911	0.9966	(86)
MIT	19.9071	20.0631	20.3181	20.6306	20.8636	20.9716	20.9950	20.9916	20.9214	20.6063	20.1938	19.8730	(87)
Th 2	19.9861	19.9876	19.9891	19.9962	19.9976	20.0038	20.0038	20.0050	20.0014	19.9976	19.9949	19.9921	(88)
util rest of house													
	0.9942	0.9877	0.9680	0.9047	0.7616	0.5474	0.3673	0.4141	0.6966	0.9360	0.9877	0.9955	(89)
MIT 2	18.5407	18.7683	19.1362	19.5758	19.8700	19.9858	20.0020	20.0017	19.9422	19.5536	18.9651	18.4954	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7559	18.9723	19.3223	19.7419	20.0265	20.1411	20.1584	20.1576	20.0964	19.7194	19.1586	18.7124	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7559	18.9723	19.3223	19.7419	20.0265	20.1411	20.1584	20.1576	20.0964	19.7194	19.1586	18.7124	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9834	0.9611	0.8976	0.7634	0.5600	0.3837	0.4311	0.7050	0.9290	0.9836	0.9934	(94)
Useful gains	795.5055	899.3070	990.4771	1030.3936	928.7633	666.6047	436.8426	459.2983	689.7813	800.7038	767.1130	756.1735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1817.5888	1766.3448	1606.7685	1347.9363	1033.6714	683.1381	438.7006	462.6588	741.2543	1132.1060	1501.4759	1812.6590	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	760.4300	582.6493	458.5208	228.6308	78.0516	0.0000	0.0000	0.0000	0.0000	246.5632	528.7413	786.0252	(98)
Space heating												3669.6122	(98)
Space heating per m2											(98) / (4) =	32.6333	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3950.0670	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	760.4300	582.6493	458.5208	228.6308	78.0516	0.0000	0.0000	0.0000	0.0000	246.5632	528.7413	786.0252	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	818.5468	627.1791	493.5638	246.1042	84.0168	0.0000	0.0000	0.0000	0.0000	265.4071	569.1510	846.0982	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3512	89.3646	89.3648	89.3606	89.3104	86.7000	86.7000	86.7000	86.7000	89.0026	89.2548	89.3693	(217)
Fuel for water heating, kWh/month													
	169.8851	126.3406	99.3898	50.0272	19.0351	1.7238	0.0000	28.7441	55.2573	104.1238	144.2707	168.6445	(219)
Water heating fuel used												967.4420	(219)
Annual totals kWh/year													
Space heating fuel - main system												3950.0670	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4752.9556	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3950.0670	3.4800	137.4623	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.4420	3.4800	33.6670	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			269.4247	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7187	(257)
SAP value		89.9742	
SAP rating (Section 12)		90	(258)
SAP band		B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3950.0670	0.2160	853.2145	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.4420	0.2160	208.9675	(264)
Space and water heating			1062.1819	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			976.7787	(272)
CO2 emissions per m2			8.6900	(273)
EI value			91.6870	
EI rating			92	(274)
EI band			A	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1383	(8)
Pressure test		Yes	
Measured/design AP50		3.5000	
Infiltration rate		0.3133	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2663	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2796	0.2596	0.2663	0.2530	0.2530	0.2463	0.2396	0.2330	0.2263	0.2463	0.2330	0.2463	(22b)
Effective ac	0.5391	0.5337	0.5355	0.5320	0.5320	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.4658	50.9518	51.1189	50.7889	50.7889	50.6303	50.4759	50.3257	50.1797	50.6303	50.3257	50.6303	(38)
Heat transfer coeff	123.9628	123.4488	123.6159	123.2859	123.2859	123.1273	122.9729	122.8227	122.6767	123.1273	122.8227	123.1273	(39)

Average = Sum(39)m / 12 = 123.1897 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1024	1.0978	1.0993	1.0964	1.0964	1.0950	1.0936	1.0922	1.0909	1.0950	1.0922	1.0950	(40)
HLP (average)												1.0955	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2724	(H8)
Utilisation factor												0.5443	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-912.8396	(H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870	(63)
										Solar input (sum of months) = Sum(63)m =		-912.8396	(63)
Output from w/h													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
										Total per year (kWh/year) = Sum(64)m =		834.2051	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.9949	63.2572	63.1717	63.3408	63.3408	63.4224	63.5020	63.5797	63.6553	63.4224	63.5797	63.4224	
alpha	5.1997	5.2171	5.2114	5.2227	5.2227	5.2282	5.2335	5.2386	5.2437	5.2282	5.2386	5.2282	
util living area													
	0.9936	0.9884	0.9678	0.9008	0.7609	0.5391	0.3932	0.4151	0.6931	0.9272	0.9852	0.9950	(86)
MIT	20.0199	20.1442	20.4096	20.7149	20.9127	20.9880	20.9981	20.9976	20.9587	20.7143	20.3264	19.9998	(87)
Th 2	19.9989	20.0026	20.0014	20.0038	20.0038	20.0050	20.0061	20.0072	20.0082	20.0050	20.0072	20.0050	(88)
util rest of house													
	0.9915	0.9846	0.9572	0.8699	0.6967	0.4502	0.2940	0.3108	0.6027	0.8961	0.9793	0.9933	(89)
MIT 2	18.7144	18.8968	19.2752	19.6922	19.9291	19.9986	20.0056	20.0065	19.9814	19.7029	19.1654	18.6897	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0933	19.4539	19.8532	20.0840	20.1544	20.1619	20.1626	20.1353	19.8622	19.3483	18.8961	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9798	0.9498	0.8645	0.7023	0.4639	0.3097	0.3273	0.6150	0.8906	0.9740	0.9905	(94)
Useful gains	827.9850	915.1843	1011.0941	1036.1954	871.5701	591.6178	375.9604	375.4194	642.3887	810.1216	801.7500	780.9423	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1737.9586	1702.7623	1539.4970	1276.4092	934.9997	597.7119	376.5281	376.1549	666.7849	1041.9312	1406.1078	1710.9844	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	677.0203	529.2524	393.1318	172.9539	47.1917	0.0000	0.0000	0.0000	0.0000	172.4663	435.1377	691.9513	(98)
Space heating												3119.1053	(98)
Space heating per m2											(98) / (4) =	27.7377	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3357.4869	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	677.0203	529.2524	393.1318	172.9539	47.1917	0.0000	0.0000	0.0000	0.0000	172.4663	435.1377	691.9513	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	728.7624	569.7012	423.1774	186.1721	50.7984	0.0000	0.0000	0.0000	0.0000	185.6473	468.3936	744.8346	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3105	89.3200	89.2956	89.2400	88.8802	86.7000	86.7000	86.7000	86.7000	88.7889	89.1715	89.3207	(217)
Fuel for water heating, kWh/month													
	165.0846	126.4921	98.8756	48.5651	23.9532	0.0000	0.0000	21.1925	49.3765	99.6455	138.7245	165.1394	(219)
Water heating fuel used												937.0489	(219)
Annual totals kWh/year													
Space heating fuel - main system												3357.4869	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4029.8735	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3357.4869	7.3800	247.7825	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	937.0489	7.3800	69.1542	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			348.0845	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3357.4869	0.2160	725.2172	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0489	0.2160	202.4026	(264)
Space and water heating			927.6197	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			790.2600	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3357.4869	1.2200	4096.1340	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0489	1.2200	1143.1996	(264)
Space and water heating			5239.3336	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4426.8205	(272)
Primary energy kWh/m2/year			39.3670	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	763.75	(P1)
Transmission heat loss coefficient	72.50	(37)
Summer heat loss coefficient	836.25	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
South	2.1300	118.5567	0.7200	0.7000	0.7650	87.6274
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						716.5712

	Jun	Jul	Aug	
Solar gains	769	717	639	(P3)
Internal gains	513	491	501	
Total summer gains	1282	1208	1140	(P5)
Summer gain/loss ratio	1.53	1.44	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.18	18.99	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 357 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Goldcrest Road, Boorley Green, Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.10	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.85		
CO_2 Emissions (t/year)	0.94	**DFEE**	44.63	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.10	$kgCO_2/m^2$	Pass
	-4.44 (-26.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.99	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.63	$kWh/m^2/yr$	
	-6.4 (-12.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.50 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	5.77 m², No overhang 2.13 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.50 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.5	m³/m²h
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 358 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	8 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.46	**TER**	16.82
Environmental	90 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	0.98	**DFEE**	46.16	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.46 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.75 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.13 m², No overhang
Windows facing East: 5.77 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3461	0.3392	0.3046	0.2977	0.2631	0.2631	0.2561	0.2769	0.2977	0.3115	0.3254	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.6842	53.4531	53.2267	52.1630	51.9640	51.0376	51.0376	50.8660	51.3944	51.9640	52.3666	52.7875	(38)
Heat transfer coeff	126.1812	125.9502	125.7237	124.6600	124.4610	123.5346	123.5346	123.3630	123.8914	124.4610	124.8636	125.2845	(39)
Average = Sum(39)m / 12 =												124.6591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1201	1.1180	1.1086	1.1068	1.0986	1.0986	1.0970	1.1017	1.1068	1.1104	1.1141	(40)
HLP (average)												1.1086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	554.7987	655.0112	776.0967	914.0632	1008.5724	1000.8682	951.7256	866.5607	758.5530	629.1703	544.2123	522.0368	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8874	62.0009	62.1126	62.6426	62.7428	63.2133	63.2133	63.3012	63.0312	62.7428	62.5405	62.3304	
alpha	5.1258	5.1334	5.1408	5.1762	5.1829	5.2142	5.2142	5.2201	5.2021	5.1829	5.1694	5.1554	
util living area													
	0.9992	0.9980	0.9928	0.9691	0.8901	0.7268	0.5575	0.6281	0.8844	0.9876	0.9983	0.9994	(86)
MIT	19.6965	19.8461	20.1159	20.4761	20.7813	20.9468	20.9891	20.9805	20.8450	20.4335	19.9970	19.6692	(87)
Th 2	19.9828	19.9845	19.9861	19.9938	19.9953	20.0020	20.0020	20.0032	19.9994	19.9953	19.9924	19.9893	(88)
util rest of house													
	0.9989	0.9972	0.9902	0.9569	0.8479	0.6376	0.4381	0.5052	0.8228	0.9810	0.9976	0.9992	(89)
MIT 2	18.2312	18.4511	18.8455	19.3673	19.7767	19.9659	19.9979	19.9949	19.8677	19.3145	18.6778	18.1959	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4620	18.6708	19.0455	19.5420	19.9349	20.1204	20.1540	20.1501	20.0216	19.4907	18.8856	18.4279	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4620	18.6708	19.0455	19.5420	19.9349	20.1204	20.1540	20.1501	20.0216	19.4907	18.8856	18.4279	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9958	0.9866	0.9497	0.8449	0.6490	0.4569	0.5243	0.8244	0.9762	0.9963	0.9987	(94)
Useful gains	553.8454	652.2542	765.6731	868.1214	852.1713	649.5804	434.8202	454.3146	625.3771	614.1648	542.2036	521.3793	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1786.9742	1734.4347	1577.2713	1326.6276	1024.9276	681.9590	439.0409	462.6277	733.6330	1106.5512	1471.5865	1782.5406	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	917.4478	727.2253	603.8291	330.1245	128.5307	0.0000	0.0000	0.0000	0.0000	366.3355	669.1557	938.3040	(98)
Space heating												4680.9526	(98)
Space heating per m2											(98) / (4) =	41.6270	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5038.7003	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.4478	727.2253	603.8291	330.1245	128.5307	0.0000	0.0000	0.0000	0.0000	366.3355	669.1557	938.3040	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	987.5649	782.8044	649.9775	355.3547	138.3539	0.0000	0.0000	0.0000	0.0000	394.3331	720.2968	1010.0150	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3660	89.3198	89.2067	88.9152	88.2222	86.7000	86.7000	86.7000	86.7000	88.9602	89.2677	89.3889	(217)
Fuel for water heating, kWh/month	198.3046	173.8995	180.5588	159.1799	154.8662	137.3772	128.6798	145.6988	146.8563	165.1355	178.0302	192.4072	(219)
Water heating fuel used												1960.9940	(219)
Annual totals kWh/year													
Space heating fuel - main system												5038.7003	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6785.1408	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5038.7003	0.2160	1088.3593	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1960.9940	0.2160	423.5747	(264)
Space and water heating			1511.9340	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1400.5807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.4600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.4600	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.6153	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6153	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3883	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	554.5280	641.9153	745.8218	863.1260	941.7305	931.0687	886.0052	813.0034	720.9193	611.1547	540.6412	524.1460	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9992	0.9981	0.9939	0.9742	0.9055	0.7495	0.5779	0.6455	0.8942	0.9887	0.9983	0.9994	(86)
MIT	19.7320	19.8712	20.1255	20.4721	20.7712	20.9435	20.9885	20.9801	20.8449	20.4482	20.0298	19.7114	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9990	0.9975	0.9916	0.9638	0.8676	0.6629	0.4586	0.5241	0.8364	0.9826	0.9976	0.9992	(89)
MIT 2	18.2986	18.5040	18.8764	19.3829	19.7892	19.9927	20.0275	20.0250	19.8940	19.3559	18.7443	18.2752	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9884	0.9572	0.8639	0.6737	0.4774	0.5429	0.8375	0.9781	0.9965	0.9988	(94)
Useful gains	553.5998	639.4614	737.1881	826.2108	813.5939	627.2333	422.9359	441.3901	603.7916	597.7949	538.7262	523.4952	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1752.3267	1697.8911	1540.7374	1289.5153	995.4331	661.9473	427.4293	449.9845	712.8900	1078.0337	1437.2521	1743.6004	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating												4581.8205	(98)
Space heating per m2											(98) / (4) =	40.7454	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4905.5894	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	954.8745	761.5254	640.0864	357.1512	144.8484	0.0000	0.0000	0.0000	0.0000	382.5457	692.6538	971.9039	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2335	88.0585	87.6346	86.5947	84.4340	80.3000	80.3000	80.3000	80.3000	86.6671	87.8234	88.3042	(217)
Fuel for water heating, kWh/month													
	245.1925	216.5291	228.4708	206.8559	205.3979	190.2164	182.2418	203.1569	205.4005	214.7011	224.0917	239.0864	(219)
Water heating fuel used												2561.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4905.5894	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												8003.0432	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4905.5894	0.2160	1059.6073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2561.3409	0.2160	553.2496	(264)
Space and water heating			1612.8569	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1891.0995	(272)
Emissions per m2 for space and water heating			14.3429	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3429 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.8200	(273)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3461	0.3392	0.3046	0.2977	0.2631	0.2631	0.2561	0.2769	0.2977	0.3115	0.3254	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.6842	53.4531	53.2267	52.1630	51.9640	51.0376	51.0376	50.8660	51.3944	51.9640	52.3666	52.7875	(38)
Heat transfer coeff	126.1812	125.9502	125.7237	124.6600	124.4610	123.5346	123.5346	123.3630	123.8914	124.4610	124.8636	125.2845	(39)
Average = Sum(39)m / 12 =												124.6591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1201	1.1180	1.1086	1.1068	1.0986	1.0986	1.0970	1.1017	1.1068	1.1104	1.1141	(40)
HLP (average)												1.1086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	521.1475	622.2079	745.0541	885.4146	981.4803	975.9661	928.6829	841.1334	732.2766	600.4162	512.6607	489.2300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8874	62.0009	62.1126	62.6426	62.7428	63.2133	63.2133	63.3012	63.0312	62.7428	62.5405	62.3304	
alpha	5.1258	5.1334	5.1408	5.1762	5.1829	5.2142	5.2142	5.2201	5.2021	5.1829	5.1694	5.1554	
util living area													
	0.9994	0.9984	0.9940	0.9728	0.8988	0.7398	0.5699	0.6439	0.8961	0.9899	0.9987	0.9996	(86)
MIT	19.6683	19.8188	20.0907	20.4555	20.7683	20.9422	20.9879	20.9782	20.8326	20.4107	19.9706	19.6417	(87)
Th 2	19.9828	19.9845	19.9861	19.9938	19.9953	20.0020	20.0020	20.0032	19.9994	19.9953	19.9924	19.9893	(88)
util rest of house													
	0.9992	0.9978	0.9918	0.9618	0.8587	0.6509	0.4485	0.5194	0.8380	0.9844	0.9982	0.9994	(89)
MIT 2	18.7588	18.9104	19.1825	19.5467	19.8356	19.9749	19.9989	19.9968	19.9006	19.5085	19.0686	18.7374	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9020	19.0535	19.3255	19.6898	19.9825	20.1273	20.1546	20.1513	20.0474	19.6505	19.2107	18.8798	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9020	19.0535	19.3255	19.6898	19.9825	20.1273	20.1546	20.1513	20.0474	19.6505	19.2107	18.8798	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9971	0.9897	0.9576	0.8581	0.6630	0.4678	0.5390	0.8414	0.9817	0.9975	0.9992	(94)
Useful gains	520.5701	620.3816	737.4160	847.8309	842.2168	647.0816	434.4156	453.3473	616.1027	589.4394	511.3956	488.8405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1842.5020	1782.6308	1612.4751	1345.0560	1030.8507	682.8085	439.1208	462.7777	736.8305	1126.4404	1512.1818	1839.1512	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	983.5173	781.0315	651.0439	358.0020	140.3436	0.0000	0.0000	0.0000	0.0000	399.5287	720.5661	1004.6312	(98)
Space heating												5038.6645	(98)
Space heating per m2											(98) / (4) =	44.8080	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1161.2249	914.1558	937.5588	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8666	0.9266	0.8947	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.2677	847.0775	838.8514	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.1346	1186.9154	1088.1383	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	171.2641	252.8394	185.4695	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												609.5730	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.8160	63.2098	46.3674	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												152.3933	(107)
Space cooling per m2												1.3552	(108)
Energy for space heating												44.8080	(99)
Energy for space cooling												1.3552	(108)
Total												46.1633	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.2	(109)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	507.7301	595.9626	701.6242	821.4249	902.2730	894.4869	851.2775	775.2057	681.5832	569.2385	495.9363	478.1897	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9995	0.9987	0.9954	0.9790	0.9179	0.7698	0.5986	0.6710	0.9116	0.9918	0.9989	0.9996	(86)
MIT	19.6926	19.8328	20.0893	20.4410	20.7503	20.9357	20.9865	20.9761	20.8251	20.4146	19.9923	19.6727	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9993	0.9982	0.9936	0.9702	0.8832	0.6843	0.4765	0.5476	0.8595	0.9872	0.9984	0.9995	(89)
MIT 2	18.8005	18.9424	19.2000	19.5555	19.8461	20.0008	20.0283	20.0264	19.9220	19.5347	19.1110	18.7880	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9976	0.9920	0.9665	0.8818	0.6956	0.4958	0.5670	0.8619	0.9849	0.9979	0.9993	(94)
Useful gains	507.2456	594.5382	695.9795	793.8985	795.5833	622.2210	422.0985	439.5297	587.4679	560.6556	494.9020	477.8608	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1803.6554	1742.5359	1573.4446	1306.5312	1000.8253	662.6183	427.4721	450.0522	715.3501	1095.5787	1474.0173	1795.5337	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	964.5289	771.4545	652.8340	369.0955	152.7000	0.0000	0.0000	0.0000	0.0000	397.9828	704.9631	980.3486	(98)
Space heating												4993.9073	(98)
Space heating per m2											(98) / (4) =	44.4100	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8527	0.9184	0.8857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	957.2878	811.6788	802.2743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9818	1097.4674	1011.9431	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	138.7397	212.6267	155.9936	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												507.3600	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.6849	53.1567	38.9984	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												126.8400	(107)
Space cooling per m2												1.1280	(108)
Energy for space heating												44.4100	(99)
Energy for space cooling												1.1280	(108)
Total												45.5380	(109)
Target Fabric Energy Efficiency (TFEE)												52.4	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2907	0.2700	0.2769	0.2631	0.2631	0.2561	0.2492	0.2423	0.2354	0.2561	0.2423	0.2561	(22b)
Effective ac	0.5423	0.5364	0.5383	0.5346	0.5346	0.5328	0.5311	0.5294	0.5277	0.5328	0.5294	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7696	51.2137	51.3944	51.0376	51.0376	50.8660	50.6990	50.5366	50.3788	50.8660	50.5366	50.8660	(38)
Heat transfer coeff	124.2666	123.7107	123.8914	123.5346	123.5346	123.3630	123.1960	123.0336	122.8758	123.3630	123.0336	123.3630	(39)
Average = Sum(39)m / 12 =												123.4305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1051	1.1001	1.1017	1.0986	1.0986	1.0970	1.0956	1.0941	1.0927	1.0970	1.0941	1.0970	(40)
HLP (average)												1.0976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8409	63.1233	63.0312	63.2133	63.2133	63.3012	63.3870	63.4707	63.5522	63.3012	63.4707	63.3012	
alpha	5.1894	5.2082	5.2021	5.2142	5.2142	5.2201	5.2258	5.2314	5.2368	5.2201	5.2314	5.2201	
util living area													
	0.9947	0.9905	0.9732	0.9111	0.7724	0.5483	0.4014	0.4280	0.7178	0.9396	0.9879	0.9958	(86)
MIT	19.9901	20.1076	20.3733	20.6929	20.9057	20.9869	20.9979	20.9972	20.9513	20.6849	20.2950	19.9742	(87)
Th 2	19.9967	20.0007	19.9994	20.0020	20.0020	20.0032	20.0045	20.0056	20.0068	20.0032	20.0056	20.0032	(88)
util rest of house													
	0.9929	0.9874	0.9641	0.8823	0.7087	0.4581	0.3001	0.3206	0.6271	0.9124	0.9830	0.9943	(89)
MIT 2	18.6695	18.8428	19.2231	19.6631	19.9207	19.9963	20.0039	20.0049	19.9744	19.6646	19.1195	18.6514	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9570	0.8763	0.7138	0.4720	0.3161	0.3375	0.6391	0.9063	0.9782	0.9919	(94)
Useful gains	797.5796	876.8686	974.2869	1015.9742	867.1410	591.9453	376.3996	375.7616	637.8282	781.9314	768.5988	754.4908	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1736.9333	1700.0303	1536.7783	1275.5320	935.8781	598.5967	377.0327	376.6222	667.0035	1039.3735	1403.1557	1709.7761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	698.8792	553.1646	418.4936	186.8816	51.1404	0.0000	0.0000	0.0000	0.0000	191.5369	456.8809	710.7323	(98)
Space heating												3267.7095	(98)
RHI space heating demand												3268	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3461	0.3392	0.3046	0.2977	0.2631	0.2631	0.2561	0.2769	0.2977	0.3115	0.3254	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.6842	53.4531	53.2267	52.1630	51.9640	51.0376	51.0376	50.8660	51.3944	51.9640	52.3666	52.7875	(38)
Heat transfer coeff	126.1812	125.9502	125.7237	124.6600	124.4610	123.5346	123.5346	123.3630	123.8914	124.4610	124.8636	125.2845	(39)
Average = Sum(39)m / 12 =												124.6591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1201	1.1180	1.1086	1.1068	1.0986	1.0986	1.0970	1.1017	1.1068	1.1104	1.1141	(40)
HLP (average)												1.1086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8874	62.0009	62.1126	62.6426	62.7428	63.2133	63.2133	63.3012	63.0312	62.7428	62.5405	62.3304	
alpha	5.1258	5.1334	5.1408	5.1762	5.1829	5.2142	5.2142	5.2201	5.2021	5.1829	5.1694	5.1554	
util living area													
	0.9962	0.9924	0.9802	0.9370	0.8276	0.6457	0.4821	0.5390	0.7997	0.9637	0.9926	0.9971	(86)
MIT	19.8795	20.0244	20.2786	20.6037	20.8524	20.9691	20.9944	20.9902	20.9087	20.5744	20.1649	19.8489	(87)
Th 2	19.9828	19.9845	19.9861	19.9938	19.9953	20.0020	20.0020	20.0032	19.9994	19.9953	19.9924	19.9893	(88)
util rest of house													
	0.9950	0.9900	0.9735	0.9155	0.7748	0.5579	0.3759	0.4279	0.7220	0.9469	0.9897	0.9961	(89)
MIT 2	18.4983	18.7102	19.0782	19.5387	19.8560	19.9823	20.0000	19.9994	19.9292	19.5091	18.9216	18.4584	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7159	18.9172	19.2672	19.7064	20.0129	20.1377	20.1566	20.1554	20.0834	19.6769	19.1174	18.6774	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7159	18.9172	19.2672	19.7064	20.0129	20.1377	20.1566	20.1554	20.0834	19.6769	19.1174	18.6774	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9862	0.9671	0.9081	0.7758	0.5704	0.3927	0.4453	0.7293	0.9400	0.9861	0.9942	(94)
Useful gains	769.7176	860.6011	951.3374	1005.4642	920.7227	666.0056	437.2721	459.3410	680.8086	769.3510	738.0185	733.4684	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1819.0119	1765.4648	1605.1435	1347.1307	1034.6377	684.0978	439.3622	463.2801	741.2981	1129.7189	1500.5353	1813.7981	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	780.6749	608.0684	486.4317	245.9999	84.7527	0.0000	0.0000	0.0000	0.0000	268.1137	549.0121	803.7653	(98)
Space heating												3826.8189	(98)
Space heating per m2											(98) / (4) =	34.0313	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4119.2884	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	780.6749	608.0684	486.4317	245.9999	84.7527	0.0000	0.0000	0.0000	0.0000	268.1137	549.0121	803.7653	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	840.3390	654.5408	523.6079	264.8008	91.2301	0.0000	0.0000	0.0000	0.0000	288.6047	590.9710	865.1941	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2903	89.2299	89.0821	88.7043	87.8978	86.7000	86.7000	86.7000	86.7000	88.7406	89.1612	89.3189	(217)
Fuel for water heating, kWh/month													
	198.4728	174.0747	180.8113	159.5585	155.4377	137.3772	128.6798	145.6988	146.8563	165.5441	178.2427	192.5580	(219)
Water heating fuel used												1963.3118	(219)
Annual totals kWh/year													
Space heating fuel - main system												4119.2884	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5868.0467	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4119.2884	3.4800	143.3512	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.3118	3.4800	68.3232	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			303.3749	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8093	(257)
SAP value		88.7109	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4119.2884	0.2160	889.7663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.3118	0.2160	424.0753	(264)
Space and water heating			1313.8416	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1202.4884	(272)
CO2 emissions per m2			10.6900	(273)
EI value			89.7661	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact                          0.216 / 0.8819 = 0.2449, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2907	0.2700	0.2769	0.2631	0.2631	0.2561	0.2492	0.2423	0.2354	0.2561	0.2423	0.2561	(22b)
Effective ac	0.5423	0.5364	0.5383	0.5346	0.5346	0.5328	0.5311	0.5294	0.5277	0.5328	0.5294	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7696	51.2137	51.3944	51.0376	51.0376	50.8660	50.6990	50.5366	50.3788	50.8660	50.5366	50.8660	(38)
Heat transfer coeff	124.2666	123.7107	123.8914	123.5346	123.5346	123.3630	123.1960	123.0336	122.8758	123.3630	123.0336	123.3630	(39)
Average = Sum(39)m / 12 =												123.4305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1051	1.1001	1.1017	1.0986	1.0986	1.0970	1.0956	1.0941	1.0927	1.0970	1.0941	1.0970	(40)
HLP (average)												1.0976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
								Total per year (kWh/year) = Sum(64)m =				1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8409	63.1233	63.0312	63.2133	63.2133	63.3012	63.3870	63.4707	63.5522	63.3012	63.4707	63.3012	
alpha	5.1894	5.2082	5.2021	5.2142	5.2142	5.2201	5.2258	5.2314	5.2368	5.2201	5.2314	5.2201	
util living area													
	0.9947	0.9905	0.9732	0.9111	0.7724	0.5483	0.4014	0.4280	0.7178	0.9396	0.9879	0.9958	(86)
MIT	19.9901	20.1076	20.3733	20.6929	20.9057	20.9869	20.9979	20.9972	20.9513	20.6849	20.2950	19.9742	(87)
Th 2	19.9967	20.0007	19.9994	20.0020	20.0020	20.0032	20.0045	20.0056	20.0068	20.0032	20.0056	20.0032	(88)
util rest of house													
	0.9929	0.9874	0.9641	0.8823	0.7087	0.4581	0.3001	0.3206	0.6271	0.9124	0.9830	0.9943	(89)
MIT 2	18.6695	18.8428	19.2231	19.6631	19.9207	19.9963	20.0039	20.0049	19.9744	19.6646	19.1195	18.6514	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9570	0.8763	0.7138	0.4720	0.3161	0.3375	0.6391	0.9063	0.9782	0.9919	(94)
Useful gains	797.5796	876.8686	974.2869	1015.9742	867.1410	591.9453	376.3996	375.7616	637.8282	781.9314	768.5988	754.4908	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1736.9333	1700.0303	1536.7783	1275.5320	935.8781	598.5967	377.0327	376.6222	667.0035	1039.3735	1403.1557	1709.7761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	698.8792	553.1646	418.4936	186.8816	51.1404	0.0000	0.0000	0.0000	0.0000	191.5369	456.8809	710.7323	(98)
Space heating												3267.7095	(98)
Space heating per m2											(98) / (4) =	29.0592	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3517.4484	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	698.8792	553.1646	418.4936	186.8816	51.1404	0.0000	0.0000	0.0000	0.0000	191.5369	456.8809	710.7323	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	752.2919	595.4409	450.4775	201.1643	55.0489	0.0000	0.0000	0.0000	0.0000	206.1754	491.7986	765.0509	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2338	89.1784	88.9872	88.4924	87.5488	86.7000	86.7000	86.7000	86.7000	88.4824	89.0518	89.2581	(217)
Fuel for water heating, kWh/month													
	198.5985	174.1752	181.0041	159.9405	156.0574	137.3772	128.6798	145.6988	146.8563	166.0271	178.4618	192.6892	(219)
Water heating fuel used												1965.5659	(219)
Annual totals kWh/year													
Space heating fuel - main system												3517.4484	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5168.3520	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3517.4484	7.3800	259.5877	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1965.5659	7.3800	145.0588	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			421.4643	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3517.4484	0.2160	759.7688	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.5659	0.2160	424.5622	(264)
Space and water heating			1184.3311	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1021.0214	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3517.4484	1.2200	4291.2870	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.5659	1.2200	2397.9904	(264)
Space and water heating			6689.2774	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5723.2643 (272)
Primary energy kWh/m2/year 50.8961 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.2%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	B 91
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£512	£436	£76
Space heating	£388	£388	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£422	£360	£62
Total cost of uses	£421	£359	£62
Delivered energy	46 kWh/m²	37 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	41 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.7500	
Infiltration rate			0.3258	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3530	0.3461	0.3392	0.3046	0.2977	0.2631	0.2631	0.2561	0.2769	0.2977	0.3115	0.3254	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.6842	53.4531	53.2267	52.1630	51.9640	51.0376	51.0376	50.8660	51.3944	51.9640	52.3666	52.7875	(38)
Heat transfer coeff	126.1812	125.9502	125.7237	124.6600	124.4610	123.5346	123.5346	123.3630	123.8914	124.4610	124.8636	125.2845	(39)
Average = Sum(39)m / 12 =												124.6591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1221	1.1201	1.1180	1.1086	1.1068	1.0986	1.0986	1.0970	1.1017	1.1068	1.1104	1.1141	(40)
HLP (average)												1.1086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8874	62.0009	62.1126	62.6426	62.7428	63.2133	63.2133	63.3012	63.0312	62.7428	62.5405	62.3304	
alpha	5.1258	5.1334	5.1408	5.1762	5.1829	5.2142	5.2142	5.2201	5.2021	5.1829	5.1694	5.1554	
util living area													
	0.9962	0.9924	0.9802	0.9370	0.8276	0.6457	0.4821	0.5390	0.7997	0.9637	0.9926	0.9971	(86)
MIT	19.8795	20.0244	20.2786	20.6037	20.8524	20.9691	20.9944	20.9902	20.9087	20.5744	20.1649	19.8489	(87)
Th 2	19.9828	19.9845	19.9861	19.9938	19.9953	20.0020	20.0020	20.0032	19.9994	19.9953	19.9924	19.9893	(88)
util rest of house													
	0.9950	0.9900	0.9735	0.9155	0.7748	0.5579	0.3759	0.4279	0.7220	0.9469	0.9897	0.9961	(89)
MIT 2	18.4983	18.7102	19.0782	19.5387	19.8560	19.9823	20.0000	19.9994	19.9292	19.5091	18.9216	18.4584	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7159	18.9172	19.2672	19.7064	20.0129	20.1377	20.1566	20.1554	20.0834	19.6769	19.1174	18.6774	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7159	18.9172	19.2672	19.7064	20.0129	20.1377	20.1566	20.1554	20.0834	19.6769	19.1174	18.6774	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9862	0.9671	0.9081	0.7758	0.5704	0.3927	0.4453	0.7293	0.9400	0.9861	0.9942	(94)
Useful gains	769.7176	860.6011	951.3374	1005.4642	920.7227	666.0056	437.2721	459.3410	680.8086	769.3510	738.0185	733.4684	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1819.0119	1765.4648	1605.1435	1347.1307	1034.6377	684.0978	439.3622	463.2801	741.2981	1129.7189	1500.5353	1813.7981	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	780.6749	608.0684	486.4317	245.9999	84.7527	0.0000	0.0000	0.0000	0.0000	268.1137	549.0121	803.7653	(98)
Space heating												3826.8189	(98)
Space heating per m2											(98) / (4) =	34.0313	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4119.2884	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	780.6749	608.0684	486.4317	245.9999	84.7527	0.0000	0.0000	0.0000	0.0000	268.1137	549.0121	803.7653	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	840.3390	654.5408	523.6079	264.8008	91.2301	0.0000	0.0000	0.0000	0.0000	288.6047	590.9710	865.1941	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3631	89.3834	89.3906	89.3926	89.3490	86.7000	86.7000	86.7000	86.7000	89.0557	89.2740	89.3791	(217)
Fuel for water heating, kWh/month													
	169.8626	126.3141	99.3611	50.0093	19.0269	1.7238	0.0000	28.7441	55.2573	104.0617	144.2398	168.6260	(219)
Water heating fuel used												967.2266	(219)
Annual totals kWh/year													
Space heating fuel - main system												4119.2884	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4921.9615	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4119.2884	3.4800	143.3512	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.2266	3.4800	33.6595	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			275.3061	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7344	(257)
SAP value	89.7554	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4119.2884	0.2160	889.7663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.2266	0.2160	208.9209	(264)
Space and water heating			1098.6872	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1013.2840	(272)
CO2 emissions per m2			9.0100	(273)
EI value			91.3763	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1383	(8)
Pressure test		Yes	
Measured/design AP50		3.7500	
Infiltration rate		0.3258	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2769	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2907	0.2700	0.2769	0.2631	0.2631	0.2561	0.2492	0.2423	0.2354	0.2561	0.2423	0.2561	(22b)
Effective ac	0.5423	0.5364	0.5383	0.5346	0.5346	0.5328	0.5311	0.5294	0.5277	0.5328	0.5294	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.7696	51.2137	51.3944	51.0376	51.0376	50.8660	50.6990	50.5366	50.3788	50.8660	50.5366	50.8660	(38)
Heat transfer coeff	124.2666	123.7107	123.8914	123.5346	123.5346	123.3630	123.1960	123.0336	122.8758	123.3630	123.0336	123.3630	(39)
Average = Sum(39)m / 12 =												123.4305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1051	1.1001	1.1017	1.0986	1.0986	1.0970	1.0956	1.0941	1.0927	1.0970	1.0941	1.0970	(40)
HLP (average)												1.0976	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213 (44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645 (45)
Energy content (annual)										Total = Sum(45)m =		1595.1500 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262 (61)
Total heat required for water heating calculated for each month												
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2724 (H8)
Utilisation factor												0.5443 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.3830 (H14)
Volume ratio Veff/V												0.7398 (H15)
Solar storage volume factor												0.9397 (H16)
Solar input												-912.8396 (H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870 (63)
										Solar input (sum of months) = Sum(63)m =		-912.8396 (63)
Output from w/h												
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037 (64)
										Total per year (kWh/year) = Sum(64)m =		834.2051 (64)
Heat gains from water heating, kWh/month												
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906 (83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.8409	63.1233	63.0312	63.2133	63.2133	63.3012	63.3870	63.4707	63.5522	63.3012	63.4707	63.3012	
alpha	5.1894	5.2082	5.2021	5.2142	5.2142	5.2201	5.2258	5.2314	5.2368	5.2201	5.2314	5.2201	
util living area	0.9947	0.9905	0.9732	0.9111	0.7724	0.5483	0.4014	0.4280	0.7178	0.9396	0.9879	0.9958	(86)
MIT	19.9901	20.1076	20.3733	20.6929	20.9057	20.9869	20.9979	20.9972	20.9513	20.6849	20.2950	19.9742	(87)
Th 2	19.9967	20.0007	19.9994	20.0020	20.0020	20.0032	20.0045	20.0056	20.0068	20.0032	20.0056	20.0032	(88)
util rest of house	0.9929	0.9874	0.9641	0.8823	0.7087	0.4581	0.3001	0.3206	0.6271	0.9124	0.9830	0.9943	(89)
MIT 2	18.6695	18.8428	19.2231	19.6631	19.9207	19.9963	20.0039	20.0049	19.9744	19.6646	19.1195	18.6514	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8775	19.0420	19.4042	19.8253	20.0758	20.1523	20.1604	20.1611	20.1283	19.8253	19.3047	18.8597	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9832	0.9570	0.8763	0.7138	0.4720	0.3161	0.3375	0.6391	0.9063	0.9782	0.9919	(94)
Useful gains	797.5796	876.8686	974.2869	1015.9742	867.1410	591.9453	376.3996	375.7616	637.8282	781.9314	768.5988	754.4908	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1736.9333	1700.0303	1536.7783	1275.5320	935.8781	598.5967	377.0327	376.6222	667.0035	1039.3735	1403.1557	1709.7761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	698.8792	553.1646	418.4936	186.8816	51.1404	0.0000	0.0000	0.0000	0.0000	191.5369	456.8809	710.7323	(98)
Space heating												3267.7095	(98)
Space heating per m2											(98) / (4) =	29.0592	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3517.4484	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	698.8792	553.1646	418.4936	186.8816	51.1404	0.0000	0.0000	0.0000	0.0000	191.5369	456.8809	710.7323	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	752.2919	595.4409	450.4775	201.1643	55.0489	0.0000	0.0000	0.0000	0.0000	206.1754	491.7986	765.0509	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3256	89.3407	89.3256	89.2797	88.9352	86.7000	86.7000	86.7000	86.7000	88.8637	89.1985	89.3333	(217)
Fuel for water heating, kWh/month													
	165.0566	126.4628	98.8423	48.5435	23.9383	0.0000	0.0000	21.1925	49.3765	99.5616	138.6823	165.1161	(219)
Water heating fuel used												936.7727	(219)
Annual totals kWh/year													
Space heating fuel - main system												3517.4484	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4189.5588	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3517.4484	7.3800	259.5877	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.7727	7.3800	69.1338	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			359.8693	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3517.4484	0.2160	759.7688	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.7727	0.2160	202.3429	(264)
Space and water heating			962.1117	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies			
PV Unit	-850.7751	0.5190	-441.5523 (269)
Total kg/year			824.7520 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3517.4484	1.2200	4291.2870	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.7727	1.2200	1142.8627	(264)
Space and water heating			5434.1497	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4621.6366	(272)
Primary energy kWh/m2/year			41.0995	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		763.75 (P1)
Transmission heat loss coefficient		72.50 (37)
Summer heat loss coefficient		836.25 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1300	87.1704	0.7200	0.7000	0.7650	64.4293
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						693.3731

	Jun	Jul	Aug	
Solar gains	747	693	605	(P3)
Internal gains	513	491	501	
Total summer gains	1260	1185	1106	(P5)
Summer gain/loss ratio	1.51	1.42	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 358 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	8 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.46	**TER**	16.82
Environmental	90 B	**% DER<TER**	25.91		
CO_2 Emissions (t/year)	0.98	**DFEE**	46.16	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.46	$kgCO_2/m^2$	Pass
	-4.36 (-25.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.16	$kWh/m^2/yr$	
	-6.2 (-11.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.75 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.13 m², No overhang 5.77 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.75 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 359 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	10 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.17	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.42		
CO_2 Emissions (t/year)	0.95	**DFEE**	44.99	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.17 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.0 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.25 (max. 0.30)        0.27 (max. 0.70)          OK
Party wall      0.00 (max. 0.20)         -                        OK
Floor           0.18 (max. 0.25)        0.18 (max. 0.70)          OK
Roof            0.15 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.32 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         3.95 (measured in this dwelling)
Maximum                                 10.0                                    OK
-------------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
-------------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
-------------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing East:                    5.77 m², No overhang
Windows facing South:                   2.13 m², No overhang
Windows facing West:                    7.61 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------------
10 Key features
Party wall U-value                      0.00 W/m²K
Thermal bridging y-value                0.027 W/m²K
Air permeability                        4.0 m³/m²h
Photovoltaic array                      1.10 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	581.6691	696.8560	822.9682	954.8093	1038.4460	1023.6051	976.5254	900.5207	803.4645	672.6141	575.6810	545.4962	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9990	0.9973	0.9908	0.9636	0.8806	0.7159	0.5454	0.6087	0.8641	0.9836	0.9978	0.9993	(86)
MIT	19.7145	19.8766	20.1498	20.5023	20.7935	20.9502	20.9900	20.9830	20.8634	20.4652	20.0202	19.6851	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9987	0.9963	0.9874	0.9495	0.8364	0.6264	0.4278	0.4878	0.7971	0.9751	0.9968	0.9991	(89)
MIT 2	18.2556	18.4937	18.8926	19.4015	19.7890	19.9670	19.9968	19.9947	19.8848	19.3578	18.7102	18.2175	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4854	18.7115	19.0906	19.5749	19.9472	20.1219	20.1532	20.1503	20.0389	19.5322	18.9165	18.4486	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4854	18.7115	19.0906	19.5749	19.9472	20.1219	20.1532	20.1503	20.0389	19.5322	18.9165	18.4486	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9945	0.9831	0.9421	0.8340	0.6381	0.4463	0.5066	0.8004	0.9695	0.9953	0.9985	(94)
Useful gains	580.4326	693.0354	809.0835	899.5245	866.0879	653.1373	435.8597	456.2271	643.0870	652.1218	572.9699	544.6556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1795.1912	1744.4856	1587.2439	1333.6804	1028.6255	683.2795	439.6776	463.3849	737.1382	1114.0631	1478.8655	1789.6217	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	903.7804	706.5745	578.9514	312.5922	120.9280	0.0000	0.0000	0.0000	0.0000	343.6843	652.2449	926.2548	(98)
Space heating												4545.0104	(98)
Space heating per m2											(98) / (4) =	40.4181	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4892.3686	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	903.7804	706.5745	578.9514	312.5922	120.9280	0.0000	0.0000	0.0000	0.0000	343.6843	652.2449	926.2548	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	972.8530	760.5754	623.1985	336.4825	130.1700	0.0000	0.0000	0.0000	0.0000	369.9508	702.0935	997.0450	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3593	89.3060	89.1835	88.8776	88.1736	86.7000	86.7000	86.7000	86.7000	88.9173	89.2546	89.3834	(217)
Fuel for water heating, kWh/month													
	198.3195	173.9264	180.6056	159.2473	154.9515	137.3772	128.6798	145.6988	146.8563	165.2152	178.0563	192.4192	(219)
Water heating fuel used												1961.3530	(219)
Annual totals kWh/year													
Space heating fuel - main system												4892.3686	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6639.1681	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4892.3686	0.2160	1056.7516	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.3530	0.2160	423.6522	(264)
Space and water heating			1480.4039	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1369.0506	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.1700	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.3253	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3253	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3883	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	578.0397	678.5296	786.8343	898.7788	967.8699	950.9635	907.7051	842.7183	760.2169	649.1680	568.1763	544.6730	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9991	0.9976	0.9922	0.9696	0.8970	0.7386	0.5655	0.6264	0.8757	0.9853	0.9979	0.9993	(86)
MIT	19.7517	19.9018	20.1588	20.4980	20.7842	20.9474	20.9896	20.9827	20.8628	20.4781	20.0529	19.7287	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9987	0.9967	0.9893	0.9576	0.8569	0.6516	0.4480	0.5068	0.8128	0.9775	0.9970	0.9991	(89)
MIT 2	18.3275	18.5485	18.9245	19.4186	19.8046	19.9957	20.0279	20.0262	19.9125	19.3982	18.7779	18.3005	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9856	0.9508	0.8539	0.6627	0.4665	0.5254	0.8154	0.9725	0.9956	0.9985	(94)
Useful gains	576.8716	675.2250	775.5222	854.5272	826.4284	630.1670	423.4638	442.7830	619.9009	631.2970	565.6688	543.8653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1755.7043	1703.0901	1546.3461	1293.6538	997.2435	662.3243	427.4966	450.1607	715.1020	1082.9026	1441.1271	1746.5299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating												4445.6344	(98)
Space heating per m2											(98) / (4) =	39.5343	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4759.7799	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	939.0273	739.5346	614.0181	338.5130	136.0668	0.0000	0.0000	0.0000	0.0000	359.7373	674.8715	958.0112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2049	88.0054	87.5504	86.4668	84.2822	80.3000	80.3000	80.3000	80.3000	86.5213	87.7732	88.2802	(217)
Fuel for water heating, kWh/month													
	245.2720	216.6598	228.6907	207.1619	205.7679	190.2164	182.2418	203.1569	205.4005	215.0629	224.2199	239.1514	(219)
Water heating fuel used												2563.0022	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.7799	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												7858.8949	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4759.7799	0.2160	1028.1125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2563.0022	0.2160	553.6085	(264)
Space and water heating			1581.7209	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1859.9635	(272)
Emissions per m2 for space and water heating			14.0660	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0660 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.5400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	548.0180	664.0527	791.9255	926.1606	1011.3538	998.7030	953.4826	875.0933	777.1881	643.8599	544.1294	512.6893	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9993	0.9978	0.9922	0.9676	0.8896	0.7287	0.5574	0.6237	0.8764	0.9864	0.9983	0.9995	(86)
MIT	19.6864	19.8494	20.1250	20.4822	20.7810	20.9459	20.9890	20.9810	20.8523	20.4429	19.9940	19.6576	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9990	0.9970	0.9893	0.9549	0.8473	0.6393	0.4378	0.5011	0.8125	0.9791	0.9976	0.9993	(89)
MIT 2	18.7747	18.9388	19.2142	19.5701	19.8440	19.9754	19.9977	19.9963	19.9130	19.5380	19.0902	18.7514	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9183	19.0822	19.3577	19.7137	19.9916	20.1283	20.1538	20.1514	20.0610	19.6805	19.2325	18.8942	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9183	19.0822	19.3577	19.7137	19.9916	20.1283	20.1538	20.1514	20.0610	19.6805	19.2325	18.8942	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9961	0.9869	0.9505	0.8472	0.6517	0.4568	0.5204	0.8172	0.9760	0.9968	0.9990	(94)
Useful gains	547.2514	661.4540	781.5217	880.2897	856.8507	650.8567	435.5041	455.4234	635.1530	628.4347	542.3749	512.1804	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1849.9717	1791.3095	1620.9164	1351.0267	1034.1693	684.0710	439.7506	463.5156	739.8711	1132.5658	1518.4136	1845.5779	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	969.2239	759.2629	624.5097	338.9306	131.9250	0.0000	0.0000	0.0000	0.0000	375.0735	702.7478	992.0478	(98)
Space heating												4893.7213	(98)
Space heating per m2											(98) / (4) =	43.5191	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1163.1604	915.6795	939.0424	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8736	0.9319	0.9052	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1016.1157	853.3106	850.0449	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1270.7102	1215.9021	1127.8318	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	183.3080	269.7681	206.6735	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												659.7496	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	45.8270	67.4420	51.6684	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												164.9374	(107)
Space cooling per m2												1.4668	(108)
Energy for space heating												43.5191	(99)
Energy for space cooling												1.4668	(108)
Total												44.9858	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	531.2417	632.5768	742.6367	857.0777	928.4124	914.3817	872.9773	804.9206	720.8807	607.2518	523.4713	498.7167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9994	0.9983	0.9940	0.9749	0.9098	0.7587	0.5855	0.6509	0.8942	0.9890	0.9986	0.9996	(86)
MIT	19.7124	19.8634	20.1229	20.4676	20.7643	20.9401	20.9878	20.9793	20.8448	20.4451	20.0154	19.6900	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9992	0.9976	0.9917	0.9648	0.8729	0.6726	0.4652	0.5290	0.8364	0.9831	0.9980	0.9994	(89)
MIT 2	18.8202	18.9730	19.2332	19.5808	19.8576	20.0033	20.0287	20.0275	19.9366	19.5643	19.1341	18.8053	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9969	0.9898	0.9608	0.8719	0.6841	0.4842	0.5482	0.8401	0.9804	0.9973	0.9992	(94)
Useful gains	530.6152	630.5957	735.0316	823.4625	809.4985	625.5698	422.7279	441.2274	605.6230	595.3439	522.0713	498.2977	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1806.0882	1746.2898	1577.5250	1309.6182	1002.2563	662.9453	427.5361	450.2212	717.1904	1099.1754	1476.8161	1797.6427	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.9519	749.7464	626.8151	350.0321	143.4118	0.0000	0.0000	0.0000	0.0000	374.8506	687.4163	966.7127	(98)
Space heating												4847.9369	(98)
Space heating per m2											(98) / (4) =	43.1119	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8607	0.9245	0.8970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	966.2755	817.0738	812.5601	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1173.2354	1122.8308	1046.6749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	149.0112	227.4832	174.1814	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.6757	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	37.2528	56.8708	43.5453	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.6689	(107)
Space cooling per m2												1.2243	(108)
Energy for space heating												43.1119	(99)
Energy for space cooling												1.2243	(108)
Total												44.3362	(109)
Target Fabric Energy Efficiency (TFEE)												51.0	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				3.9500	
Infiltration rate				0.3358	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9936	0.9884	0.9681	0.9015	0.7624	0.5407	0.3945	0.4163	0.6945	0.9277	0.9853	0.9950	(86)
MIT	20.0133	20.1386	20.4044	20.7114	20.9110	20.9877	20.9980	20.9975	20.9580	20.7114	20.3226	19.9947	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9915	0.9847	0.9575	0.8707	0.6981	0.4514	0.2947	0.3115	0.6038	0.8967	0.9794	0.9933	(89)
MIT 2	18.7018	18.8861	19.2650	19.6850	19.9243	19.9953	20.0026	20.0037	19.9782	19.6966	19.1579	18.6800	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9799	0.9501	0.8652	0.7036	0.4651	0.3105	0.3280	0.6162	0.8912	0.9741	0.9905	(94)
Useful gains	828.0039	915.2414	1011.3653	1037.0880	873.2637	593.1933	376.8807	376.2849	643.5863	810.6185	801.8112	780.9501	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1744.2967	1708.1404	1544.5993	1280.2949	937.9202	599.4539	377.4661	377.0415	668.4245	1044.8631	1409.6670	1715.8639	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	681.7218	532.8281	396.7261	175.1090	48.1044	0.0000	0.0000	0.0000	0.0000	174.2780	437.6562	695.5758	(98)
Space heating												3141.9994	(98)
RHI space heating demand												3142	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Total per year (kWh/year) = Sum(64)m =												1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9956	0.9907	0.9762	0.9290	0.8174	0.6363	0.4728	0.5239	0.7781	0.9560	0.9911	0.9966	(86)
MIT	19.8970	20.0537	20.3099	20.6254	20.8608	20.9709	20.9948	20.9914	20.9198	20.6019	20.1872	19.8644	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9942	0.9877	0.9683	0.9055	0.7633	0.5489	0.3683	0.4151	0.6982	0.9364	0.9877	0.9955	(89)
MIT 2	18.5219	18.7506	19.1204	19.5653	19.8631	19.9821	19.9987	19.9984	19.9373	19.5442	18.9522	18.4794	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7385	18.9558	19.3078	19.7322	20.0202	20.1378	20.1555	20.1548	20.0921	19.7108	19.1467	18.6975	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7385	18.9558	19.3078	19.7322	20.0202	20.1378	20.1555	20.1548	20.0921	19.7108	19.1467	18.6975	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9835	0.9614	0.8983	0.7649	0.5614	0.3848	0.4322	0.7065	0.9294	0.9836	0.9934	(94)
Useful gains	795.5124	899.3650	990.7401	1031.2241	930.5971	668.3091	438.0486	460.4840	691.1931	801.0785	767.1522	756.1737	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1827.2164	1775.3422	1614.6241	1353.3368	1037.7325	685.2533	439.9650	463.9383	743.7332	1136.3419	1507.6720	1820.8809	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	767.5878	588.6567	464.1697	231.9212	79.7087	0.0000	0.0000	0.0000	0.0000	249.4359	533.1742	792.1422	(98)
Space heating												3706.7964	(98)
Space heating per m2											(98) / (4) =	32.9640	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3990.0930	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	767.5878	588.6567	464.1697	231.9212	79.7087	0.0000	0.0000	0.0000	0.0000	249.4359	533.1742	792.1422	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	826.2517	633.6455	499.6445	249.6460	85.8006	0.0000	0.0000	0.0000	0.0000	268.4994	573.9228	852.6826	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2819	89.2126	89.0533	88.6598	87.8522	86.7000	86.7000	86.7000	86.7000	88.6867	89.1445	89.3120	(217)
Fuel for water heating, kWh/month													
	198.4915	174.1085	180.8698	159.6385	155.5184	137.3772	128.6798	145.6988	146.8563	165.6447	178.2762	192.5730	(219)
Water heating fuel used												1963.7327	(219)
Annual totals kWh/year													
Space heating fuel - main system												3990.0930	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5739.2723	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3990.0930	3.4800	138.8552	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.7327	3.4800	68.3379	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			298.8935	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7973	(257)
SAP value		88.8776	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3990.0930	0.2160	861.8601	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.7327	0.2160	424.1663	(264)
Space and water heating			1286.0264	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1174.6731	(272)
CO2 emissions per m2			10.4500	(273)
EI value			90.0028	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8817 = 3.947, stars = 4
Water heating environmental impact	0.216 / 0.8817 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9936	0.9884	0.9681	0.9015	0.7624	0.5407	0.3945	0.4163	0.6945	0.9277	0.9853	0.9950	(86)
MIT	20.0133	20.1386	20.4044	20.7114	20.9110	20.9877	20.9980	20.9975	20.9580	20.7114	20.3226	19.9947	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9915	0.9847	0.9575	0.8707	0.6981	0.4514	0.2947	0.3115	0.6038	0.8967	0.9794	0.9933	(89)
MIT 2	18.7018	18.8861	19.2650	19.6850	19.9243	19.9953	20.0026	20.0037	19.9782	19.6966	19.1579	18.6800	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9799	0.9501	0.8652	0.7036	0.4651	0.3105	0.3280	0.6162	0.8912	0.9741	0.9905	(94)
Useful gains	828.0039	915.2414	1011.3653	1037.0880	873.2637	593.1933	376.8807	376.2849	643.5863	810.6185	801.8112	780.9501	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1744.2967	1708.1404	1544.5993	1280.2949	937.9202	599.4539	377.4661	377.0415	668.4245	1044.8631	1409.6670	1715.8639	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	681.7218	532.8281	396.7261	175.1090	48.1044	0.0000	0.0000	0.0000	0.0000	174.2780	437.6562	695.5758	(98)
Space heating												3141.9994	(98)
Space heating per m2											(98) / (4) =	27.9413	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3382.1307	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	681.7218	532.8281	396.7261	175.1090	48.1044	0.0000	0.0000	0.0000	0.0000	174.2780	437.6562	695.5758	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	733.8233	573.5502	427.0464	188.4919	51.7809	0.0000	0.0000	0.0000	0.0000	187.5974	471.1046	748.7361	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2206	89.1572	88.9520	88.4409	87.5111	86.7000	86.7000	86.7000	86.7000	88.4075	89.0247	89.2470	(217)
Fuel for water heating, kWh/month													
	198.6279	174.2165	181.0758	160.0336	156.1245	137.3772	128.6798	145.6988	146.8563	166.1678	178.5161	192.7132	(219)
Water heating fuel used												1966.0875	(219)
Annual totals kWh/year													
Space heating fuel - main system												3382.1307	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5033.5559	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3382.1307	7.3800	249.6012	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1966.0875	7.3800	145.0973	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			411.5163	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3382.1307	0.2160	730.5402	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0875	0.2160	424.6749	(264)
Space and water heating			1155.2151	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			991.9054	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3382.1307	1.2200	4126.1994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0875	1.2200	2398.6267	(264)
Space and water heating			6524.8262	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5558.8131 (272)
Primary energy kWh/m2/year 49.4336 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.8%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	A 92
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£502	£426	£76
Space heating	£378	£378	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£412	£350	£62
Total cost of uses	£411	£349	£62
Delivered energy	45 kWh/m²	36 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	49 kWh/m²	40 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3639	0.3568	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3211	0.3353	(22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5368	0.5368	0.5348	0.5407	0.5471	0.5515	0.5562	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.0551	53.8096	53.5691	52.4391	52.2277	51.2435	51.2435	51.0612	51.6226	52.2277	52.6553	53.1025	(38)
Heat transfer coeff	126.5521	126.3066	126.0661	124.9361	124.7247	123.7405	123.7405	123.5582	124.1196	124.7247	125.1523	125.5995	(39)
Average = Sum(39)m / 12 =												124.9351	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1254	1.1232	1.1211	1.1110	1.1092	1.1004	1.1004	1.0988	1.1038	1.1092	1.1130	1.1169	(40)
HLP (average)												1.1110	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7060	61.8260	61.9439	62.5042	62.6101	63.1081	63.1081	63.2012	62.9154	62.6101	62.3962	62.1740	
alpha	5.1137	5.1217	5.1296	5.1669	5.1740	5.2072	5.2072	5.2134	5.1944	5.1740	5.1597	5.1449	
util living area													
	0.9956	0.9907	0.9762	0.9290	0.8174	0.6363	0.4728	0.5239	0.7781	0.9560	0.9911	0.9966	(86)
MIT	19.8970	20.0537	20.3099	20.6254	20.8608	20.9709	20.9948	20.9914	20.9198	20.6019	20.1872	19.8644	(87)
Th 2	19.9801	19.9819	19.9837	19.9918	19.9934	20.0005	20.0005	20.0018	19.9978	19.9934	19.9903	19.9870	(88)
util rest of house													
	0.9942	0.9877	0.9683	0.9055	0.7633	0.5489	0.3683	0.4151	0.6982	0.9364	0.9877	0.9955	(89)
MIT 2	18.5219	18.7506	19.1204	19.5653	19.8631	19.9821	19.9987	19.9984	19.9373	19.5442	18.9522	18.4794	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7385	18.9558	19.3078	19.7322	20.0202	20.1378	20.1555	20.1548	20.0921	19.7108	19.1467	18.6975	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7385	18.9558	19.3078	19.7322	20.0202	20.1378	20.1555	20.1548	20.0921	19.7108	19.1467	18.6975	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9835	0.9614	0.8983	0.7649	0.5614	0.3848	0.4322	0.7065	0.9294	0.9836	0.9934	(94)
Useful gains	795.5124	899.3650	990.7401	1031.2241	930.5971	668.3091	438.0486	460.4840	691.1931	801.0785	767.1522	756.1737	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1827.2164	1775.3422	1614.6241	1353.3368	1037.7325	685.2533	439.9650	463.9383	743.7332	1136.3419	1507.6720	1820.8809	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	767.5878	588.6567	464.1697	231.9212	79.7087	0.0000	0.0000	0.0000	0.0000	249.4359	533.1742	792.1422	(98)
Space heating												3706.7964	(98)
Space heating per m2											(98) / (4) =	32.9640	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3990.0930	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	767.5878	588.6567	464.1697	231.9212	79.7087	0.0000	0.0000	0.0000	0.0000	249.4359	533.1742	792.1422	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	826.2517	633.6455	499.6445	249.6460	85.8006	0.0000	0.0000	0.0000	0.0000	268.4994	573.9228	852.6826	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3555	89.3692	89.3702	89.3670	89.3205	86.7000	86.7000	86.7000	86.7000	89.0101	89.2591	89.3727	(217)
Fuel for water heating, kWh/month	169.8770	126.3342	99.3838	50.0236	19.0329	1.7238	0.0000	28.7441	55.2573	104.1150	144.2638	168.6381	(219)
Water heating fuel used												967.3936	(219)
Annual totals kWh/year													
Space heating fuel - main system												3990.0930	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4792.9332	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3990.0930	3.4800	138.8552	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.3936	3.4800	33.6653	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			270.8159	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7224	(257)
SAP value	89.9224	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3990.0930	0.2160	861.8601	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.3936	0.2160	208.9570	(264)
Space and water heating			1070.8171	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			985.4139	(272)
CO2 emissions per m2			8.7600	(273)
EI value			91.6135	
EI rating			92	(274)
EI band			A	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			3.9500	
Infiltration rate			0.3358	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2854	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2997	0.2783	0.2854	0.2711	0.2711	0.2640	0.2569	0.2497	0.2426	0.2640	0.2497	0.2640	(22b)
Effective ac	0.5449	0.5387	0.5407	0.5368	0.5368	0.5348	0.5330	0.5312	0.5294	0.5348	0.5312	0.5348	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0211	51.4306	51.6226	51.2435	51.2435	51.0612	50.8838	50.7113	50.5436	51.0612	50.7113	51.0612	(38)
Heat transfer coeff	124.5181	123.9276	124.1196	123.7405	123.7405	123.5582	123.3808	123.2083	123.0406	123.5582	123.2083	123.5582	(39)
Average = Sum(39)m / 12 =												123.6299	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1073	1.1021	1.1038	1.1004	1.1004	1.0988	1.0972	1.0957	1.0942	1.0988	1.0957	1.0988	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2724	(H8)
Utilisation factor												0.5443	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-912.8396	(H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870	(63)
										Solar input (sum of months) = Sum(63)m =		-912.8396	(63)
Output from w/h													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
										Total per year (kWh/year) = Sum(64)m =		834.2051	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7140	63.0128	62.9154	63.1081	63.1081	63.2012	63.2921	63.3807	63.4671	63.2012	63.3807	63.2012	
alpha	5.1809	5.2009	5.1944	5.2072	5.2072	5.2134	5.2195	5.2254	5.2311	5.2134	5.2254	5.2134	
util living area													
	0.9936	0.9884	0.9681	0.9015	0.7624	0.5407	0.3945	0.4163	0.6945	0.9277	0.9853	0.9950	(86)
MIT	20.0133	20.1386	20.4044	20.7114	20.9110	20.9877	20.9980	20.9975	20.9580	20.7114	20.3226	19.9947	(87)
Th 2	19.9949	19.9991	19.9978	20.0005	20.0005	20.0018	20.0031	20.0044	20.0056	20.0018	20.0044	20.0018	(88)
util rest of house													
	0.9915	0.9847	0.9575	0.8707	0.6981	0.4514	0.2947	0.3115	0.6038	0.8967	0.9794	0.9933	(89)
MIT 2	18.7018	18.8861	19.2650	19.6850	19.9243	19.9953	20.0026	20.0037	19.9782	19.6966	19.1579	18.6800	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9084	19.0834	19.4444	19.8466	20.0797	20.1516	20.1594	20.1602	20.1326	19.8564	19.3413	18.8871	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9799	0.9501	0.8652	0.7036	0.4651	0.3105	0.3280	0.6162	0.8912	0.9741	0.9905	(94)
Useful gains	828.0039	915.2414	1011.3653	1037.0880	873.2637	593.1933	376.8807	376.2849	643.5863	810.6185	801.8112	780.9501	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1744.2967	1708.1404	1544.5993	1280.2949	937.9202	599.4539	377.4661	377.0415	668.4245	1044.8631	1409.6670	1715.8639	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	681.7218	532.8281	396.7261	175.1090	48.1044	0.0000	0.0000	0.0000	0.0000	174.2780	437.6562	695.5758	(98)
Space heating												3141.9994	(98)
Space heating per m2											(98) / (4) =	27.9413	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3382.1307	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	681.7218	532.8281	396.7261	175.1090	48.1044	0.0000	0.0000	0.0000	0.0000	174.2780	437.6562	695.5758	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	733.8233	573.5502	427.0464	188.4919	51.7809	0.0000	0.0000	0.0000	0.0000	187.5974	471.1046	748.7361	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3138	89.3232	89.3000	89.2465	88.8934	86.7000	86.7000	86.7000	86.7000	88.7964	89.1747	89.3232	(217)
Fuel for water heating, kWh/month	165.0785	126.4875	98.8707	48.5616	23.9496	0.0000	0.0000	21.1925	49.3765	99.6370	138.7194	165.1348	(219)
Water heating fuel used												937.0081	(219)
Annual totals kWh/year													
Space heating fuel - main system												3382.1307	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4054.4765	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3382.1307	7.3800	249.6012	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	937.0081	7.3800	69.1512	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			349.9002	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3382.1307	0.2160	730.5402	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0081	0.2160	202.3937	(264)
Space and water heating			932.9340	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies			
PV Unit	-850.7751	0.5190	-441.5523 (269)
Total kg/year			795.5743 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3382.1307	1.2200	4126.1994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.0081	1.2200	1143.1499	(264)
Space and water heating			5269.3493	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4456.8362	(272)
Primary energy kWh/m2/year			39.6339	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		763.75 (P1)
Transmission heat loss coefficient		72.50 (37)
Summer heat loss coefficient		836.25 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
South	2.1300	118.5567	0.7200	0.7000	0.7650	87.6274
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						716.5712

	Jun	Jul	Aug	
Solar gains	769	717	639	(P3)
Internal gains	513	491	501	
Total summer gains	1282	1208	1140	(P5)
Summer gain/loss ratio	1.53	1.44	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.18	18.99	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 359 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	10 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.17	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.42		
CO_2 Emissions (t/year)	0.95	**DFEE**	44.99	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.77		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.17	$kgCO_2/m^2$	Pass
	-4.37 (-26.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.99	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.99	$kWh/m^2/yr$	
	-6.0 (-11.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	5.77 m², No overhang 2.13 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	4.0	m³/m²h
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 360 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	12 Goldcrest Road, Boorley Green , Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.63	**TER**	16.82
Environmental	90 B	**% DER<TER**	24.90		
CO_2 Emissions (t/year)	0.99	**DFEE**	46.96	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.63 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.70 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.13 m², No overhang
Windows facing East: 5.77 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5458	55.2424	54.9451	53.5486	53.2873	52.0711	52.0711	51.8458	52.5396	53.2873	53.8159	54.3685	(38)
Heat transfer coeff	128.0428	127.7394	127.4421	126.0456	125.7844	124.5681	124.5681	124.3428	125.0366	125.7844	126.3129	126.8655	(39)
Average = Sum(39)m / 12 =												126.0444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1387	1.1360	1.1333	1.1209	1.1186	1.1078	1.1078	1.1058	1.1119	1.1186	1.1233	1.1282	(40)
HLP (average)												1.1209	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	554.7987	655.0112	776.0967	914.0632	1008.5724	1000.8682	951.7256	866.5607	758.5530	629.1703	544.2123	522.0368	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9877	61.1325	61.2751	61.9540	62.0827	62.6888	62.6888	62.8024	62.4540	62.0827	61.8229	61.5536	
alpha	5.0658	5.0755	5.0850	5.1303	5.1388	5.1793	5.1793	5.1868	5.1636	5.1388	5.1215	5.1036	
util living area													
	0.9992	0.9979	0.9929	0.9697	0.8924	0.7304	0.5614	0.6319	0.8865	0.9878	0.9983	0.9994	(86)
MIT	19.6744	19.8253	20.0975	20.4637	20.7734	20.9443	20.9884	20.9794	20.8400	20.4232	19.9824	19.6503	(87)
Th 2	19.9694	19.9716	19.9737	19.9838	19.9857	19.9945	19.9945	19.9961	19.9911	19.9857	19.9819	19.9779	(88)
util rest of house													
	0.9989	0.9972	0.9903	0.9576	0.8505	0.6408	0.4406	0.5078	0.8252	0.9812	0.9976	0.9992	(89)
MIT 2	18.1894	18.4116	18.8098	19.3422	19.7588	19.9567	19.9901	19.9874	19.8548	19.2928	18.6491	18.1602	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4233	18.6342	19.0126	19.5188	19.9186	20.1122	20.1474	20.1436	20.0100	19.4708	18.8591	18.3949	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4233	18.6342	19.0126	19.5188	19.9186	20.1122	20.1474	20.1436	20.0100	19.4708	18.8591	18.3949	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9958	0.9866	0.9504	0.8473	0.6522	0.4596	0.5271	0.8266	0.9763	0.9963	0.9987	(94)
Useful gains	553.8309	652.2400	765.7347	868.7201	854.5168	652.7195	437.3959	456.7230	627.0212	614.2829	542.1927	521.3689	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1808.3800	1754.4010	1594.6363	1338.4559	1033.7724	686.6490	441.8866	465.4902	738.9633	1115.8073	1485.3206	1800.8421	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	933.3845	740.6522	616.7028	338.2098	133.3662	0.0000	0.0000	0.0000	0.0000	373.1342	679.0521	951.9281	(98)
Space heating												4766.4297	(98)
Space heating per m2											(98) / (4) =	42.3871	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5130.7101	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	933.3845	740.6522	616.7028	338.2098	133.3662	0.0000	0.0000	0.0000	0.0000	373.1342	679.0521	951.9281	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1004.7196	797.2574	663.8351	364.0579	143.5589	0.0000	0.0000	0.0000	0.0000	401.6514	730.9495	1024.6804	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3736	89.3284	89.2181	88.9316	88.2517	86.7000	86.7000	86.7000	86.7000	88.9723	89.2751	89.3951	(217)
Fuel for water heating, kWh/month													
	198.2877	173.8827	180.5357	159.1506	154.8144	137.3772	128.6798	145.6988	146.8563	165.1129	178.0154	192.3939	(219)
Water heating fuel used												1960.8054	(219)
Annual totals kWh/year													
Space heating fuel - main system												5130.7101	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6876.9621	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5130.7101	0.2160	1108.2334	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1960.8054	0.2160	423.5340	(264)
Space and water heating			1531.7674	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1420.4141	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6300	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.7853	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.7853	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	554.5280	641.9153	745.8218	863.1260	941.7305	931.0687	886.0052	813.0034	720.9193	611.1547	540.6412	524.1460	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9992	0.9981	0.9939	0.9742	0.9055	0.7495	0.5779	0.6455	0.8942	0.9887	0.9983	0.9994	(86)
MIT	19.7320	19.8712	20.1255	20.4721	20.7712	20.9435	20.9885	20.9801	20.8449	20.4482	20.0298	19.7114	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9990	0.9975	0.9916	0.9638	0.8676	0.6629	0.4586	0.5241	0.8364	0.9826	0.9976	0.9992	(89)
MIT 2	18.2986	18.5040	18.8764	19.3829	19.7892	19.9927	20.0275	20.0250	19.8940	19.3559	18.7443	18.2752	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9884	0.9572	0.8639	0.6737	0.4774	0.5429	0.8375	0.9781	0.9965	0.9988	(94)
Useful gains	553.5998	639.4614	737.1881	826.2108	813.5939	627.2333	422.9359	441.3901	603.7916	597.7949	538.7262	523.4952	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1752.3267	1697.8911	1540.7374	1289.5153	995.4331	661.9473	427.4293	449.9845	712.8900	1078.0337	1437.2521	1743.6004	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating												4581.8205	(98)
Space heating per m2											(98) / (4) =	40.7454	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4905.5894	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	954.8745	761.5254	640.0864	357.1512	144.8484	0.0000	0.0000	0.0000	0.0000	382.5457	692.6538	971.9039	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2335	88.0585	87.6346	86.5947	84.4340	80.3000	80.3000	80.3000	80.3000	86.6671	87.8234	88.3042	(217)
Fuel for water heating, kWh/month													
	245.1925	216.5291	228.4708	206.8559	205.3979	190.2164	182.2418	203.1569	205.4005	214.7011	224.0917	239.0864	(219)
Water heating fuel used												2561.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4905.5894	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												8003.0432	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4905.5894	0.2160	1059.6073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2561.3409	0.2160	553.2496	(264)
Space and water heating			1612.8569	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1891.0995	(272)
Emissions per m2 for space and water heating			14.3429	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3429 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.8200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5458	55.2424	54.9451	53.5486	53.2873	52.0711	52.0711	51.8458	52.5396	53.2873	53.8159	54.3685	(38)
Heat transfer coeff	128.0428	127.7394	127.4421	126.0456	125.7844	124.5681	124.5681	124.3428	125.0366	125.7844	126.3129	126.8655	(39)
Average = Sum(39)m / 12 =												126.0444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1387	1.1360	1.1333	1.1209	1.1186	1.1078	1.1078	1.1058	1.1119	1.1186	1.1233	1.1282	(40)
HLP (average)												1.1209	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	521.1475	622.2079	745.0541	885.4146	981.4803	975.9661	928.6829	841.1334	732.2766	600.4162	512.6607	489.2300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9877	61.1325	61.2751	61.9540	62.0827	62.6888	62.6888	62.8024	62.4540	62.0827	61.8229	61.5536	
alpha	5.0658	5.0755	5.0850	5.1303	5.1388	5.1793	5.1793	5.1868	5.1636	5.1388	5.1215	5.1036	
util living area													
	0.9994	0.9984	0.9941	0.9733	0.9010	0.7433	0.5738	0.6476	0.8980	0.9900	0.9987	0.9996	(86)
MIT	19.6463	19.7981	20.0724	20.4430	20.7602	20.9396	20.9872	20.9770	20.8275	20.4005	19.9562	19.6229	(87)
Th 2	19.9694	19.9716	19.9737	19.9838	19.9857	19.9945	19.9945	19.9961	19.9911	19.9857	19.9819	19.9779	(88)
util rest of house													
	0.9992	0.9978	0.9918	0.9624	0.8612	0.6541	0.4511	0.5220	0.8402	0.9845	0.9982	0.9994	(89)
MIT 2	18.7261	18.8794	19.1543	19.5263	19.8202	19.9662	19.9912	19.9893	19.8891	19.4906	19.0457	18.7094	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8710	19.0241	19.2989	19.6706	19.9682	20.1195	20.1480	20.1449	20.0369	19.6339	19.1891	18.8533	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8710	19.0241	19.2989	19.6706	19.9682	20.1195	20.1480	20.1449	20.0369	19.6339	19.1891	18.8533	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9970	0.9898	0.9581	0.8603	0.6662	0.4705	0.5418	0.8434	0.9819	0.9975	0.9992	(94)
Useful gains	520.5600	620.3701	737.4603	848.3455	844.4151	650.1464	436.9715	455.7169	617.6099	589.5251	511.3870	488.8336	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1865.7096	1804.2006	1631.1182	1357.5922	1040.0158	687.5514	441.9727	465.6509	742.3235	1136.3192	1527.0106	1858.9992	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1000.7913	795.5341	664.8815	366.6577	145.5269	0.0000	0.0000	0.0000	0.0000	406.8148	731.2490	1019.4032	(98)
Space heating												5130.8585	(98)
Space heating per m2											(98) / (4) =	45.6279	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1170.9397	921.8036	945.0054	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8625	0.9237	0.8913	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1009.8991	851.4512	842.2536	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.1346	1186.9154	1088.1383	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	168.6495	249.5853	182.9383	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												601.1731	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	42.1624	62.3963	45.7346	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												150.2933	(107)
Space cooling per m2												1.3365	(108)
Energy for space heating												45.6279	(99)
Energy for space cooling												1.3365	(108)
Total												46.9644	(109)
Dwelling Fabric Energy Efficiency (DFEE)												47.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7520	(36)
Total fabric heat loss	(33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

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Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645 (45)
Energy content (annual)										Total = Sum(45)m =		1595.1500 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	507.7301	595.9626	701.6242	821.4249	902.2730	894.4869	851.2775	775.2057	681.5832	569.2385	495.9363	478.1897	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9995	0.9987	0.9954	0.9790	0.9179	0.7698	0.5986	0.6710	0.9116	0.9918	0.9989	0.9996	(86)
MIT	19.6926	19.8328	20.0893	20.4410	20.7503	20.9357	20.9865	20.9761	20.8251	20.4146	19.9923	19.6727	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9993	0.9982	0.9936	0.9702	0.8832	0.6843	0.4765	0.5476	0.8595	0.9872	0.9984	0.9995	(89)
MIT 2	18.8005	18.9424	19.2000	19.5555	19.8461	20.0008	20.0283	20.0264	19.9220	19.5347	19.1110	18.7880	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9976	0.9920	0.9665	0.8818	0.6956	0.4958	0.5670	0.8619	0.9849	0.9979	0.9993	(94)
Useful gains	507.2456	594.5382	695.9795	793.8985	795.5833	622.2210	422.0985	439.5297	587.4679	560.6556	494.9020	477.8608	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1803.6554	1742.5359	1573.4446	1306.5312	1000.8253	662.6183	427.4721	450.0522	715.3501	1095.5787	1474.0173	1795.5337	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	964.5289	771.4545	652.8340	369.0955	152.7000	0.0000	0.0000	0.0000	0.0000	397.9828	704.9631	980.3486	(98)
Space heating												4993.9073	(98)
Space heating per m2											(98) / (4) =	44.4100	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8527	0.9184	0.8857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	957.2878	811.6788	802.2743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9818	1097.4674	1011.9431	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	138.7397	212.6267	155.9936	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												507.3600	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.6849	53.1567	38.9984	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												126.8400	(107)
Space cooling per m2												1.1280	(108)
Energy for space heating												44.4100	(99)
Energy for space cooling												1.1280	(108)
Total												45.5380	(109)
Target Fabric Energy Efficiency (TFEE)												52.4	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3331	0.3093	0.3173	0.3014	0.3014	0.2935	0.2855	0.2776	0.2697	0.2935	0.2776	0.2935	(22b)
Effective ac	0.5555	0.5478	0.5503	0.5454	0.5454	0.5431	0.5408	0.5385	0.5364	0.5431	0.5385	0.5431	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0321	52.3023	52.5396	52.0711	52.0711	51.8458	51.6266	51.4134	51.2061	51.8458	51.4134	51.8458	(38)
Heat transfer coeff	125.5291	124.7993	125.0366	124.5681	124.5681	124.3428	124.1236	123.9104	123.7031	124.3428	123.9104	124.3428	(39)
Average = Sum(39)m / 12 =												124.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1163	1.1098	1.1119	1.1078	1.1078	1.1058	1.1038	1.1019	1.1001	1.1058	1.1019	1.1058	(40)
HLP (average)												1.1065	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
								Total per year (kWh/year) = Sum(64)m =				1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2089	62.5727	62.4540	62.6888	62.6888	62.8024	62.9133	63.0216	63.1272	62.8024	63.0216	62.8024	
alpha	5.1473	5.1715	5.1636	5.1793	5.1793	5.1868	5.1942	5.2014	5.2085	5.1868	5.2014	5.1868	
util living area													
	0.9947	0.9906	0.9736	0.9126	0.7756	0.5520	0.4043	0.4309	0.7207	0.9406	0.9880	0.9958	(86)
MIT	19.9751	20.0949	20.3614	20.6848	20.9019	20.9862	20.9977	20.9970	20.9494	20.6782	20.2864	19.9627	(87)
Th 2	19.9875	19.9928	19.9911	19.9945	19.9945	19.9961	19.9977	19.9993	20.0008	19.9961	19.9993	19.9961	(88)
util rest of house													
	0.9929	0.9875	0.9646	0.8840	0.7119	0.4608	0.3016	0.3221	0.6297	0.9135	0.9832	0.9943	(89)
MIT 2	18.6411	18.8186	19.1998	19.6464	19.9097	19.9888	19.9971	19.9984	19.9672	19.6500	19.1024	18.6294	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9575	0.8778	0.7168	0.4748	0.3179	0.3393	0.6416	0.9073	0.9784	0.9919	(94)
Useful gains	797.6043	876.9547	974.7530	1017.7315	870.7936	595.4843	378.4818	377.7159	640.3757	782.8144	768.6952	754.4997	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1751.2785	1712.1925	1548.2950	1284.2909	942.4777	602.5465	379.1598	378.6323	670.7004	1045.9632	1411.2028	1720.8286	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.5335	561.2798	426.7152	191.9228	53.3329	0.0000	0.0000	0.0000	0.0000	195.7826	462.6055	718.9487	(98)
Space heating												3320.1212	(98)
RHI space heating demand												3320	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5458	55.2424	54.9451	53.5486	53.2873	52.0711	52.0711	51.8458	52.5396	53.2873	53.8159	54.3685	(38)
Heat transfer coeff	128.0428	127.7394	127.4421	126.0456	125.7844	124.5681	124.5681	124.3428	125.0366	125.7844	126.3129	126.8655	(39)
Average = Sum(39)m / 12 =												126.0444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1387	1.1360	1.1333	1.1209	1.1186	1.1078	1.1078	1.1058	1.1119	1.1186	1.1233	1.1282	(40)
HLP (average)												1.1209	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9877	61.1325	61.2751	61.9540	62.0827	62.6888	62.6888	62.8024	62.4540	62.0827	61.8229	61.5536	
alpha	5.0658	5.0755	5.0850	5.1303	5.1388	5.1793	5.1793	5.1868	5.1636	5.1388	5.1215	5.1036	
util living area													
	0.9963	0.9925	0.9806	0.9383	0.8310	0.6496	0.4857	0.5426	0.8031	0.9644	0.9927	0.9971	(86)
MIT	19.8569	20.0032	20.2600	20.5918	20.8458	20.9674	20.9940	20.9897	20.9049	20.5642	20.1500	19.8296	(87)
Th 2	19.9694	19.9716	19.9737	19.9838	19.9857	19.9945	19.9945	19.9961	19.9911	19.9857	19.9819	19.9779	(88)
util rest of house													
	0.9950	0.9901	0.9740	0.9172	0.7783	0.5611	0.3781	0.4303	0.7253	0.9478	0.9898	0.9961	(89)
MIT 2	18.4557	18.6700	19.0424	19.5145	19.8399	19.9737	19.9923	19.9920	19.9177	19.4877	18.8924	18.4221	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.6764	18.8800	19.2342	19.6842	19.9983	20.1302	20.1501	20.1491	20.0732	19.6572	19.0904	18.6438	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6764	18.8800	19.2342	19.6842	19.9983	20.1302	20.1501	20.1491	20.0732	19.6572	19.0904	18.6438	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9863	0.9676	0.9095	0.7790	0.5736	0.3951	0.4479	0.7324	0.9407	0.9861	0.9942	(94)
Useful gains	769.7206	860.6805	951.7667	1007.0376	924.5700	669.7870	439.9897	461.9932	683.6859	769.9865	738.0756	733.4626	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1840.7959	1785.7952	1622.8681	1359.3005	1043.7977	688.8876	442.2283	466.1781	746.8685	1139.2542	1514.5471	1832.4145	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	796.8801	621.6771	499.2994	253.6293	88.7054	0.0000	0.0000	0.0000	0.0000	274.7352	559.0595	817.6202	(98)
Space heating												3911.6061	(98)
Space heating per m2											(98) / (4) =	34.7853	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4210.5556	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	796.8801	621.6771	499.2994	253.6293	88.7054	0.0000	0.0000	0.0000	0.0000	274.7352	559.0595	817.6202	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	857.7826	669.1896	537.4590	273.0133	95.4848	0.0000	0.0000	0.0000	0.0000	295.7322	601.7863	880.1078	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3004	89.2416	89.0979	88.7271	87.9322	86.7000	86.7000	86.7000	86.7000	88.7586	89.1715	89.3270	(217)
Fuel for water heating, kWh/month													
	198.4504	174.0519	180.7792	159.5175	155.3770	137.3772	128.6798	145.6988	146.8563	165.5106	178.2222	192.5406	(219)
Water heating fuel used												1963.0614	(219)
Annual totals kWh/year													
Space heating fuel - main system												4210.5556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5959.0636	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4210.5556	3.4800	146.5273	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.0614	3.4800	68.3145	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			306.5423	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8177	(257)
SAP value		88.5930	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4210.5556	0.2160	909.4800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.0614	0.2160	424.0213	(264)
Space and water heating			1333.5013	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1222.1480	(272)
CO2 emissions per m2			10.8700	(273)
EI value			89.5987	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8820 = 3.946, stars = 4
Water heating environmental impact                              0.216 / 0.8820 = 0.2449, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3331	0.3093	0.3173	0.3014	0.3014	0.2935	0.2855	0.2776	0.2697	0.2935	0.2776	0.2935	(22b)
Effective ac	0.5555	0.5478	0.5503	0.5454	0.5454	0.5431	0.5408	0.5385	0.5364	0.5431	0.5385	0.5431	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0321	52.3023	52.5396	52.0711	52.0711	51.8458	51.6266	51.4134	51.2061	51.8458	51.4134	51.8458	(38)
Heat transfer coeff	125.5291	124.7993	125.0366	124.5681	124.5681	124.3428	124.1236	123.9104	123.7031	124.3428	123.9104	124.3428	(39)
Average = Sum(39)m / 12 =												124.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1163	1.1098	1.1119	1.1078	1.1078	1.1058	1.1038	1.1019	1.1001	1.1058	1.1019	1.1058	(40)
HLP (average)												1.1065	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2089	62.5727	62.4540	62.6888	62.6888	62.8024	62.9133	63.0216	63.1272	62.8024	63.0216	62.8024	
alpha	5.1473	5.1715	5.1636	5.1793	5.1793	5.1868	5.1942	5.2014	5.2085	5.1868	5.2014	5.1868	
util living area													
	0.9947	0.9906	0.9736	0.9126	0.7756	0.5520	0.4043	0.4309	0.7207	0.9406	0.9880	0.9958	(86)
MIT	19.9751	20.0949	20.3614	20.6848	20.9019	20.9862	20.9977	20.9970	20.9494	20.6782	20.2864	19.9627	(87)
Th 2	19.9875	19.9928	19.9911	19.9945	19.9945	19.9961	19.9977	19.9993	20.0008	19.9961	19.9993	19.9961	(88)
util rest of house													
	0.9929	0.9875	0.9646	0.8840	0.7119	0.4608	0.3016	0.3221	0.6297	0.9135	0.9832	0.9943	(89)
MIT 2	18.6411	18.8186	19.1998	19.6464	19.9097	19.9888	19.9971	19.9984	19.9672	19.6500	19.1024	18.6294	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9575	0.8778	0.7168	0.4748	0.3179	0.3393	0.6416	0.9073	0.9784	0.9919	(94)
Useful gains	797.6043	876.9547	974.7530	1017.7315	870.7936	595.4843	378.4818	377.7159	640.3757	782.8144	768.6952	754.4997	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1751.2785	1712.1925	1548.2950	1284.2909	942.4777	602.5465	379.1598	378.6323	670.7004	1045.9632	1411.2028	1720.8286	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.5335	561.2798	426.7152	191.9228	53.3329	0.0000	0.0000	0.0000	0.0000	195.7826	462.6055	718.9487	(98)
Space heating												3320.1212	(98)
Space heating per m2											(98) / (4) =	29.5253	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3573.8656	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	709.5335	561.2798	426.7152	191.9228	53.3329	0.0000	0.0000	0.0000	0.0000	195.7826	462.6055	718.9487	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	763.7605	604.1763	459.3275	206.5908	57.4090	0.0000	0.0000	0.0000	0.0000	210.7456	497.9607	773.8953	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2417	89.1865	88.9998	88.5134	87.5752	86.7000	86.7000	86.7000	86.7000	88.4997	89.0595	89.2640	(217)
Fuel for water heating, kWh/month													
	198.5808	174.1594	180.9784	159.9026	156.0103	137.3772	128.6798	145.6988	146.8563	165.9947	178.4463	192.6765	(219)
Water heating fuel used												1965.3611	(219)
Annual totals kWh/year													
Space heating fuel - main system												3573.8656	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5224.5644	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3573.8656	7.3800	263.7513	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1965.3611	7.3800	145.0436	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			425.6127	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3573.8656	0.2160	771.9550	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.3611	0.2160	424.5180	(264)
Space and water heating			1196.4730	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1033.1633	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3573.8656	1.2200	4360.1161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.3611	1.2200	2397.7405	(264)
Space and water heating			6757.8566	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year	5791.8435 (272)
Primary energy kWh/m2/year	51.5059 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 89
Current environmental impact rating:	B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.75 kg/m²	B 90	B 91
Total Savings	£62	1.75 kg/m²		

Potential energy efficiency rating:	B 90
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£516	£440	£76
Space heating	£392	£392	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£426	£364	£62
Total cost of uses	£425	£363	£62
Delivered energy	46 kWh/m²	38 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	52 kWh/m²	42 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4045	0.3966	0.3887	0.3490	0.3411	0.3014	0.3014	0.2935	0.3173	0.3411	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.5458	55.2424	54.9451	53.5486	53.2873	52.0711	52.0711	51.8458	52.5396	53.2873	53.8159	54.3685	(38)
Heat transfer coeff	128.0428	127.7394	127.4421	126.0456	125.7844	124.5681	124.5681	124.3428	125.0366	125.7844	126.3129	126.8655	(39)
Average = Sum(39)m / 12 =												126.0444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1387	1.1360	1.1333	1.1209	1.1186	1.1078	1.1078	1.1058	1.1119	1.1186	1.1233	1.1282	(40)
HLP (average)												1.1209	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9877	61.1325	61.2751	61.9540	62.0827	62.6888	62.6888	62.8024	62.4540	62.0827	61.8229	61.5536	
alpha	5.0658	5.0755	5.0850	5.1303	5.1388	5.1793	5.1793	5.1868	5.1636	5.1388	5.1215	5.1036	
util living area													
	0.9963	0.9925	0.9806	0.9383	0.8310	0.6496	0.4857	0.5426	0.8031	0.9644	0.9927	0.9971	(86)
MIT	19.8569	20.0032	20.2600	20.5918	20.8458	20.9674	20.9940	20.9897	20.9049	20.5642	20.1500	19.8296	(87)
Th 2	19.9694	19.9716	19.9737	19.9838	19.9857	19.9945	19.9945	19.9961	19.9911	19.9857	19.9819	19.9779	(88)
util rest of house													
	0.9950	0.9901	0.9740	0.9172	0.7783	0.5611	0.3781	0.4303	0.7253	0.9478	0.9898	0.9961	(89)
MIT 2	18.4557	18.6700	19.0424	19.5145	19.8399	19.9737	19.9923	19.9920	19.9177	19.4877	18.8924	18.4221	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.6764	18.8800	19.2342	19.6842	19.9983	20.1302	20.1501	20.1491	20.0732	19.6572	19.0904	18.6438	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6764	18.8800	19.2342	19.6842	19.9983	20.1302	20.1501	20.1491	20.0732	19.6572	19.0904	18.6438	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9863	0.9676	0.9095	0.7790	0.5736	0.3951	0.4479	0.7324	0.9407	0.9861	0.9942	(94)
Useful gains	769.7206	860.6805	951.7667	1007.0376	924.5700	669.7870	439.9897	461.9932	683.6859	769.9865	738.0756	733.4626	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1840.7959	1785.7952	1622.8681	1359.3005	1043.7977	688.8876	442.2283	466.1781	746.8685	1139.2542	1514.5471	1832.4145	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	796.8801	621.6771	499.2994	253.6293	88.7054	0.0000	0.0000	0.0000	0.0000	274.7352	559.0595	817.6202	(98)
Space heating												3911.6061	(98)
Space heating per m2											(98) / (4) =	34.7853	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4210.5556	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	796.8801	621.6771	499.2994	253.6293	88.7054	0.0000	0.0000	0.0000	0.0000	274.7352	559.0595	817.6202	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	857.7826	669.1896	537.4590	273.0133	95.4848	0.0000	0.0000	0.0000	0.0000	295.7322	601.7863	880.1078	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3722	89.3929	89.4017	89.4055	89.3695	86.7000	86.7000	86.7000	86.7000	89.0708	89.2831	89.3865	(217)
Fuel for water heating, kWh/month													
	169.8452	126.3006	99.3488	50.0020	19.0225	1.7238	0.0000	28.7441	55.2573	104.0441	144.2251	168.6120	(219)
Water heating fuel used												967.1256	(219)
Annual totals kWh/year													
Space heating fuel - main system												4210.5556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5013.1278	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4210.5556	3.4800	146.5273	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.1256	3.4800	33.6560	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			278.4787	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7428	(257)
SAP value	89.6373	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4210.5556	0.2160	909.4800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.1256	0.2160	208.8991	(264)
Space and water heating			1118.3791	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1032.9759	(272)
CO2 emissions per m2			9.1900	(273)
EI value			91.2087	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.7000	
Infiltration rate			0.3733	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3173	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3331	0.3093	0.3173	0.3014	0.3014	0.2935	0.2855	0.2776	0.2697	0.2935	0.2776	0.2935	(22b)
Effective ac	0.5555	0.5478	0.5503	0.5454	0.5454	0.5431	0.5408	0.5385	0.5364	0.5431	0.5385	0.5431	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0321	52.3023	52.5396	52.0711	52.0711	51.8458	51.6266	51.4134	51.2061	51.8458	51.4134	51.8458	(38)
Heat transfer coeff	125.5291	124.7993	125.0366	124.5681	124.5681	124.3428	124.1236	123.9104	123.7031	124.3428	123.9104	124.3428	(39)
Average = Sum(39)m / 12 =												124.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1163	1.1098	1.1119	1.1078	1.1078	1.1058	1.1038	1.1019	1.1001	1.1058	1.1019	1.1058	(40)
HLP (average)												1.1065	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2724	(H8)
Utilisation factor												0.5443	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-912.8396	(H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870	(63)
								Solar input (sum of months) = Sum(63)m =				-912.8396	(63)
Output from w/h													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
								Total per year (kWh/year) = Sum(64)m =				834.2051	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2089	62.5727	62.4540	62.6888	62.6888	62.8024	62.9133	63.0216	63.1272	62.8024	63.0216	62.8024	
alpha	5.1473	5.1715	5.1636	5.1793	5.1793	5.1868	5.1942	5.2014	5.2085	5.1868	5.2014	5.1868	
util living area													
	0.9947	0.9906	0.9736	0.9126	0.7756	0.5520	0.4043	0.4309	0.7207	0.9406	0.9880	0.9958	(86)
MIT	19.9751	20.0949	20.3614	20.6848	20.9019	20.9862	20.9977	20.9970	20.9494	20.6782	20.2864	19.9627	(87)
Th 2	19.9875	19.9928	19.9911	19.9945	19.9945	19.9961	19.9977	19.9993	20.0008	19.9961	19.9993	19.9961	(88)
util rest of house													
	0.9929	0.9875	0.9646	0.8840	0.7119	0.4608	0.3016	0.3221	0.6297	0.9135	0.9832	0.9943	(89)
MIT 2	18.6411	18.8186	19.1998	19.6464	19.9097	19.9888	19.9971	19.9984	19.9672	19.6500	19.1024	18.6294	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8512	19.0196	19.3827	19.8100	20.0660	20.1458	20.1547	20.1557	20.1219	19.8119	19.2889	18.8394	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9575	0.8778	0.7168	0.4748	0.3179	0.3393	0.6416	0.9073	0.9784	0.9919	(94)
Useful gains	797.6043	876.9547	974.7530	1017.7315	870.7936	595.4843	378.4818	377.7159	640.3757	782.8144	768.6952	754.4997	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1751.2785	1712.1925	1548.2950	1284.2909	942.4777	602.5465	379.1598	378.6323	670.7004	1045.9632	1411.2028	1720.8286	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	709.5335	561.2798	426.7152	191.9228	53.3329	0.0000	0.0000	0.0000	0.0000	195.7826	462.6055	718.9487	(98)
Space heating												3320.1212	(98)
Space heating per m2											(98) / (4) =	29.5253	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3573.8656	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	709.5335	561.2798	426.7152	191.9228	53.3329	0.0000	0.0000	0.0000	0.0000	195.7826	462.6055	718.9487	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	763.7605	604.1763	459.3275	206.5908	57.4090	0.0000	0.0000	0.0000	0.0000	210.7456	497.9607	773.8953	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3327	89.3474	89.3347	89.2929	88.9632	86.7000	86.7000	86.7000	86.7000	88.8790	89.2053	89.3387	(217)
Fuel for water heating, kWh/month	165.0435	126.4533	98.8322	48.5363	23.9308	0.0000	0.0000	21.1925	49.3765	99.5445	138.6718	165.1062	(219)
Water heating fuel used												936.6877	(219)
Annual totals kWh/year													
Space heating fuel - main system												3573.8656	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4245.8911	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3573.8656	7.3800	263.7513	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.6877	7.3800	69.1276	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			364.0266	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3573.8656	0.2160	771.9550	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.6877	0.2160	202.3245	(264)
Space and water heating			974.2795	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies			
PV Unit	-850.7751	0.5190	-441.5523 (269)
Total kg/year			836.9198 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3573.8656	1.2200	4360.1161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.6877	1.2200	1142.7590	(264)
Space and water heating			5502.8751	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4690.3620	(272)
Primary energy kWh/m2/year			41.7106	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		763.75 (P1)
Transmission heat loss coefficient		72.50 (37)
Summer heat loss coefficient		836.25 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1300	87.1704	0.7200	0.7000	0.7650	64.4293
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						693.3731

	Jun	Jul	Aug	
Solar gains	747	693	605	(P3)
Internal gains	513	491	501	
Total summer gains	1260	1185	1106	(P5)
Summer gain/loss ratio	1.51	1.42	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 360 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	12 Goldcrest Road, Boorley Green , Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.63	**TER**	16.82
Environmental	90 B	**% DER<TER**	24.90		
CO_2 Emissions (t/year)	0.99	**DFEE**	46.96	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.32		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.63	$kgCO_2/m^2$	Pass
	-4.19 (-24.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.96	$kWh/m^2/yr$	
	-5.4 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.70 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.13 m², No overhang 5.77 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.70 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 361 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	14 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.23	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.06		
CO_2 Emissions (t/year)	0.96	**DFEE**	45.25	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.25		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.23 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.27 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 5.77 m², No overhang
Windows facing South: 2.13 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1383	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3518	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3812	0.3738	0.3663	0.3289	0.3214	0.2841	0.2841	0.2766	0.2990	0.3214	0.3364	0.3513	(22b)
Effective ac	0.5727	0.5698	0.5671	0.5541	0.5517	0.5403	0.5403	0.5382	0.5447	0.5517	0.5566	0.5617	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.6718	54.4024	54.1384	52.8981	52.6661	51.5859	51.5859	51.3858	52.0019	52.6661	53.1355	53.6263	(38)
Heat transfer coeff	127.1688	126.8994	126.6354	125.3951	125.1631	124.0829	124.0829	123.8828	124.4989	125.1631	125.6325	126.1233	(39)
Average = Sum(39)m / 12 =												125.3940	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1309	1.1285	1.1261	1.1151	1.1131	1.1034	1.1034	1.1017	1.1071	1.1131	1.1172	1.1216	(40)
HLP (average)												1.1151	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	581.6691	696.8560	822.9682	954.8093	1038.4460	1023.6051	976.5254	900.5207	803.4645	672.6141	575.6810	545.4962	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4068	61.5371	61.6655	62.2754	62.3908	62.9340	62.9340	63.0356	62.7236	62.3908	62.1577	61.9158	
alpha	5.0938	5.1025	5.1110	5.1517	5.1594	5.1956	5.1956	5.2024	5.1816	5.1594	5.1438	5.1277	
util living area													
	0.9990	0.9973	0.9908	0.9638	0.8815	0.7171	0.5467	0.6100	0.8649	0.9837	0.9978	0.9993	(86)
MIT	19.7071	19.8696	20.1437	20.4982	20.7909	20.9494	20.9898	20.9827	20.8619	20.4618	20.0154	19.6788	(87)
Th 2	19.9757	19.9776	19.9795	19.9885	19.9902	19.9980	19.9980	19.9995	19.9950	19.9902	19.9868	19.9832	(88)
util rest of house													
	0.9987	0.9963	0.9874	0.9498	0.8373	0.6274	0.4286	0.4886	0.7980	0.9752	0.9968	0.9990	(89)
MIT 2	18.2417	18.4806	18.8807	19.3933	19.7831	19.9640	19.9942	19.9922	19.8807	19.3505	18.7007	18.2057	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.4725	18.6993	19.0796	19.5673	19.9419	20.1192	20.1510	20.1482	20.0352	19.5256	18.9077	18.4377	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4725	18.6993	19.0796	19.5673	19.9419	20.1192	20.1510	20.1482	20.0352	19.5256	18.9077	18.4377	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9945	0.9832	0.9424	0.8349	0.6391	0.4472	0.5075	0.8012	0.9696	0.9953	0.9985	(94)
Useful gains	580.4273	693.0324	809.1205	899.7784	866.9503	654.2140	436.7236	457.0476	643.7403	652.1862	572.9669	544.6518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1802.3032	1751.1279	1593.0267	1337.6240	1031.5761	684.8396	440.6224	464.3369	738.9275	1117.1513	1483.4323	1795.7001	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	909.0757	711.0401	583.2262	315.2488	122.4816	0.0000	0.0000	0.0000	0.0000	345.9340	655.5351	930.7799	(98)
Space heating												4573.3214	(98)
Space heating per m2											(98) / (4) =	40.6698	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4922.8433	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	909.0757	711.0401	583.2262	315.2488	122.4816	0.0000	0.0000	0.0000	0.0000	345.9340	655.5351	930.7799	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	978.5529	765.3823	627.8000	339.3421	131.8424	0.0000	0.0000	0.0000	0.0000	372.3724	705.6352	1001.9159	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3619	89.3090	89.1876	88.8835	88.1838	86.7000	86.7000	86.7000	86.7000	88.9217	89.2572	89.3855	(217)
Fuel for water heating, kWh/month													
	198.3137	173.9204	180.5973	159.2367	154.9337	137.3772	128.6798	145.6988	146.8563	165.2070	178.0511	192.4146	(219)
Water heating fuel used												1961.2867	(219)
Annual totals kWh/year													
Space heating fuel - main system												4922.8433	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6669.5765	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4922.8433	0.2160	1063.3342	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.2867	0.2160	423.6379	(264)
Space and water heating			1486.9721	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1375.6188	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.2300	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.3853	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3853	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	578.0397	678.5296	786.8343	898.7788	967.8699	950.9635	907.7051	842.7183	760.2169	649.1680	568.1763	544.6730	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9991	0.9976	0.9922	0.9696	0.8970	0.7386	0.5655	0.6264	0.8757	0.9853	0.9979	0.9993	(86)
MIT	19.7517	19.9018	20.1588	20.4980	20.7842	20.9474	20.9896	20.9827	20.8628	20.4781	20.0529	19.7287	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9987	0.9967	0.9893	0.9576	0.8569	0.6516	0.4480	0.5068	0.8128	0.9775	0.9970	0.9991	(89)
MIT 2	18.3275	18.5485	18.9245	19.4186	19.8046	19.9957	20.0279	20.0262	19.9125	19.3982	18.7779	18.3005	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9856	0.9508	0.8539	0.6627	0.4665	0.5254	0.8154	0.9725	0.9956	0.9985	(94)
Useful gains	576.8716	675.2250	775.5222	854.5272	826.4284	630.1670	423.4638	442.7830	619.9009	631.2970	565.6688	543.8653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1755.7043	1703.0901	1546.3461	1293.6538	997.2435	662.3243	427.4966	450.1607	715.1020	1082.9026	1441.1271	1746.5299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating												4445.6344	(98)
Space heating per m2											(98) / (4) =	39.5343	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4759.7799	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	939.0273	739.5346	614.0181	338.5130	136.0668	0.0000	0.0000	0.0000	0.0000	359.7373	674.8715	958.0112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2049	88.0054	87.5504	86.4668	84.2822	80.3000	80.3000	80.3000	80.3000	86.5213	87.7732	88.2802	(217)
Fuel for water heating, kWh/month													
	245.2720	216.6598	228.6907	207.1619	205.7679	190.2164	182.2418	203.1569	205.4005	215.0629	224.2199	239.1514	(219)
Water heating fuel used												2563.0022	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.7799	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												7858.8949	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4759.7799	0.2160	1028.1125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2563.0022	0.2160	553.6085	(264)
Space and water heating			1581.7209	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1859.9635	(272)
Emissions per m2 for space and water heating			14.0660	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0660 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.5400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3812	0.3738	0.3663	0.3289	0.3214	0.2841	0.2841	0.2766	0.2990	0.3214	0.3364	0.3513	(22b)
Effective ac	0.5727	0.5698	0.5671	0.5541	0.5517	0.5403	0.5403	0.5382	0.5447	0.5517	0.5566	0.5617	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.6718	54.4024	54.1384	52.8981	52.6661	51.5859	51.5859	51.3858	52.0019	52.6661	53.1355	53.6263	(38)
Heat transfer coeff	127.1688	126.8994	126.6354	125.3951	125.1631	124.0829	124.0829	123.8828	124.4989	125.1631	125.6325	126.1233	(39)
Average = Sum(39)m / 12 =												125.3940	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1309	1.1285	1.1261	1.1151	1.1131	1.1034	1.1034	1.1017	1.1071	1.1131	1.1172	1.1216	(40)
HLP (average)												1.1151	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	548.0180	664.0527	791.9255	926.1606	1011.3538	998.7030	953.4826	875.0933	777.1881	643.8599	544.1294	512.6893	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4068	61.5371	61.6655	62.2754	62.3908	62.9340	62.9340	63.0356	62.7236	62.3908	62.1577	61.9158	
alpha	5.0938	5.1025	5.1110	5.1517	5.1594	5.1956	5.1956	5.2024	5.1816	5.1594	5.1438	5.1277	
util living area													
	0.9993	0.9978	0.9922	0.9678	0.8904	0.7299	0.5587	0.6250	0.8771	0.9864	0.9983	0.9995	(86)
MIT	19.6791	19.8425	20.1189	20.4781	20.7784	20.9451	20.9888	20.9807	20.8507	20.4395	19.9892	19.6513	(87)
Th 2	19.9757	19.9776	19.9795	19.9885	19.9902	19.9980	19.9980	19.9995	19.9950	19.9902	19.9868	19.9832	(88)
util rest of house													
	0.9990	0.9970	0.9893	0.9552	0.8482	0.6404	0.4386	0.5020	0.8133	0.9792	0.9976	0.9993	(89)
MIT 2	18.7638	18.9285	19.2049	19.5634	19.8390	19.9726	19.9951	19.9939	19.9093	19.5321	19.0826	18.7422	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9079	19.0724	19.3488	19.7074	19.9870	20.1257	20.1516	20.1493	20.0575	19.6750	19.2254	18.8854	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9079	19.0724	19.3488	19.7074	19.9870	20.1257	20.1516	20.1493	20.0575	19.6750	19.2254	18.8854	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9961	0.9869	0.9507	0.8480	0.6528	0.4577	0.5214	0.8180	0.9761	0.9968	0.9990	(94)
Useful gains	547.2477	661.4512	781.5497	880.5116	857.6640	651.9103	436.3621	456.2328	635.7611	628.4839	542.3723	512.1778	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1857.6755	1798.4758	1627.1145	1355.1977	1037.2207	685.6475	440.6972	464.4708	741.7084	1135.8541	1523.3386	1852.1647	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	974.9583	764.0805	629.1002	341.7740	133.5902	0.0000	0.0000	0.0000	0.0000	377.4834	706.2957	996.9503	(98)
Space heating												4924.2325	(98)
Space heating per m2											(98) / (4) =	43.7904	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1166.3790	918.2132	941.5095	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8723	0.9310	0.9042	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1017.3924	854.8238	851.2676	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1270.7102	1215.9021	1127.8318	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	182.3888	268.6423	205.7637	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												656.7948	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	45.5972	67.1606	51.4409	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												164.1987	(107)
Space cooling per m2												1.4602	(108)
Energy for space heating												43.7904	(99)
Energy for space cooling												1.4602	(108)
Total												45.2506	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.3	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7520	(36)
Total fabric heat loss	(33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	531.2417	632.5768	742.6367	857.0777	928.4124	914.3817	872.9773	804.9206	720.8807	607.2518	523.4713	498.7167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9994	0.9983	0.9940	0.9749	0.9098	0.7587	0.5855	0.6509	0.8942	0.9890	0.9986	0.9996	(86)
MIT	19.7124	19.8634	20.1229	20.4676	20.7643	20.9401	20.9878	20.9793	20.8448	20.4451	20.0154	19.6900	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9992	0.9976	0.9917	0.9648	0.8729	0.6726	0.4652	0.5290	0.8364	0.9831	0.9980	0.9994	(89)
MIT 2	18.8202	18.9730	19.2332	19.5808	19.8576	20.0033	20.0287	20.0275	19.9366	19.5643	19.1341	18.8053	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9969	0.9898	0.9608	0.8719	0.6841	0.4842	0.5482	0.8401	0.9804	0.9973	0.9992	(94)
Useful gains	530.6152	630.5957	735.0316	823.4625	809.4985	625.5698	422.7279	441.2274	605.6230	595.3439	522.0713	498.2977	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1806.0882	1746.2898	1577.5250	1309.6182	1002.2563	662.9453	427.5361	450.2212	717.1904	1099.1754	1476.8161	1797.6427	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.9519	749.7464	626.8151	350.0321	143.4118	0.0000	0.0000	0.0000	0.0000	374.8506	687.4163	966.7127	(98)
Space heating												4847.9369	(98)
Space heating per m2											(98) / (4) =	43.1119	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8607	0.9245	0.8970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	966.2755	817.0738	812.5601	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1173.2354	1122.8308	1046.6749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	149.0112	227.4832	174.1814	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.6757	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	37.2528	56.8708	43.5453	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.6689	(107)
Space cooling per m2												1.2243	(108)
Energy for space heating												43.1119	(99)
Energy for space cooling												1.2243	(108)
Total												44.3362	(109)
Target Fabric Energy Efficiency (TFEE)												51.0	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3140	0.2915	0.2990	0.2841	0.2841	0.2766	0.2691	0.2616	0.2542	0.2766	0.2616	0.2766	(22b)
Effective ac	0.5493	0.5425	0.5447	0.5403	0.5403	0.5382	0.5362	0.5342	0.5323	0.5382	0.5342	0.5382	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4394	51.7912	52.0019	51.5859	51.5859	51.3858	51.1911	51.0017	50.8177	51.3858	51.0017	51.3858	(38)
Heat transfer coeff	124.9364	124.2882	124.4989	124.0829	124.0829	123.8828	123.6881	123.4988	123.3147	123.8828	123.4988	123.8828	(39)
Average = Sum(39)m / 12 =												123.9615	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1110	1.1053	1.1071	1.1034	1.1034	1.1017	1.0999	1.0983	1.0966	1.1017	1.0983	1.1017	(40)
HLP (average)												1.1024	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5040	62.8300	62.7236	62.9340	62.9340	63.0356	63.1348	63.2316	63.3260	63.0356	63.2316	63.0356	
alpha	5.1669	5.1887	5.1816	5.1956	5.1956	5.2024	5.2090	5.2154	5.2217	5.2024	5.2154	5.2024	
util living area													
	0.9937	0.9885	0.9682	0.9021	0.7635	0.5420	0.3954	0.4172	0.6955	0.9281	0.9853	0.9950	(86)
MIT	20.0083	20.1343	20.4004	20.7088	20.9098	20.9874	20.9980	20.9974	20.9575	20.7092	20.3198	19.9909	(87)
Th 2	19.9918	19.9965	19.9950	19.9980	19.9980	19.9995	20.0009	20.0023	20.0036	19.9995	20.0023	19.9995	(88)
util rest of house													
	0.9915	0.9847	0.9577	0.8714	0.6992	0.4522	0.2952	0.3120	0.6047	0.8972	0.9795	0.9933	(89)
MIT 2	18.6924	18.8781	19.2573	19.6795	19.9208	19.9928	20.0003	20.0016	19.9759	19.6919	19.1522	18.6727	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9799	0.9503	0.8658	0.7046	0.4660	0.3110	0.3286	0.6170	0.8916	0.9741	0.9906	(94)
Useful gains	828.0177	915.2835	1011.5661	1037.7520	874.5292	594.3765	377.5724	376.9354	644.4841	810.9881	801.8566	780.9558	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1749.0645	1712.1867	1548.4373	1283.2176	940.1168	600.7644	378.1715	377.7082	669.6580	1047.0684	1412.3453	1719.5355	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	685.2588	535.5189	399.4322	176.7353	48.7972	0.0000	0.0000	0.0000	0.0000	175.6438	439.5519	698.3033	(98)
Space heating												3159.2413	(98)
RHI space heating demand												3159	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3812	0.3738	0.3663	0.3289	0.3214	0.2841	0.2841	0.2766	0.2990	0.3214	0.3364	0.3513	(22b)
Effective ac	0.5727	0.5698	0.5671	0.5541	0.5517	0.5403	0.5403	0.5382	0.5447	0.5517	0.5566	0.5617	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.6718	54.4024	54.1384	52.8981	52.6661	51.5859	51.5859	51.3858	52.0019	52.6661	53.1355	53.6263	(38)
Heat transfer coeff	127.1688	126.8994	126.6354	125.3951	125.1631	124.0829	124.0829	123.8828	124.4989	125.1631	125.6325	126.1233	(39)
Average = Sum(39)m / 12 =												125.3940	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1309	1.1285	1.1261	1.1151	1.1131	1.1034	1.1034	1.1017	1.1071	1.1131	1.1172	1.1216	(40)
HLP (average)												1.1151	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4068	61.5371	61.6655	62.2754	62.3908	62.9340	62.9340	63.0356	62.7236	62.3908	62.1577	61.9158	
alpha	5.0938	5.1025	5.1110	5.1517	5.1594	5.1956	5.1956	5.2024	5.1816	5.1594	5.1438	5.1277	
util living area													
	0.9956	0.9908	0.9764	0.9295	0.8186	0.6376	0.4740	0.5251	0.7792	0.9563	0.9912	0.9966	(86)
MIT	19.8895	20.0466	20.3038	20.6215	20.8587	20.9704	20.9947	20.9912	20.9186	20.5985	20.1823	19.8580	(87)
Th 2	19.9757	19.9776	19.9795	19.9885	19.9902	19.9980	19.9980	19.9995	19.9950	19.9902	19.9868	19.9832	(88)
util rest of house													
	0.9942	0.9878	0.9685	0.9062	0.7645	0.5499	0.3690	0.4159	0.6993	0.9368	0.9878	0.9955	(89)
MIT 2	18.5077	18.7372	19.1086	19.5574	19.8578	19.9793	19.9961	19.9960	19.9337	19.5372	18.9425	18.4673	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.7253	18.9435	19.2968	19.7250	20.0154	20.1354	20.1534	20.1527	20.0888	19.7043	19.1377	18.6863	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7253	18.9435	19.2968	19.7250	20.0154	20.1354	20.1534	20.1527	20.0888	19.7043	19.1377	18.6863	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9835	0.9616	0.8988	0.7660	0.5625	0.3856	0.4331	0.7076	0.9297	0.9837	0.9934	(94)
Useful gains	795.5170	899.4070	990.9330	1031.8384	931.9613	669.5868	438.9546	461.3745	692.2468	801.3555	767.1809	756.1735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1834.4541	1782.1064	1620.5296	1357.3971	1040.7855	686.8443	440.9158	464.9005	745.5970	1139.5268	1512.3316	1827.0637	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	772.9692	593.1740	468.4199	234.4022	80.9652	0.0000	0.0000	0.0000	0.0000	251.5995	536.5085	796.7423	(98)
Space heating												3734.7807	(98)
Space heating per m2											(98) / (4) =	33.2128	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4020.2160	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	772.9692	593.1740	468.4199	234.4022	80.9652	0.0000	0.0000	0.0000	0.0000	251.5995	536.5085	796.7423	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	832.0444	638.5080	504.2195	252.3167	87.1530	0.0000	0.0000	0.0000	0.0000	270.8283	577.5118	857.6343	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2854	89.2167	89.0589	88.6679	87.8637	86.7000	86.7000	86.7000	86.7000	88.6932	89.1481	89.3147	(217)
Fuel for water heating, kWh/month													
	198.4837	174.1005	180.8583	159.6239	155.4980	137.3772	128.6798	145.6988	146.8563	165.6326	178.2690	192.5670	(219)
Water heating fuel used												1963.6451	(219)
Annual totals kWh/year													
Space heating fuel - main system												4020.2160	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5769.3077	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4020.2160	3.4800	139.9035	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.6451	3.4800	68.3349	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			299.9388	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8001	(257)
SAP value		88.8387	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4020.2160	0.2160	868.3667	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.6451	0.2160	424.1473	(264)
Space and water heating			1292.5140	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1181.1608	(272)
CO2 emissions per m2			10.5000	(273)
EI value			89.9476	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8817 = 3.947, stars = 4
Water heating environmental impact                          0.216 / 0.8817 = 0.2450, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3140	0.2915	0.2990	0.2841	0.2841	0.2766	0.2691	0.2616	0.2542	0.2766	0.2616	0.2766	(22b)
Effective ac	0.5493	0.5425	0.5447	0.5403	0.5403	0.5382	0.5362	0.5342	0.5323	0.5382	0.5342	0.5382	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4394	51.7912	52.0019	51.5859	51.5859	51.3858	51.1911	51.0017	50.8177	51.3858	51.0017	51.3858	(38)
Heat transfer coeff	124.9364	124.2882	124.4989	124.0829	124.0829	123.8828	123.6881	123.4988	123.3147	123.8828	123.4988	123.8828	(39)
Average = Sum(39)m / 12 =												123.9615	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1110	1.1053	1.1071	1.1034	1.1034	1.1017	1.0999	1.0983	1.0966	1.1017	1.0983	1.1017	(40)
HLP (average)												1.1024	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5040	62.8300	62.7236	62.9340	62.9340	63.0356	63.1348	63.2316	63.3260	63.0356	63.2316	63.0356	
alpha	5.1669	5.1887	5.1816	5.1956	5.1956	5.2024	5.2090	5.2154	5.2217	5.2024	5.2154	5.2024	
util living area													
	0.9937	0.9885	0.9682	0.9021	0.7635	0.5420	0.3954	0.4172	0.6955	0.9281	0.9853	0.9950	(86)
MIT	20.0083	20.1343	20.4004	20.7088	20.9098	20.9874	20.9980	20.9974	20.9575	20.7092	20.3198	19.9909	(87)
Th 2	19.9918	19.9965	19.9950	19.9980	19.9980	19.9995	20.0009	20.0023	20.0036	19.9995	20.0023	19.9995	(88)
util rest of house													
	0.9915	0.9847	0.9577	0.8714	0.6992	0.4522	0.2952	0.3120	0.6047	0.8972	0.9795	0.9933	(89)
MIT 2	18.6924	18.8781	19.2573	19.6795	19.9208	19.9928	20.0003	20.0016	19.9759	19.6919	19.1522	18.6727	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9799	0.9503	0.8658	0.7046	0.4660	0.3110	0.3286	0.6170	0.8916	0.9741	0.9906	(94)
Useful gains	828.0177	915.2835	1011.5661	1037.7520	874.5292	594.3765	377.5724	376.9354	644.4841	810.9881	801.8566	780.9558	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1749.0645	1712.1867	1548.4373	1283.2176	940.1168	600.7644	378.1715	377.7082	669.6580	1047.0684	1412.3453	1719.5355	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	685.2588	535.5189	399.4322	176.7353	48.7972	0.0000	0.0000	0.0000	0.0000	175.6438	439.5519	698.3033	(98)
Space heating												3159.2413	(98)
Space heating per m2											(98) / (4) =	28.0946	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3400.6903	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	685.2588	535.5189	399.4322	176.7353	48.7972	0.0000	0.0000	0.0000	0.0000	175.6438	439.5519	698.3033	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	737.6306	576.4467	429.9593	190.2425	52.5266	0.0000	0.0000	0.0000	0.0000	189.0676	473.1452	751.6721	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2233	89.1601	88.9565	88.4483	87.5198	86.7000	86.7000	86.7000	86.7000	88.4138	89.0274	89.2490	(217)
Fuel for water heating, kWh/month													
	198.6217	174.2109	181.0666	160.0203	156.1090	137.3772	128.6798	145.6988	146.8563	166.1561	178.5106	192.7088	(219)
Water heating fuel used												1966.0162	(219)
Annual totals kWh/year													
Space heating fuel - main system												3400.6903	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5052.0443	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3400.6903	7.3800	250.9709	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1966.0162	7.3800	145.0920	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			412.8807	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3400.6903	0.2160	734.5491	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0162	0.2160	424.6595	(264)
Space and water heating			1159.2086	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			995.8989	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3400.6903	1.2200	4148.8422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0162	1.2200	2398.5397	(264)
Space and water heating			6547.3819	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5581.3689 (272)
Primary energy kWh/m2/year 49.6342 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.7%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	A 92
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£503	£427	£76
Space heating	£379	£379	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£413	£351	£62
Total cost of uses	£412	£350	£62
Delivered energy	45 kWh/m²	36 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	50 kWh/m²	40 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3812	0.3738	0.3663	0.3289	0.3214	0.2841	0.2841	0.2766	0.2990	0.3214	0.3364	0.3513	(22b)
Effective ac	0.5727	0.5698	0.5671	0.5541	0.5517	0.5403	0.5403	0.5382	0.5447	0.5517	0.5566	0.5617	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.6718	54.4024	54.1384	52.8981	52.6661	51.5859	51.5859	51.3858	52.0019	52.6661	53.1355	53.6263	(38)
Heat transfer coeff	127.1688	126.8994	126.6354	125.3951	125.1631	124.0829	124.0829	123.8828	124.4989	125.1631	125.6325	126.1233	(39)
Average = Sum(39)m / 12 =												125.3940	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1309	1.1285	1.1261	1.1151	1.1131	1.1034	1.1034	1.1017	1.1071	1.1131	1.1172	1.1216	(40)
HLP (average)												1.1151	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2420	914.4555	1030.5293	1147.9566	1216.6665	1190.3852	1138.4171	1065.3857	978.3679	861.9313	779.9250	761.1806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.4068	61.5371	61.6655	62.2754	62.3908	62.9340	62.9340	63.0356	62.7236	62.3908	62.1577	61.9158	
alpha	5.0938	5.1025	5.1110	5.1517	5.1594	5.1956	5.1956	5.2024	5.1816	5.1594	5.1438	5.1277	
util living area													
	0.9956	0.9908	0.9764	0.9295	0.8186	0.6376	0.4740	0.5251	0.7792	0.9563	0.9912	0.9966	(86)
MIT	19.8895	20.0466	20.3038	20.6215	20.8587	20.9704	20.9947	20.9912	20.9186	20.5985	20.1823	19.8580	(87)
Th 2	19.9757	19.9776	19.9795	19.9885	19.9902	19.9980	19.9980	19.9995	19.9950	19.9902	19.9868	19.9832	(88)
util rest of house													
	0.9942	0.9878	0.9685	0.9062	0.7645	0.5499	0.3690	0.4159	0.6993	0.9368	0.9878	0.9955	(89)
MIT 2	18.5077	18.7372	19.1086	19.5574	19.8578	19.9793	19.9961	19.9960	19.9337	19.5372	18.9425	18.4673	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7253	18.9435	19.2968	19.7250	20.0154	20.1354	20.1534	20.1527	20.0888	19.7043	19.1377	18.6863	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7253	18.9435	19.2968	19.7250	20.0154	20.1354	20.1534	20.1527	20.0888	19.7043	19.1377	18.6863	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9835	0.9616	0.8988	0.7660	0.5625	0.3856	0.4331	0.7076	0.9297	0.9837	0.9934	(94)
Useful gains	795.5170	899.4070	990.9330	1031.8384	931.9613	669.5868	438.9546	461.3745	692.2468	801.3555	767.1809	756.1735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1834.4541	1782.1064	1620.5296	1357.3971	1040.7855	686.8443	440.9158	464.9005	745.5970	1139.5268	1512.3316	1827.0637	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	772.9692	593.1740	468.4199	234.4022	80.9652	0.0000	0.0000	0.0000	0.0000	251.5995	536.5085	796.7423	(98)
Space heating												3734.7807	(98)
Space heating per m2											(98) / (4) =	33.2128	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4020.2160	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	772.9692	593.1740	468.4199	234.4022	80.9652	0.0000	0.0000	0.0000	0.0000	251.5995	536.5085	796.7423	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	832.0444	638.5080	504.2195	252.3167	87.1530	0.0000	0.0000	0.0000	0.0000	270.8283	577.5118	857.6343	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3586	89.3725	89.3742	89.3717	89.3279	86.7000	86.7000	86.7000	86.7000	89.0156	89.2623	89.3753	(217)
Fuel for water heating, kWh/month	169.8710	126.3294	99.3793	50.0210	19.0314	1.7238	0.0000	28.7441	55.2573	104.1086	144.2587	168.6333	(219)
Water heating fuel used												967.3578	(219)
Annual totals kWh/year													
Space heating fuel - main system												4020.2160	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4823.0203	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4020.2160	3.4800	139.9035	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.3578	3.4800	33.6641	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			271.8630	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7252	(257)
SAP value	89.8835	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4020.2160	0.2160	868.3667	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.3578	0.2160	208.9493	(264)
Space and water heating			1077.3159	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			991.9127	(272)
CO2 emissions per m2			8.8200	(273)
EI value			91.5582	
EI rating			92	(274)
EI band			A	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3518	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2990	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3140	0.2915	0.2990	0.2841	0.2841	0.2766	0.2691	0.2616	0.2542	0.2766	0.2616	0.2766	(22b)
Effective ac	0.5493	0.5425	0.5447	0.5403	0.5403	0.5382	0.5362	0.5342	0.5323	0.5382	0.5342	0.5382	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.4394	51.7912	52.0019	51.5859	51.5859	51.3858	51.1911	51.0017	50.8177	51.3858	51.0017	51.3858	(38)
Heat transfer coeff	124.9364	124.2882	124.4989	124.0829	124.0829	123.8828	123.6881	123.4988	123.3147	123.8828	123.4988	123.8828	(39)
Average = Sum(39)m / 12 =												123.9615	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1110	1.1053	1.1071	1.1034	1.1034	1.1017	1.0999	1.0983	1.0966	1.1017	1.0983	1.1017	(40)
HLP (average)												1.1024	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213 (44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645 (45)
Energy content (annual)										Total = Sum(45)m =		1595.1500 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262 (61)
Total heat required for water heating calculated for each month												
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2724 (H8)
Utilisation factor												0.5443 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.3830 (H14)
Volume ratio Veff/V												0.7398 (H15)
Solar storage volume factor												0.9397 (H16)
Solar input												-912.8396 (H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870 (63)
										Solar input (sum of months) = Sum(63)m =		-912.8396 (63)
Output from w/h												
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037 (64)
										Total per year (kWh/year) = Sum(64)m =		834.2051 (64)
Heat gains from water heating, kWh/month												
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8605	934.0147	1064.5171	1198.6526	1241.0921	1275.3868	1213.9438	1147.0524	1044.4914	909.6089	823.1587	788.4023	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5040	62.8300	62.7236	62.9340	62.9340	63.0356	63.1348	63.2316	63.3260	63.0356	63.2316	63.0356	
alpha	5.1669	5.1887	5.1816	5.1956	5.1956	5.2024	5.2090	5.2154	5.2217	5.2024	5.2154	5.2024	
util living area	0.9937	0.9885	0.9682	0.9021	0.7635	0.5420	0.3954	0.4172	0.6955	0.9281	0.9853	0.9950	(86)
MIT	20.0083	20.1343	20.4004	20.7088	20.9098	20.9874	20.9980	20.9974	20.9575	20.7092	20.3198	19.9909	(87)
Th 2	19.9918	19.9965	19.9950	19.9980	19.9980	19.9995	20.0009	20.0023	20.0036	19.9995	20.0023	19.9995	(88)
util rest of house	0.9915	0.9847	0.9577	0.8714	0.6992	0.4522	0.2952	0.3120	0.6047	0.8972	0.9795	0.9933	(89)
MIT 2	18.6924	18.8781	19.2573	19.6795	19.9208	19.9928	20.0003	20.0016	19.9759	19.6919	19.1522	18.6727	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8996	19.0759	19.4374	19.8416	20.0765	20.1495	20.1575	20.1584	20.1305	19.8521	19.3361	18.8803	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9799	0.9503	0.8658	0.7046	0.4660	0.3110	0.3286	0.6170	0.8916	0.9741	0.9906	(94)
Useful gains	828.0177	915.2835	1011.5661	1037.7520	874.5292	594.3765	377.5724	376.9354	644.4841	810.9881	801.8566	780.9558	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1749.0645	1712.1867	1548.4373	1283.2176	940.1168	600.7644	378.1715	377.7082	669.6580	1047.0684	1412.3453	1719.5355	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	685.2588	535.5189	399.4322	176.7353	48.7972	0.0000	0.0000	0.0000	0.0000	175.6438	439.5519	698.3033	(98)
Space heating												3159.2413	(98)
Space heating per m2											(98) / (4) =	28.0946	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3400.6903	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	685.2588	535.5189	399.4322	176.7353	48.7972	0.0000	0.0000	0.0000	0.0000	175.6438	439.5519	698.3033	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	737.6306	576.4467	429.9593	190.2425	52.5266	0.0000	0.0000	0.0000	0.0000	189.0676	473.1452	751.6721	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3163	89.3256	89.3033	89.2513	88.9033	86.7000	86.7000	86.7000	86.7000	88.8021	89.1771	89.3250	(217)
Fuel for water heating, kWh/month	165.0739	126.4842	98.8670	48.5590	23.9469	0.0000	0.0000	21.1925	49.3765	99.6307	138.7156	165.1314	(219)
Water heating fuel used												936.9777	(219)

Annual totals kWh/year		
Space heating fuel - main system	3400.6903	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =	-850.7751	(233)
Total delivered energy for all uses	4073.0058	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3400.6903	7.3800	250.9709	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.9777	7.3800	69.1490	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			351.2677	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3400.6903	0.2160	734.5491	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.9777	0.2160	202.3872	(264)
Space and water heating			936.9363	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies				
PV Unit		-850.7751	0.5190	-441.5523 (269)
Total kg/year				799.5766 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3400.6903	1.2200	4148.8422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.9777	1.2200	1143.1128	(264)
Space and water heating			5291.9550	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4479.4419	(272)
Primary energy kWh/m2/year			39.8350	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		763.75 (P1)
Transmission heat loss coefficient		72.50 (37)
Summer heat loss coefficient		836.25 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
South	2.1300	118.5567	0.7200	0.7000	0.7650	87.6274
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						716.5712

	Jun	Jul	Aug	
Solar gains	769	717	639	(P3)
Internal gains	513	491	501	
Total summer gains	1282	1208	1140	(P5)
Summer gain/loss ratio	1.53	1.44	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.18	18.99	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 361 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	14 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.23	**TER**	16.54
Environmental	90 B	**% DER<TER**	26.06		
CO_2 Emissions (t/year)	0.96	**DFEE**	45.25	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.25		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.23	$kgCO_2/m^2$	Pass
	-4.31 (-26.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.99	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.25	$kWh/m^2/yr$	
	-5.7 (-11.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	5.77 m², No overhang 2.13 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 362 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	16 Goldcrest Road, Boorley Green, Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.69	**TER**	16.82
Environmental	90 B	**% DER<TER**	24.54		
CO_2 Emissions (t/year)	1.00	**DFEE**	47.24	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.69 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.00 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.13 m², No overhang
Windows facing East: 5.77 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	128.6832	128.3550	128.0333	126.5223	126.2396	124.9236	124.9236	124.6799	125.4305	126.2396	126.8115	127.4094	(39)
Average = Sum(39)m / 12 =												126.5210	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1386	1.1251	1.1226	1.1109	1.1109	1.1088	1.1154	1.1226	1.1277	1.1330	(40)
HLP (average)												1.1251	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	447.4591	445.0491	428.6577	402.1459	374.9141	349.0343	332.4824	339.1391	353.0054	379.7490	410.4168	433.7149	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	554.7987	655.0112	776.0967	914.0632	1008.5724	1000.8682	951.7256	866.5607	758.5530	629.1703	544.2123	522.0368	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6841	60.8393	60.9922	61.7206	61.8588	62.5104	62.5104	62.6326	62.2578	61.8588	61.5798	61.2908	
alpha	5.0456	5.0560	5.0661	5.1147	5.1239	5.1674	5.1674	5.1755	5.1505	5.1239	5.1053	5.0861	
util living area													
	0.9992	0.9979	0.9930	0.9699	0.8931	0.7317	0.5627	0.6332	0.8873	0.9878	0.9983	0.9994	(86)
MIT	19.6668	19.8182	20.0912	20.4594	20.7707	20.9435	20.9881	20.9791	20.8383	20.4197	19.9774	19.6439	(87)
Th 2	19.9648	19.9671	19.9695	19.9804	19.9824	19.9919	19.9919	19.9937	19.9882	19.9824	19.9783	19.9739	(88)
util rest of house													
	0.9989	0.9972	0.9903	0.9579	0.8514	0.6419	0.4414	0.5087	0.8260	0.9813	0.9976	0.9992	(89)
MIT 2	18.1750	18.3980	18.7976	19.3336	19.7527	19.9535	19.9875	19.9848	19.8504	19.2853	18.6392	18.1480	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4100	18.6217	19.0014	19.5109	19.9130	20.1094	20.1451	20.1414	20.0060	19.4640	18.8500	18.3836	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4100	18.6217	19.0014	19.5109	19.9130	20.1094	20.1451	20.1414	20.0060	19.4640	18.8500	18.3836	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9958	0.9867	0.9506	0.8480	0.6532	0.4605	0.5280	0.8273	0.9764	0.9963	0.9987	(94)
Useful gains	553.8258	652.2348	765.7543	868.9187	855.3023	653.7863	438.2763	457.5451	627.5742	614.3218	542.1888	521.3653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1815.7182	1761.2463	1600.5897	1342.5124	1036.8042	688.2578	442.8623	466.4718	740.7905	1118.9820	1490.0316	1807.1195	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	938.8479	745.2557	621.1176	340.9875	135.0374	0.0000	0.0000	0.0000	0.0000	375.4672	682.4468	956.6011	(98)
Space heating												4795.7611	(98)
Space heating per m2											(98) / (4) =	42.6479	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5162.2832	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	938.8479	745.2557	621.1176	340.9875	135.0374	0.0000	0.0000	0.0000	0.0000	375.4672	682.4468	956.6011	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1010.6006	802.2128	668.5873	367.0479	145.3578	0.0000	0.0000	0.0000	0.0000	404.1627	734.6037	1029.7106	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3762	89.3313	89.2219	88.9371	88.2617	86.7000	86.7000	86.7000	86.7000	88.9764	89.2776	89.3972	(217)
Fuel for water heating, kWh/month													
	198.2820	173.8770	180.5280	159.1407	154.7970	137.3772	128.6798	145.6988	146.8563	165.1053	178.0104	192.3895	(219)
Water heating fuel used												1960.7419	(219)
Annual totals kWh/year													
Space heating fuel - main system												5162.2832	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6908.4717	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5162.2832	0.2160	1115.0532	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1960.7419	0.2160	423.5203	(264)
Space and water heating			1538.5734	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1427.2202	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6900	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.8453	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.8453	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	554.5280	641.9153	745.8218	863.1260	941.7305	931.0687	886.0052	813.0034	720.9193	611.1547	540.6412	524.1460	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9992	0.9981	0.9939	0.9742	0.9055	0.7495	0.5779	0.6455	0.8942	0.9887	0.9983	0.9994	(86)
MIT	19.7320	19.8712	20.1255	20.4721	20.7712	20.9435	20.9885	20.9801	20.8449	20.4482	20.0298	19.7114	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9990	0.9975	0.9916	0.9638	0.8676	0.6629	0.4586	0.5241	0.8364	0.9826	0.9976	0.9992	(89)
MIT 2	18.2986	18.5040	18.8764	19.3829	19.7892	19.9927	20.0275	20.0250	19.8940	19.3559	18.7443	18.2752	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5244	18.7193	19.0731	19.5544	19.9439	20.1424	20.1788	20.1754	20.0438	19.5279	18.9468	18.5014	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9884	0.9572	0.8639	0.6737	0.4774	0.5429	0.8375	0.9781	0.9965	0.9988	(94)
Useful gains	553.5998	639.4614	737.1881	826.2108	813.5939	627.2333	422.9359	441.3901	603.7916	597.7949	538.7262	523.4952	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1752.3267	1697.8911	1540.7374	1289.5153	995.4331	661.9473	427.4293	449.9845	712.8900	1078.0337	1437.2521	1743.6004	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating												4581.8205	(98)
Space heating per m2											(98) / (4) =	40.7454	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4905.5894	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	891.8528	711.2648	597.8407	333.5793	135.2884	0.0000	0.0000	0.0000	0.0000	357.2977	646.9386	907.7583	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	954.8745	761.5254	640.0864	357.1512	144.8484	0.0000	0.0000	0.0000	0.0000	382.5457	692.6538	971.9039	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2335	88.0585	87.6346	86.5947	84.4340	80.3000	80.3000	80.3000	80.3000	86.6671	87.8234	88.3042	(217)
Fuel for water heating, kWh/month													
	245.1925	216.5291	228.4708	206.8559	205.3979	190.2164	182.2418	203.1569	205.4005	214.7011	224.0917	239.0864	(219)
Water heating fuel used												2561.3409	(219)
Annual totals kWh/year													
Space heating fuel - main system												4905.5894	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												8003.0432	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4905.5894	0.2160	1059.6073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2561.3409	0.2160	553.2496	(264)
Space and water heating			1612.8569	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1891.0995	(272)
Emissions per m2 for space and water heating			14.3429	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3429 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.8200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	128.6832	128.3550	128.0333	126.5223	126.2396	124.9236	124.9236	124.6799	125.4305	126.2396	126.8115	127.4094	(39)
Average = Sum(39)m / 12 =												126.5210	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1386	1.1251	1.1226	1.1109	1.1109	1.1088	1.1154	1.1226	1.1277	1.1330	(40)
HLP (average)												1.1251	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	521.1475	622.2079	745.0541	885.4146	981.4803	975.9661	928.6829	841.1334	732.2766	600.4162	512.6607	489.2300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6841	60.8393	60.9922	61.7206	61.8588	62.5104	62.5104	62.6326	62.2578	61.8588	61.5798	61.2908	
alpha	5.0456	5.0560	5.0661	5.1147	5.1239	5.1674	5.1674	5.1755	5.1505	5.1239	5.1053	5.0861	
util living area													
	0.9994	0.9984	0.9941	0.9734	0.9017	0.7445	0.5751	0.6489	0.8987	0.9901	0.9987	0.9996	(86)
MIT	19.6388	19.7910	20.0661	20.4387	20.7574	20.9387	20.9869	20.9766	20.8257	20.3970	19.9512	19.6165	(87)
Th 2	19.9648	19.9671	19.9695	19.9804	19.9824	19.9919	19.9919	19.9937	19.9882	19.9824	19.9783	19.9739	(88)
util rest of house													
	0.9992	0.9978	0.9919	0.9626	0.8620	0.6551	0.4519	0.5229	0.8410	0.9846	0.9981	0.9994	(89)
MIT 2	18.7148	18.8687	19.1446	19.5193	19.8149	19.9632	19.9885	19.9868	19.8851	19.4844	19.0379	18.6999	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8604	19.0140	19.2898	19.6641	19.9633	20.1168	20.1458	20.1427	20.0332	19.6281	19.1817	18.8442	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8604	19.0140	19.2898	19.6641	19.9633	20.1168	20.1458	20.1427	20.0332	19.6281	19.1817	18.8442	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9970	0.9898	0.9583	0.8611	0.6672	0.4715	0.5428	0.8441	0.9819	0.9975	0.9992	(94)
Useful gains	520.5565	620.3660	737.4743	848.5162	845.1512	651.1878	437.8450	456.5255	618.1166	589.5533	511.3840	488.8311	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1873.6725	1811.6018	1637.5150	1361.8946	1043.1597	689.1788	442.9507	466.6364	744.2075	1139.7096	1532.1007	1865.8121	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1006.7183	800.5105	669.6303	369.6325	147.3183	0.0000	0.0000	0.0000	0.0000	409.3163	734.9160	1024.4738	(98)
Space heating												5162.5159	(98)
Space heating per m2											(98) / (4) =	45.9094	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1174.2819	924.4347	947.5672	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8611	0.9227	0.8901	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1011.1270	852.9372	843.4071	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1244.1346	1186.9154	1088.1383	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	167.7655	248.4798	182.0800	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												598.3253	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	41.9414	62.1199	45.5200	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												149.5813	(107)
Space cooling per m2												1.3302	(108)
Energy for space heating												45.9094	(99)
Energy for space cooling												1.3302	(108)
Total												47.2396	(109)
Dwelling Fabric Energy Efficiency (DFEE)												47.2	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7520	(36)
Total fabric heat loss	(33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645 (45)
Energy content (annual)										Total = Sum(45)m =		1595.1500 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219	(74)
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	93.9221	183.7168	304.0091	447.9276	554.4510	570.3547	541.8378	461.4939	354.8542	218.2437	117.0711	77.2816	(83)
Total gains	507.7301	595.9626	701.6242	821.4249	902.2730	894.4869	851.2775	775.2057	681.5832	569.2385	495.9363	478.1897	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9995	0.9987	0.9954	0.9790	0.9179	0.7698	0.5986	0.6710	0.9116	0.9918	0.9989	0.9996	(86)
MIT	19.6926	19.8328	20.0893	20.4410	20.7503	20.9357	20.9865	20.9761	20.8251	20.4146	19.9923	19.6727	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9993	0.9982	0.9936	0.9702	0.8832	0.6843	0.4765	0.5476	0.8595	0.9872	0.9984	0.9995	(89)
MIT 2	18.8005	18.9424	19.2000	19.5555	19.8461	20.0008	20.0283	20.0264	19.9220	19.5347	19.1110	18.7880	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9410	19.0827	19.3400	19.6950	19.9885	20.1481	20.1792	20.1760	20.0643	19.6732	19.2498	18.9274	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9976	0.9920	0.9665	0.8818	0.6956	0.4958	0.5670	0.8619	0.9849	0.9979	0.9993	(94)
Useful gains	507.2456	594.5382	695.9795	793.8985	795.5833	622.2210	422.0985	439.5297	587.4679	560.6556	494.9020	477.8608	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1803.6554	1742.5359	1573.4446	1306.5312	1000.8253	662.6183	427.4721	450.0522	715.3501	1095.5787	1474.0173	1795.5337	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	964.5289	771.4545	652.8340	369.0955	152.7000	0.0000	0.0000	0.0000	0.0000	397.9828	704.9631	980.3486	(98)
Space heating												4993.9073	(98)
Space heating per m2											(98) / (4) =	44.4100	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8527	0.9184	0.8857	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	957.2878	811.6788	802.2743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1149.9818	1097.4674	1011.9431	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	138.7397	212.6267	155.9936	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												507.3600	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	34.6849	53.1567	38.9984	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												126.8400	(107)
Space cooling per m2												1.1280	(108)
Energy for space heating												44.4100	(99)
Energy for space cooling												1.1280	(108)
Total												45.5380	(109)
Target Fabric Energy Efficiency (TFEE)												52.4	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3883	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3465	0.3218	0.3300	0.3135	0.3135	0.3053	0.2970	0.2888	0.2805	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5600	0.5518	0.5545	0.5491	0.5491	0.5466	0.5441	0.5417	0.5393	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.4664	52.6768	52.9335	52.4266	52.4266	52.1829	51.9457	51.7150	51.4908	52.1829	51.7150	52.1829	(38)
Heat transfer coeff	125.9634	125.1738	125.4305	124.9236	124.9236	124.6799	124.4427	124.2120	123.9878	124.6799	124.2120	124.6799	(39)
Average = Sum(39)m / 12 =												124.7758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1202	1.1132	1.1154	1.1109	1.1109	1.1088	1.1066	1.1046	1.1026	1.1088	1.1046	1.1088	(40)
HLP (average)												1.1096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9944	62.3855	62.2578	62.5104	62.5104	62.6326	62.7520	62.8686	62.9822	62.6326	62.8686	62.6326	
alpha	5.1330	5.1590	5.1505	5.1674	5.1674	5.1755	5.1835	5.1912	5.1988	5.1755	5.1912	5.1755	
util living area													
	0.9947	0.9907	0.9737	0.9131	0.7767	0.5532	0.4053	0.4319	0.7218	0.9409	0.9881	0.9958	(86)
MIT	19.9700	20.0905	20.3573	20.6821	20.9005	20.9859	20.9977	20.9969	20.9488	20.6759	20.2835	19.9587	(87)
Th 2	19.9844	19.9901	19.9882	19.9919	19.9919	19.9937	19.9954	19.9971	19.9987	19.9937	19.9971	19.9937	(88)
util rest of house													
	0.9929	0.9875	0.9647	0.8846	0.7130	0.4617	0.3022	0.3226	0.6306	0.9139	0.9832	0.9943	(89)
MIT 2	18.6313	18.8102	19.1918	19.6407	19.9059	19.9862	19.9948	19.9962	19.9646	19.6450	19.0966	18.6219	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9576	0.8783	0.7179	0.4758	0.3185	0.3399	0.6425	0.9077	0.9784	0.9919	(94)
Useful gains	797.6122	876.9831	974.9085	1018.3225	872.0318	596.6949	379.1954	378.3856	641.2439	783.1113	768.7274	754.5025	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1756.2015	1716.3677	1552.2474	1287.2964	944.7419	603.9021	379.8893	379.3218	671.9692	1048.2244	1413.9660	1724.6237	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.1904	564.0664	429.5401	193.6612	54.0963	0.0000	0.0000	0.0000	0.0000	197.2441	464.5718	721.7702	(98)
Space heating												3338.1406	(98)
RHI space heating demand												3338	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	128.6832	128.3550	128.0333	126.5223	126.2396	124.9236	124.9236	124.6799	125.4305	126.2396	126.8115	127.4094	(39)
Average = Sum(39)m / 12 =												126.5210	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1386	1.1251	1.1226	1.1109	1.1109	1.1088	1.1154	1.1226	1.1277	1.1330	(40)
HLP (average)												1.1251	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6841	60.8393	60.9922	61.7206	61.8588	62.5104	62.5104	62.6326	62.2578	61.8588	61.5798	61.2908	
alpha	5.0456	5.0560	5.0661	5.1147	5.1239	5.1674	5.1674	5.1755	5.1505	5.1239	5.1053	5.0861	
util living area													
	0.9963	0.9926	0.9808	0.9388	0.8321	0.6510	0.4870	0.5439	0.8042	0.9646	0.9927	0.9971	(86)
MIT	19.8492	19.9959	20.2537	20.5877	20.8435	20.9668	20.9938	20.9894	20.9035	20.5607	20.1449	19.8230	(87)
Th 2	19.9648	19.9671	19.9695	19.9804	19.9824	19.9919	19.9919	19.9937	19.9882	19.9824	19.9783	19.9739	(88)
util rest of house													
	0.9950	0.9901	0.9742	0.9177	0.7795	0.5622	0.3789	0.4311	0.7264	0.9481	0.9898	0.9961	(89)
MIT 2	18.4411	18.6563	19.0301	19.5062	19.8343	19.9708	19.9897	19.9895	19.9138	19.4803	18.8823	18.4096	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.6629	18.8672	19.2228	19.6765	19.9933	20.1276	20.1479	20.1470	20.0697	19.6504	19.0812	18.6322	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6629	18.8672	19.2228	19.6765	19.9933	20.1276	20.1479	20.1470	20.0697	19.6504	19.0812	18.6322	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9864	0.9677	0.9100	0.7801	0.5747	0.3959	0.4488	0.7335	0.9410	0.9862	0.9942	(94)
Useful gains	769.7208	860.7057	951.9074	1007.5617	925.8640	671.0762	440.9200	462.9004	684.6587	770.1979	738.0940	733.4602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1848.2636	1792.7652	1628.9443	1363.4735	1046.9377	690.5311	443.2114	467.1723	748.7783	1142.5242	1519.3532	1838.7997	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	802.4359	626.3440	503.7154	256.2565	90.0788	0.0000	0.0000	0.0000	0.0000	277.0107	562.5066	822.3726	(98)
Space heating												3940.7206	(98)
Space heating per m2											(98) / (4) =	35.0442	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4241.8951	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	802.4359	626.3440	503.7154	256.2565	90.0788	0.0000	0.0000	0.0000	0.0000	277.0107	562.5066	822.3726	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	863.7631	674.2131	542.2125	275.8412	96.9632	0.0000	0.0000	0.0000	0.0000	298.1816	605.4969	885.2235	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3037	89.2455	89.1032	88.7347	87.9438	86.7000	86.7000	86.7000	86.7000	88.7647	89.1750	89.3297	(217)
Fuel for water heating, kWh/month													
	198.4429	174.0443	180.7685	159.5037	155.3564	137.3772	128.6798	145.6988	146.8563	165.4993	178.2153	192.5347	(219)
Water heating fuel used												1962.9772	(219)
Annual totals kWh/year													
Space heating fuel - main system												4241.8951	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5990.3189	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4241.8951	3.4800	147.6179	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1962.9772	3.4800	68.3116	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			307.6300	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8206	(257)
SAP value		88.5525	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4241.8951	0.2160	916.2493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1962.9772	0.2160	424.0031	(264)
Space and water heating			1340.2524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1228.8992	(272)
CO2 emissions per m2			10.9300	(273)
EI value			89.5413	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8820 = 3.946, stars = 4
Water heating environmental impact                              0.216 / 0.8820 = 0.2449, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3465	0.3218	0.3300	0.3135	0.3135	0.3053	0.2970	0.2888	0.2805	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5600	0.5518	0.5545	0.5491	0.5491	0.5466	0.5441	0.5417	0.5393	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.4664	52.6768	52.9335	52.4266	52.4266	52.1829	51.9457	51.7150	51.4908	52.1829	51.7150	52.1829	(38)
Heat transfer coeff	125.9634	125.1738	125.4305	124.9236	124.9236	124.6799	124.4427	124.2120	123.9878	124.6799	124.2120	124.6799	(39)
Average = Sum(39)m / 12 =												124.7758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1202	1.1132	1.1154	1.1109	1.1109	1.1088	1.1066	1.1046	1.1026	1.1088	1.1046	1.1088	(40)
HLP (average)												1.1096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
									Total per year (kWh/year) = Sum(64)m =			1733.9113	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9944	62.3855	62.2578	62.5104	62.5104	62.6326	62.7520	62.8686	62.9822	62.6326	62.8686	62.6326	
alpha	5.1330	5.1590	5.1505	5.1674	5.1674	5.1755	5.1835	5.1912	5.1988	5.1755	5.1912	5.1755	
util living area													
	0.9947	0.9907	0.9737	0.9131	0.7767	0.5532	0.4053	0.4319	0.7218	0.9409	0.9881	0.9958	(86)
MIT	19.9700	20.0905	20.3573	20.6821	20.9005	20.9859	20.9977	20.9969	20.9488	20.6759	20.2835	19.9587	(87)
Th 2	19.9844	19.9901	19.9882	19.9919	19.9919	19.9937	19.9954	19.9971	19.9987	19.9937	19.9971	19.9937	(88)
util rest of house													
	0.9929	0.9875	0.9647	0.8846	0.7130	0.4617	0.3022	0.3226	0.6306	0.9139	0.9832	0.9943	(89)
MIT 2	18.6313	18.8102	19.1918	19.6407	19.9059	19.9862	19.9948	19.9962	19.9646	19.6450	19.0966	18.6219	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9576	0.8783	0.7179	0.4758	0.3185	0.3399	0.6425	0.9077	0.9784	0.9919	(94)
Useful gains	797.6122	876.9831	974.9085	1018.3225	872.0318	596.6949	379.1954	378.3856	641.2439	783.1113	768.7274	754.5025	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1756.2015	1716.3677	1552.2474	1287.2964	944.7419	603.9021	379.8893	379.3218	671.9692	1048.2244	1413.9660	1724.6237	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.1904	564.0664	429.5401	193.6612	54.0963	0.0000	0.0000	0.0000	0.0000	197.2441	464.5718	721.7702	(98)
Space heating												3338.1406	(98)
Space heating per m2											(98) / (4) =	29.6856	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3593.2623	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.1904	564.0664	429.5401	193.6612	54.0963	0.0000	0.0000	0.0000	0.0000	197.2441	464.5718	721.7702	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	767.6969	607.1759	462.3683	208.4620	58.2307	0.0000	0.0000	0.0000	0.0000	212.3188	500.0773	776.9324	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2444	89.1892	89.0041	88.5204	87.5843	86.7000	86.7000	86.7000	86.7000	88.5056	89.0621	89.2660	(217)
Fuel for water heating, kWh/month													
	198.5748	174.1540	180.9697	159.8898	155.9942	137.3772	128.6798	145.6988	146.8563	165.9837	178.4410	192.6722	(219)
Water heating fuel used												1965.2916	(219)
Annual totals kWh/year													
Space heating fuel - main system												3593.2623	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5243.8916	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3593.2623	7.3800	265.1828	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1965.2916	7.3800	145.0385	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			427.0391	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3593.2623	0.2160	776.1446	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.2916	0.2160	424.5030	(264)
Space and water heating			1200.6476	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1037.3379	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3593.2623	1.2200	4383.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.2916	1.2200	2397.6557	(264)
Space and water heating			6781.4357	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5815.4226 (272)
Primary energy kWh/m2/year 51.7156 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (18.9%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	B 91
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£517	£441	£76
Space heating	£394	£394	£0
Water heating	£145	£83	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£427	£365	£62
Total cost of uses	£427	£365	£62
Delivered energy	47 kWh/m²	38 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	52 kWh/m²	42 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	128.6832	128.3550	128.0333	126.5223	126.2396	124.9236	124.9236	124.6799	125.4305	126.2396	126.8115	127.4094	(39)
Average = Sum(39)m / 12 =												126.5210	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1386	1.1251	1.1226	1.1109	1.1109	1.1088	1.1154	1.1226	1.1277	1.1330	(40)
HLP (average)												1.1251	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
								Total per year (kWh/year) = Sum(64)m =				861.7042	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	10.6334	0.7200	0.7000	0.7700	7.9107	(74)
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	107.3396	209.9620	347.4390	511.9173	633.6583	651.8339	619.2432	527.4216	405.5476	249.4213	133.7955	88.3219	(83)
Total gains	775.3715	872.6107	983.6578	1107.2106	1186.7929	1167.6483	1113.6173	1031.4258	933.4564	818.4875	748.4563	737.7212	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6841	60.8393	60.9922	61.7206	61.8588	62.5104	62.5104	62.6326	62.2578	61.8588	61.5798	61.2908	
alpha	5.0456	5.0560	5.0661	5.1147	5.1239	5.1674	5.1674	5.1755	5.1505	5.1239	5.1053	5.0861	
util living area													
	0.9963	0.9926	0.9808	0.9388	0.8321	0.6510	0.4870	0.5439	0.8042	0.9646	0.9927	0.9971	(86)
MIT	19.8492	19.9959	20.2537	20.5877	20.8435	20.9668	20.9938	20.9894	20.9035	20.5607	20.1449	19.8230	(87)
Th 2	19.9648	19.9671	19.9695	19.9804	19.9824	19.9919	19.9919	19.9937	19.9882	19.9824	19.9783	19.9739	(88)
util rest of house													
	0.9950	0.9901	0.9742	0.9177	0.7795	0.5622	0.3789	0.4311	0.7264	0.9481	0.9898	0.9961	(89)
MIT 2	18.4411	18.6563	19.0301	19.5062	19.8343	19.9708	19.9897	19.9895	19.9138	19.4803	18.8823	18.4096	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.6629	18.8672	19.2228	19.6765	19.9933	20.1276	20.1479	20.1470	20.0697	19.6504	19.0812	18.6322	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6629	18.8672	19.2228	19.6765	19.9933	20.1276	20.1479	20.1470	20.0697	19.6504	19.0812	18.6322	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9864	0.9677	0.9100	0.7801	0.5747	0.3959	0.4488	0.7335	0.9410	0.9862	0.9942	(94)
Useful gains	769.7208	860.7057	951.9074	1007.5617	925.8640	671.0762	440.9200	462.9004	684.6587	770.1979	738.0940	733.4602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1848.2636	1792.7652	1628.9443	1363.4735	1046.9377	690.5311	443.2114	467.1723	748.7783	1142.5242	1519.3532	1838.7997	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	802.4359	626.3440	503.7154	256.2565	90.0788	0.0000	0.0000	0.0000	0.0000	277.0107	562.5066	822.3726	(98)
Space heating												3940.7206	(98)
Space heating per m2											(98) / (4) =	35.0442	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4241.8951	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.4359	626.3440	503.7154	256.2565	90.0788	0.0000	0.0000	0.0000	0.0000	277.0107	562.5066	822.3726	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	863.7631	674.2131	542.2125	275.8412	96.9632	0.0000	0.0000	0.0000	0.0000	298.1816	605.4969	885.2235	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.7944	112.9038	88.8195	44.7046	17.0003	1.4946	0.0000	24.9211	47.9081	92.6729	128.7686	150.7164	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3753	89.3961	89.4054	89.4098	89.3763	86.7000	86.7000	86.7000	86.7000	89.0758	89.2861	89.3890	(217)
Fuel for water heating, kWh/month	169.8394	126.2961	99.3447	49.9996	19.0211	1.7238	0.0000	28.7441	55.2573	104.0382	144.2202	168.6073	(219)
Water heating fuel used												967.0918	(219)
Annual totals kWh/year													
Space heating fuel - main system												4241.8951	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5044.4335	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4241.8951	3.4800	147.6179	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.0918	3.4800	33.6548	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			279.5681	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7458	(257)
SAP value		89.5968	
SAP rating (Section 12)		90	(258)
SAP band		B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4241.8951	0.2160	916.2493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.0918	0.2160	208.8918	(264)
Space and water heating			1125.1412	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1039.7379	(272)
CO2 emissions per m2			9.2500	(273)
EI value			91.1512	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3465	0.3218	0.3300	0.3135	0.3135	0.3053	0.2970	0.2888	0.2805	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5600	0.5518	0.5545	0.5491	0.5491	0.5466	0.5441	0.5417	0.5393	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.4664	52.6768	52.9335	52.4266	52.4266	52.1829	51.9457	51.7150	51.4908	52.1829	51.7150	52.1829	(38)
Heat transfer coeff	125.9634	125.1738	125.4305	124.9236	124.9236	124.6799	124.4427	124.2120	123.9878	124.6799	124.2120	124.6799	(39)
Average = Sum(39)m / 12 =												124.7758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1202	1.1132	1.1154	1.1109	1.1109	1.1088	1.1066	1.1046	1.1026	1.1088	1.1046	1.1088	(40)
HLP (average)												1.1096	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8340	10.6817	11.8098	11.4061	11.7644	11.3597	11.7226	11.7497	11.3850	11.7886	11.4334	11.8262	(61)
Total heat required for water heating calculated for each month													
	177.2169	155.3267	161.0705	141.5352	136.6264	119.1060	111.5654	126.3208	127.3244	146.9049	158.9234	171.9907	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2724	(H8)
Utilisation factor												0.5443	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-912.8396	(H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870	(63)
								Solar input (sum of months) = Sum(63)m =				-912.8396	(63)
Output from w/h													
	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
								Total per year (kWh/year) = Sum(64)m =				834.2051	(64)
Heat gains from water heating, kWh/month													
	57.9483	50.7649	52.5816	46.1194	44.4577	38.6656	36.1284	41.0323	41.3961	47.8733	51.8988	56.2113	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8875	75.5430	70.6742	64.0548	59.7550	53.7022	48.5597	55.1510	57.4946	64.3458	72.0816	75.5528	(72)
Total internal gains													
	668.0319	662.6486	636.2188	595.2933	553.1346	515.8145	494.3741	504.0041	527.9088	569.0662	614.6608	649.3993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.1300	13.4839	0.7200	0.7000	0.7700	10.0313	(74)
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	137.6364	229.2249	381.8057	564.0742	661.6460	738.3998	696.3594	609.1988	470.1149	293.7046	171.0427	111.2906	(83)
Total gains	805.6683	891.8735	1018.0246	1159.3675	1214.7806	1254.2143	1190.7335	1113.2030	998.0238	862.7708	785.7035	760.6900	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9944	62.3855	62.2578	62.5104	62.5104	62.6326	62.7520	62.8686	62.9822	62.6326	62.8686	62.6326	
alpha	5.1330	5.1590	5.1505	5.1674	5.1674	5.1755	5.1835	5.1912	5.1988	5.1755	5.1912	5.1755	
util living area													
	0.9947	0.9907	0.9737	0.9131	0.7767	0.5532	0.4053	0.4319	0.7218	0.9409	0.9881	0.9958	(86)
MIT	19.9700	20.0905	20.3573	20.6821	20.9005	20.9859	20.9977	20.9969	20.9488	20.6759	20.2835	19.9587	(87)
Th 2	19.9844	19.9901	19.9882	19.9919	19.9919	19.9937	19.9954	19.9971	19.9987	19.9937	19.9971	19.9937	(88)
util rest of house													
	0.9929	0.9875	0.9647	0.8846	0.7130	0.4617	0.3022	0.3226	0.6306	0.9139	0.9832	0.9943	(89)
MIT 2	18.6313	18.8102	19.1918	19.6407	19.9059	19.9862	19.9948	19.9962	19.9646	19.6450	19.0966	18.6219	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8422	19.0119	19.3754	19.8047	20.0626	20.1436	20.1527	20.1538	20.1196	19.8073	19.2835	18.8324	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9833	0.9576	0.8783	0.7179	0.4758	0.3185	0.3399	0.6425	0.9077	0.9784	0.9919	(94)
Useful gains	797.6122	876.9831	974.9085	1018.3225	872.0318	596.6949	379.1954	378.3856	641.2439	783.1113	768.7274	754.5025	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1756.2015	1716.3677	1552.2474	1287.2964	944.7419	603.9021	379.8893	379.3218	671.9692	1048.2244	1413.9660	1724.6237	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	713.1904	564.0664	429.5401	193.6612	54.0963	0.0000	0.0000	0.0000	0.0000	197.2441	464.5718	721.7702	(98)
Space heating												3338.1406	(98)
Space heating per m2											(98) / (4) =	29.6856	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3593.2623	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	713.1904	564.0664	429.5401	193.6612	54.0963	0.0000	0.0000	0.0000	0.0000	197.2441	464.5718	721.7702	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	767.6969	607.1759	462.3683	208.4620	58.2307	0.0000	0.0000	0.0000	0.0000	212.3188	500.0773	776.9324	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.4379	112.9828	88.2915	43.3395	21.2896	0.0000	0.0000	18.3739	42.8095	88.4741	123.7026	147.5037	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3351	89.3497	89.3378	89.2973	88.9726	86.7000	86.7000	86.7000	86.7000	88.8841	89.2076	89.3405	(217)
Fuel for water heating, kWh/month	165.0391	126.4501	98.8288	48.5339	23.9283	0.0000	0.0000	21.1925	49.3765	99.5387	138.6682	165.1029	(219)
Water heating fuel used												936.6591	(219)
Annual totals kWh/year													
Space heating fuel - main system												3593.2623	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4265.2591	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3593.2623	7.3800	265.1828	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	936.6591	7.3800	69.1254	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			365.4560	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3593.2623	0.2160	776.1446	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.6591	0.2160	202.3184	(264)
Space and water heating			978.4630	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

Energy saving/generation technologies			
PV Unit	-850.7751	0.5190	-441.5523 (269)
Total kg/year			841.1033 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3593.2623	1.2200	4383.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	936.6591	1.2200	1142.7241	(264)
Space and water heating			5526.5040	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4713.9909	(272)
Primary energy kWh/m2/year			41.9208	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		763.75 (P1)
Transmission heat loss coefficient		72.50 (37)
Summer heat loss coefficient		836.25 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1300	87.1704	0.7200	0.7000	0.7650	64.4293
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						693.3731

	Jun	Jul	Aug	
Solar gains	747	693	605	(P3)
Internal gains	513	491	501	
Total summer gains	1260	1185	1106	(P5)
Summer gain/loss ratio	1.51	1.42	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 362 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	16 Goldcrest Road, Boorley Green, Southampton , SO32 2BZ		

SAP Rating	89 B	**DER**	12.69	**TER**	16.82
Environmental	90 B	**% DER<TER**	24.54		
CO_2 Emissions (t/year)	1.00	**DFEE**	47.24	**TFEE**	52.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.79		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.69	$kgCO_2/m^2$	Pass
	-4.13 (-24.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.24	$kWh/m^2/yr$	
	-5.2 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.13 m², No overhang 5.77 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 363 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	18 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.27	**TER**	16.54
Environmental	90 B	**% DER<TER**	25.82		
CO_2 Emissions (t/year)	0.96	**DFEE**	45.40	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.95		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 112 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.27 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.4 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.45 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 5.77 m², No overhang
Windows facing South: 2.13 m², No overhang
Windows facing West: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.4500	
Infiltration rate			0.3608	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3296	0.2913	0.2913	0.2837	0.3067	0.3296	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.0313	54.7480	54.4703	53.1657	52.9217	51.7855	51.7855	51.5751	52.2231	52.9217	53.4154	53.9316	(38)
Heat transfer coeff	127.5283	127.2450	126.9673	125.6627	125.4187	124.2825	124.2825	124.0721	124.7201	125.4187	125.9124	126.4286	(39)
Average = Sum(39)m / 12 =												125.6616	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1341	1.1316	1.1291	1.1175	1.1153	1.1052	1.1052	1.1034	1.1091	1.1153	1.1197	1.1243	(40)
HLP (average)												1.1175	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	447.4692	445.0592	428.6678	402.1560	374.9242	349.0444	332.4925	339.1492	353.0155	379.7591	410.4269	433.7250	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	581.6792	696.8661	822.9783	954.8194	1038.4561	1023.6152	976.5355	900.5308	803.4746	672.6242	575.6911	545.5063	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2337	61.3700	61.5043	62.1427	62.2637	62.8329	62.8329	62.9395	62.6124	62.2637	62.0195	61.7663	
alpha	5.0822	5.0913	5.1003	5.1428	5.1509	5.1889	5.1889	5.1960	5.1742	5.1509	5.1346	5.1178	
util living area													
	0.9990	0.9973	0.9908	0.9639	0.8819	0.7178	0.5475	0.6107	0.8654	0.9837	0.9978	0.9993	(86)
MIT	19.7029	19.8656	20.1402	20.4958	20.7894	20.9489	20.9897	20.9825	20.8609	20.4598	20.0126	19.6752	(87)
Th 2	19.9731	19.9751	19.9771	19.9866	19.9883	19.9966	19.9966	19.9981	19.9934	19.9883	19.9848	19.9810	(88)
util rest of house													
	0.9987	0.9963	0.9874	0.9500	0.8378	0.6281	0.4291	0.4891	0.7986	0.9752	0.9968	0.9990	(89)
MIT 2	18.2337	18.4729	18.8738	19.3884	19.7797	19.9623	19.9927	19.9908	19.8783	19.3464	18.6951	18.1988	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.4650	18.6923	19.0733	19.5628	19.9388	20.1177	20.1498	20.1469	20.0330	19.5217	18.9026	18.4313	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4650	18.6923	19.0733	19.5628	19.9388	20.1177	20.1498	20.1469	20.0330	19.5217	18.9026	18.4313	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9945	0.9832	0.9425	0.8353	0.6397	0.4477	0.5081	0.8017	0.9697	0.9953	0.9984	(94)
Useful gains	580.4342	693.0404	809.1509	899.9320	867.4524	654.8401	437.2261	457.5249	644.1217	652.2319	572.9750	544.6596	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1806.4450	1754.9963	1596.3947	1339.9213	1033.2944	685.7483	441.1724	464.8913	739.9697	1118.9507	1486.0929	1799.2408	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	912.1520	713.6344	585.7094	316.7923	123.3865	0.0000	0.0000	0.0000	0.0000	347.2388	657.4449	933.4084	(98)
Space heating												4589.7666	(98)
Space heating per m2											(98) / (4) =	40.8161	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4940.5454	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	912.1520	713.6344	585.7094	316.7923	123.3865	0.0000	0.0000	0.0000	0.0000	347.2388	657.4449	933.4084	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	981.8644	768.1748	630.4730	341.0036	132.8164	0.0000	0.0000	0.0000	0.0000	373.7770	707.6909	1004.7453	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3634	89.3107	89.1899	88.8867	88.1895	86.7000	86.7000	86.7000	86.7000	88.9241	89.2586	89.3866	(217)
Fuel for water heating, kWh/month													
	198.3442	173.9476	180.6265	159.2637	154.9578	137.4107	128.7145	145.7334	146.8899	165.2363	178.0809	192.4458	(219)
Water heating fuel used												1961.6513	(219)
Annual totals kWh/year													
Space heating fuel - main system												4940.5454	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6687.6432	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4940.5454	0.2160	1067.1578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1961.6513	0.2160	423.7167	(264)
Space and water heating			1490.8745	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1379.5212	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.2700	ZC1
Total Floor Area	TFA	112.4500	
Assumed number of occupants	N	2.8288	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4933	ZC2
CO2 emissions from cooking, equation (L16)		1.6620	ZC3
Total CO2 emissions		28.4253	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4253	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7520	(36)
Total fabric heat loss (33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.9972	48.5639	44.9974	46.4973	48.5639	48.9972	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
									Total per year (kWh/year) = Sum(64)m =			2180.9448	(64)
Heat gains from water heating, kWh/month													
	67.7295	59.6013	62.3689	55.5172	53.6576	47.0750	44.8221	50.2359	50.7992	57.6659	61.3692	65.9944	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	91.0343	88.6924	83.8292	77.1072	72.1204	65.3820	60.2447	67.5213	70.5544	77.5079	85.2350	88.7022	(72)
Total internal gains													
	460.6059	458.1986	441.8127	415.1983	387.2795	360.7141	344.1675	351.5094	366.0652	392.9111	423.5701	446.8644	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	578.0397	678.5296	786.8343	898.7788	967.8699	950.9635	907.7051	842.7183	760.2169	649.1680	568.1763	544.6730	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9991	0.9976	0.9922	0.9696	0.8970	0.7386	0.5655	0.6264	0.8757	0.9853	0.9979	0.9993	(86)
MIT	19.7517	19.9018	20.1588	20.4980	20.7842	20.9474	20.9896	20.9827	20.8628	20.4781	20.0529	19.7287	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9987	0.9967	0.9893	0.9576	0.8569	0.6516	0.4480	0.5068	0.8128	0.9775	0.9970	0.9991	(89)
MIT 2	18.3275	18.5485	18.9245	19.4186	19.8046	19.9957	20.0279	20.0262	19.9125	19.3982	18.7779	18.3005	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5518	18.7616	19.1189	19.5886	19.9589	20.1456	20.1794	20.1769	20.0622	19.5683	18.9787	18.5254	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9856	0.9508	0.8539	0.6627	0.4665	0.5254	0.8154	0.9725	0.9956	0.9985	(94)
Useful gains	576.8716	675.2250	775.5222	854.5272	826.4284	630.1670	423.4638	442.7830	619.9009	631.2970	565.6688	543.8653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1755.7043	1703.0901	1546.3461	1293.6538	997.2435	662.3243	427.4966	450.1607	715.1020	1082.9026	1441.1271	1746.5299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating												4445.6344	(98)
Space heating per m2											(98) / (4) =	39.5343	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4759.7799	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	877.0515	690.7253	573.4929	316.1712	127.0864	0.0000	0.0000	0.0000	0.0000	335.9946	630.3300	894.7825	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	939.0273	739.5346	614.0181	338.5130	136.0668	0.0000	0.0000	0.0000	0.0000	359.7373	674.8715	958.0112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3418	190.6724	200.2196	179.1262	173.4258	152.7437	146.3401	163.1350	164.9366	186.0751	196.8050	211.1234	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2049	88.0054	87.5504	86.4668	84.2822	80.3000	80.3000	80.3000	80.3000	86.5213	87.7732	88.2802	(217)
Fuel for water heating, kWh/month													
	245.2720	216.6598	228.6907	207.1619	205.7679	190.2164	182.2418	203.1569	205.4005	215.0629	224.2199	239.1514	(219)
Water heating fuel used												2563.0022	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.7799	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Total delivered energy for all uses												7858.8949	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4759.7799	0.2160	1028.1125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2563.0022	0.2160	553.6085	(264)
Space and water heating			1581.7209	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Total CO2, kg/m2/year			1859.9635	(272)
Emissions per m2 for space and water heating			14.0660	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1282	(272b)
Emissions per m2 for pumps and fans			0.3462	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0660 * 1.00) + 2.1282 + 0.3462, rounded to 2 d.p.			16.5400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				4.4500	
Infiltration rate				0.3608	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3296	0.2913	0.2913	0.2837	0.3067	0.3296	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.0313	54.7480	54.4703	53.1657	52.9217	51.7855	51.7855	51.5751	52.2231	52.9217	53.4154	53.9316	(38)
Heat transfer coeff	127.5283	127.2450	126.9673	125.6627	125.4187	124.2825	124.2825	124.0721	124.7201	125.4187	125.9124	126.4286	(39)
Average = Sum(39)m / 12 =												125.6616	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1341	1.1316	1.1291	1.1175	1.1153	1.1052	1.1052	1.1034	1.1091	1.1153	1.1197	1.1243	(40)
HLP (average)												1.1175	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	548.0180	664.0527	791.9255	926.1606	1011.3538	998.7030	953.4826	875.0933	777.1881	643.8599	544.1294	512.6893	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2337	61.3700	61.5043	62.1427	62.2637	62.8329	62.8329	62.9395	62.6124	62.2637	62.0195	61.7663	
alpha	5.0822	5.0913	5.1003	5.1428	5.1509	5.1889	5.1889	5.1960	5.1742	5.1509	5.1346	5.1178	
util living area													
	0.9993	0.9978	0.9922	0.9679	0.8908	0.7306	0.5594	0.6257	0.8775	0.9865	0.9983	0.9995	(86)
MIT	19.6748	19.8385	20.1153	20.4757	20.7769	20.9446	20.9887	20.9805	20.8498	20.4375	19.9864	19.6477	(87)
Th 2	19.9731	19.9751	19.9771	19.9866	19.9883	19.9966	19.9966	19.9981	19.9934	19.9883	19.9848	19.9810	(88)
util rest of house													
	0.9990	0.9970	0.9893	0.9553	0.8487	0.6410	0.4391	0.5025	0.8138	0.9793	0.9976	0.9993	(89)
MIT 2	18.7575	18.9225	19.1994	19.5594	19.8361	19.9709	19.9937	19.9924	19.9071	19.5286	19.0781	18.7368	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.9019	19.0668	19.3437	19.7037	19.9842	20.1242	20.1504	20.1480	20.0556	19.6718	19.2212	18.8802	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9019	19.0668	19.3437	19.7037	19.9842	20.1242	20.1504	20.1480	20.0556	19.6718	19.2212	18.8802	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9961	0.9869	0.9508	0.8485	0.6534	0.4582	0.5219	0.8185	0.9762	0.9968	0.9990	(94)
Useful gains	547.2455	661.4495	781.5657	880.6392	858.1333	652.5216	436.8611	456.7032	636.1126	628.5122	542.3708	512.1762	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1862.1618	1802.6491	1630.7239	1357.6269	1038.9975	686.5656	441.2484	465.0270	742.7782	1137.7692	1526.2072	1856.0011	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	978.2977	766.8861	631.7737	343.4312	134.5629	0.0000	0.0000	0.0000	0.0000	378.8872	708.3622	999.8057	(98)
Space heating												4942.0068	(98)
Space heating per m2											(98) / (4) =	43.9485	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1168.2552	919.6903	942.9477	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8715	0.9304	0.9035	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1018.1318	855.7019	851.9766	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1270.7102	1215.9021	1127.8318	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	181.8564	267.9890	205.2362	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												655.0817	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	45.4641	66.9973	51.3091	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												163.7704	(107)
Space cooling per m2												1.4564	(108)
Energy for space heating												43.9485	(99)
Energy for space cooling												1.4564	(108)
Total												45.4049	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.4	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3883	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3300	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4208	0.4125	0.4043	0.3630	0.3548	0.3135	0.3135	0.3053	0.3300	0.3548	0.3713	0.3878	(22b)
Effective ac	0.5885	0.5851	0.5817	0.5659	0.5629	0.5491	0.5491	0.5466	0.5545	0.5629	0.5689	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5100	1.3258	20.5625			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1800	1.2762			(29a)
External Wall	109.6400	16.1400	93.5000	0.1800	16.8300			(29a)
Knee Wall	13.5000		13.5000	0.1800	2.4300			(29a)
Main Roof	18.3700		18.3700	0.1300	2.3881			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1300	1.3182			(30)
Dormer roof	2.4300		2.4300	0.1300	0.3159			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.2538			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.7520	(36)
Total fabric heat loss	(33) + (36) =	67.0058	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.1862	55.8580	55.5363	54.0253	53.7426	52.4266	52.4266	52.1829	52.9335	53.7426	54.3145	54.9124	(38)
Heat transfer coeff	123.1920	122.8638	122.5421	121.0311	120.7484	119.4324	119.4324	119.1887	119.9393	120.7484	121.3203	121.9182	(39)
Average = Sum(39)m / 12 =												121.0298	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0955	1.0926	1.0897	1.0763	1.0738	1.0621	1.0621	1.0599	1.0666	1.0738	1.0789	1.0842	(40)
HLP (average)												1.0763	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.1439	30.7371	31.7179	27.6524	26.5332	22.8961	21.2166	24.3464	24.6371	28.7122	31.3416	34.0350	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	141.4380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.1101	23.1908	18.8600	14.2782	10.6732	9.0107	9.7364	12.6557	16.9865	21.5683	25.1734	26.8358	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	275.0300	277.8840	270.6921	255.3815	236.0546	217.8900	205.7549	202.9010	210.0929	225.4035	244.7304	262.8950	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	37.1438	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	47.2364	45.7397	42.6316	38.4061	35.6628	31.8001	28.5169	32.7236	34.2182	38.5917	43.5300	45.7459	(72)
Total internal gains													
	413.8079	412.2458	397.6151	373.4973	347.8220	324.1322	309.4397	313.7117	326.7290	350.9948	378.8652	400.9081	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.6300	0.7000	0.7700	34.6334	(76)
South	2.1300	46.7521	0.6300	0.7000	0.7700	30.4335	(78)
West	7.6100	19.6403	0.6300	0.7000	0.7700	45.6777	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	117.4338	220.3310	345.0216	483.5804	580.5904	590.2494	563.5376	491.2089	394.1517	256.2570	144.6062	97.8086	(83)
Total gains	531.2417	632.5768	742.6367	857.0777	928.4124	914.3817	872.9773	804.9206	720.8807	607.2518	523.4713	498.7167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.3891	63.5584	63.7252	64.5208	64.6719	65.3845	65.3845	65.5182	65.1081	64.6719	64.3670	64.0513	
alpha	5.2259	5.2372	5.2483	5.3014	5.3115	5.3590	5.3590	5.3679	5.3405	5.3115	5.2911	5.2701	
util living area													
	0.9994	0.9983	0.9940	0.9749	0.9098	0.7587	0.5855	0.6509	0.8942	0.9890	0.9986	0.9996	(86)
MIT	19.7124	19.8634	20.1229	20.4676	20.7643	20.9401	20.9878	20.9793	20.8448	20.4451	20.0154	19.6900	(87)
Th 2	20.0045	20.0069	20.0092	20.0202	20.0223	20.0319	20.0319	20.0337	20.0282	20.0223	20.0181	20.0138	(88)
util rest of house													
	0.9992	0.9976	0.9917	0.9648	0.8729	0.6726	0.4652	0.5290	0.8364	0.9831	0.9980	0.9994	(89)
MIT 2	18.8202	18.9730	19.2332	19.5808	19.8576	20.0033	20.0287	20.0275	19.9366	19.5643	19.1341	18.8053	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9608	19.1132	19.3733	19.7205	20.0004	20.1508	20.1797	20.1774	20.0796	19.7030	19.2729	18.9447	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9969	0.9898	0.9608	0.8719	0.6841	0.4842	0.5482	0.8401	0.9804	0.9973	0.9992	(94)
Useful gains	530.6152	630.5957	735.0316	823.4625	809.4985	625.5698	422.7279	441.2274	605.6230	595.3439	522.0713	498.2977	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1806.0882	1746.2898	1577.5250	1309.6182	1002.2563	662.9453	427.5361	450.2212	717.1904	1099.1754	1476.8161	1797.6427	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.9519	749.7464	626.8151	350.0321	143.4118	0.0000	0.0000	0.0000	0.0000	374.8506	687.4163	966.7127	(98)
Space heating												4847.9369	(98)
Space heating per m2											(98) / (4) =	43.1119	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1122.6649	883.8000	905.8343	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8607	0.9245	0.8970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	966.2755	817.0738	812.5601	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1173.2354	1122.8308	1046.6749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	149.0112	227.4832	174.1814	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.6757	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	37.2528	56.8708	43.5453	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.6689	(107)
Space cooling per m2												1.2243	(108)
Energy for space heating												43.1119	(99)
Energy for space cooling												1.2243	(108)
Total												44.3362	(109)
Target Fabric Energy Efficiency (TFEE)												51.0	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1383	(8)
Pressure test				Yes	
Measured/design AP50				4.4500	
Infiltration rate				0.3608	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3220	0.2990	0.3067	0.2913	0.2913	0.2837	0.2760	0.2683	0.2607	0.2837	0.2683	0.2837	(22b)
Effective ac	0.5518	0.5447	0.5470	0.5424	0.5424	0.5402	0.5381	0.5360	0.5340	0.5402	0.5360	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.6832	52.0015	52.2231	51.7855	51.7855	51.5751	51.3703	51.1711	50.9775	51.5751	51.1711	51.5751	(38)
Heat transfer coeff	125.1802	124.4985	124.7201	124.2825	124.2825	124.0721	123.8673	123.6681	123.4745	124.0721	123.6681	124.0721	(39)
Average = Sum(39)m / 12 =												124.1548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1132	1.1071	1.1091	1.1052	1.1052	1.1034	1.1015	1.0998	1.0980	1.1034	1.0998	1.1034	(40)
HLP (average)												1.1041	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF HEAT DEMAND 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
RHI water heating demand												1734	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8706	934.0248	1064.5272	1198.6627	1241.1022	1275.3970	1213.9539	1147.0625	1044.5015	909.6190	823.1688	788.4124	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3823	62.7239	62.6124	62.8329	62.8329	62.9395	63.0435	63.1451	63.2440	62.9395	63.1451	62.9395	
alpha	5.1588	5.1816	5.1742	5.1889	5.1889	5.1960	5.2029	5.2097	5.2163	5.1960	5.2097	5.1960	
util living area													
	0.9937	0.9885	0.9683	0.9024	0.7642	0.5427	0.3960	0.4178	0.6961	0.9283	0.9853	0.9950	(86)
MIT	20.0054	20.1319	20.3982	20.7073	20.9091	20.9873	20.9980	20.9974	20.9572	20.7080	20.3181	19.9886	(87)
Th 2	19.9901	19.9950	19.9934	19.9966	19.9966	19.9981	19.9996	20.0010	20.0024	19.9981	20.0010	19.9981	(88)
util rest of house													
	0.9915	0.9847	0.9578	0.8717	0.6998	0.4528	0.2955	0.3123	0.6052	0.8974	0.9795	0.9933	(89)
MIT 2	18.6869	18.8734	19.2529	19.6763	19.9187	19.9914	19.9990	20.0003	19.9745	19.6891	19.1489	18.6685	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9800	0.9504	0.8661	0.7052	0.4666	0.3114	0.3289	0.6175	0.8918	0.9742	0.9906	(94)
Useful gains	828.0350	915.3169	1011.6897	1038.1409	875.2648	595.0649	377.9751	377.3141	645.0067	811.2076	801.8917	780.9686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1751.8426	1714.5449	1550.6738	1284.9204	941.3962	601.5278	378.5822	378.0964	670.3765	1048.3536	1413.9068	1721.6757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	687.3128	537.0812	401.0041	177.6813	49.2017	0.0000	0.0000	0.0000	0.0000	176.4366	440.6509	699.8861	(98)
Space heating												3169.2548	(98)
RHI space heating demand												3169	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1383	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3296	0.2913	0.2913	0.2837	0.3067	0.3296	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.0313	54.7480	54.4703	53.1657	52.9217	51.7855	51.7855	51.5751	52.2231	52.9217	53.4154	53.9316	(38)
Heat transfer coeff	127.5283	127.2450	126.9673	125.6627	125.4187	124.2825	124.2825	124.0721	124.7201	125.4187	125.9124	126.4286	(39)
Average = Sum(39)m / 12 =												125.6616	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1341	1.1316	1.1291	1.1175	1.1153	1.1052	1.1052	1.1034	1.1091	1.1153	1.1197	1.1243	(40)
HLP (average)												1.1175	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2521	914.4656	1030.5394	1147.9668	1216.6766	1190.3953	1138.4272	1065.3958	978.3780	861.9414	779.9351	761.1907	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2337	61.3700	61.5043	62.1427	62.2637	62.8329	62.8329	62.9395	62.6124	62.2637	62.0195	61.7663	
alpha	5.0822	5.0913	5.1003	5.1428	5.1509	5.1889	5.1889	5.1960	5.1742	5.1509	5.1346	5.1178	
util living area													
	0.9956	0.9908	0.9765	0.9298	0.8192	0.6384	0.4747	0.5258	0.7799	0.9564	0.9912	0.9966	(86)
MIT	19.8852	20.0425	20.3002	20.6193	20.8574	20.9701	20.9946	20.9911	20.9179	20.5966	20.1794	19.8543	(87)
Th 2	19.9731	19.9751	19.9771	19.9866	19.9883	19.9966	19.9966	19.9981	19.9934	19.9883	19.9848	19.9810	(88)
util rest of house													
	0.9942	0.9878	0.9686	0.9065	0.7652	0.5505	0.3694	0.4164	0.6999	0.9370	0.9878	0.9955	(89)
MIT 2	18.4995	18.7295	19.1017	19.5528	19.8548	19.9776	19.9947	19.9946	19.9315	19.5331	18.9368	18.4603	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7177	18.9363	19.2905	19.7207	20.0127	20.1339	20.1521	20.1515	20.0869	19.7006	19.1325	18.6798	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7177	18.9363	19.2905	19.7207	20.0127	20.1339	20.1521	20.1515	20.0869	19.7006	19.1325	18.6798	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9836	0.9617	0.8992	0.7666	0.5631	0.3860	0.4335	0.7082	0.9299	0.9837	0.9934	(94)
Useful gains	795.5291	899.4402	991.0518	1032.1984	932.7529	670.3297	439.4819	461.8927	692.8593	801.5221	767.2065	756.1831	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1838.6689	1786.0456	1623.9687	1359.7619	1042.5632	687.7710	441.4695	465.4608	746.6823	1141.3822	1515.0461	1830.6652	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	776.0960	595.7989	470.8902	235.8457	81.6988	0.0000	0.0000	0.0000	0.0000	252.8559	538.4445	799.4147	(98)
Space heating												3751.0448	(98)
Space heating per m2											(98) / (4) =	33.3574	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4037.7231	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	776.0960	595.7989	470.8902	235.8457	81.6988	0.0000	0.0000	0.0000	0.0000	252.8559	538.4445	799.4147	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	835.4101	641.3335	506.8786	253.8706	87.9428	0.0000	0.0000	0.0000	0.0000	272.1808	579.5958	860.5109	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2873	89.2189	89.0621	88.6724	87.8703	86.7000	86.7000	86.7000	86.7000	88.6968	89.1500	89.3162	(217)
Fuel for water heating, kWh/month													
	198.5131	174.1265	180.8857	159.6487	155.5207	137.4107	128.7145	145.7334	146.8899	165.6598	178.2977	192.5974	(219)
Water heating fuel used												1963.9981	(219)
Annual totals kWh/year													
Space heating fuel - main system												4037.7231	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												5787.1678	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.7231	3.4800	140.5128	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1963.9981	3.4800	68.3471	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			300.5603	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8017	(257)
SAP value		88.8156	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.7231	0.2160	872.1482	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.9981	0.2160	424.2236	(264)
Space and water heating			1296.3718	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1185.0185	(272)
CO2 emissions per m2			10.5400	(273)
EI value			89.9147	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Calculation of stars for heating and DHW
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Main heating energy efficiency                                  3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact                       0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency                                   3.48 / 0.8817 = 3.947, stars = 4
Water heating environmental impact                          0.216 / 0.8817 = 0.2450, stars = 4


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.5400 (2b)	=	111.8616	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6900 (2c)	=	107.0082	(1c) - (3c)
Second floor	28.6300 (1d)	x	2.4600 (2d)	=	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.4500	
Infiltration rate			0.3608	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3220	0.2990	0.3067	0.2913	0.2913	0.2837	0.2760	0.2683	0.2607	0.2837	0.2683	0.2837	(22b)
Effective ac	0.5518	0.5447	0.5470	0.5424	0.5424	0.5402	0.5381	0.5360	0.5340	0.5402	0.5360	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.6832	52.0015	52.2231	51.7855	51.7855	51.5751	51.3703	51.1711	50.9775	51.5751	51.1711	51.5751	(38)
Heat transfer coeff	125.1802	124.4985	124.7201	124.2825	124.2825	124.0721	123.8673	123.6681	123.4745	124.0721	123.6681	124.0721	(39)
Average = Sum(39)m / 12 =												124.1548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1132	1.1071	1.1091	1.1052	1.1052	1.1034	1.1015	1.0998	1.0980	1.1034	1.0998	1.1034	(40)
HLP (average)												1.1041	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
									Total per year (kWh/year) = Sum(64)m =			1734.2653	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8706	934.0248	1064.5272	1198.6627	1241.1022	1275.3970	1213.9539	1147.0625	1044.5015	909.6190	823.1688	788.4124	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3823	62.7239	62.6124	62.8329	62.8329	62.9395	63.0435	63.1451	63.2440	62.9395	63.1451	62.9395	
alpha	5.1588	5.1816	5.1742	5.1889	5.1889	5.1960	5.2029	5.2097	5.2163	5.1960	5.2097	5.1960	
util living area													
	0.9937	0.9885	0.9683	0.9024	0.7642	0.5427	0.3960	0.4178	0.6961	0.9283	0.9853	0.9950	(86)
MIT	20.0054	20.1319	20.3982	20.7073	20.9091	20.9873	20.9980	20.9974	20.9572	20.7080	20.3181	19.9886	(87)
Th 2	19.9901	19.9950	19.9934	19.9966	19.9966	19.9981	19.9996	20.0010	20.0024	19.9981	20.0010	19.9981	(88)
util rest of house													
	0.9915	0.9847	0.9578	0.8717	0.6998	0.4528	0.2955	0.3123	0.6052	0.8974	0.9795	0.9933	(89)
MIT 2	18.6869	18.8734	19.2529	19.6763	19.9187	19.9914	19.9990	20.0003	19.9745	19.6891	19.1489	18.6685	(90)
Living area fraction										fLA = Living area / (4) =		0.1575	(91)
MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9800	0.9504	0.8661	0.7052	0.4666	0.3114	0.3289	0.6175	0.8918	0.9742	0.9906	(94)
Useful gains	828.0350	915.3169	1011.6897	1038.1409	875.2648	595.0649	377.9751	377.3141	645.0067	811.2076	801.8917	780.9686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1751.8426	1714.5449	1550.6738	1284.9204	941.3962	601.5278	378.5822	378.0964	670.3765	1048.3536	1413.9068	1721.6757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	687.3128	537.0812	401.0041	177.6813	49.2017	0.0000	0.0000	0.0000	0.0000	176.4366	440.6509	699.8861	(98)
Space heating												3169.2548	(98)
Space heating per m2											(98) / (4) =	28.1837	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3411.4691	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	687.3128	537.0812	401.0041	177.6813	49.2017	0.0000	0.0000	0.0000	0.0000	176.4366	440.6509	699.8861	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	739.8416	578.1284	431.6514	191.2608	52.9621	0.0000	0.0000	0.0000	0.0000	189.9210	474.3282	753.3758	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2248	89.1617	88.9590	88.4523	87.5247	86.7000	86.7000	86.7000	86.7000	88.4172	89.0289	89.2501	(217)
Fuel for water heating, kWh/month													
	198.6521	174.2383	181.0953	160.0458	156.1346	137.4107	128.7145	145.7334	146.8899	166.1837	178.5403	192.7402	(219)
Water heating fuel used												1966.3790	(219)
Annual totals kWh/year													
Space heating fuel - main system												3411.4691	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5063.1859	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3411.4691	7.3800	251.7664	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1966.3790	7.3800	145.1188	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			413.7030	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3411.4691	0.2160	736.8773	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.3790	0.2160	424.7379	(264)
Space and water heating			1161.6152	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			998.3055	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3411.4691	1.2200	4161.9923	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.3790	1.2200	2398.9823	(264)
Space and water heating			6560.9747	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Primary energy kWh/year 5594.9616 (272)
Primary energy kWh/m2/year 49.7551 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (19.7%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating	£62	1.75 kg/m²		B 90	A 92
Total Savings	£62	1.75 kg/m²			

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£154	£168	-£14
Mains gas	£504	£428	£76
Space heating	£380	£380	£0
Water heating	£145	£84	£62
Lighting	£132	£132	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£414	£352	£62
Total cost of uses	£413	£352	£62
Delivered energy	45 kWh/m²	36 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	50 kWh/m²	40 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.4500	
Infiltration rate			0.3608	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3296	0.2913	0.2913	0.2837	0.3067	0.3296	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.0313	54.7480	54.4703	53.1657	52.9217	51.7855	51.7855	51.5751	52.2231	52.9217	53.4154	53.9316	(38)
Heat transfer coeff	127.5283	127.2450	126.9673	125.6627	125.4187	124.2825	124.2825	124.0721	124.7201	125.4187	125.9124	126.4286	(39)
Average = Sum(39)m / 12 =												125.6616	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1341	1.1316	1.1291	1.1175	1.1153	1.1052	1.1052	1.1034	1.1091	1.1153	1.1197	1.1243	(40)
HLP (average)												1.1175	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288 (42)
Average daily hot water use (litres/day)	101.3830 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213	(44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645	(45)
Energy content (annual)										Total = Sum(45)m =		1595.1500	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563	(61)
Total heat required for water heating calculated for each month													
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1369	(H8)
Utilisation factor												0.5850	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.3830	(H14)
Volume ratio Veff/V												0.7398	(H15)
Solar storage volume factor												0.9397	(H16)
Solar input												-876.6988	(H17)
Solar input	-25.4225	-42.4229	-72.2510	-96.8306	-119.6260	-117.6114	-116.0572	-101.3997	-79.4163	-54.2320	-30.1548	-21.2743	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6988	(63)
Output from w/h													
	151.8245	112.9309	88.8495	44.7337	17.0304	1.5237	0.0000	24.9512	47.9372	92.7029	128.7977	150.7465	(64)
								Total per year (kWh/year) = Sum(64)m =				862.0282	(64)
Heat gains from water heating, kWh/month													
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)													
	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains													
	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	19.6403	0.7200	0.7000	0.7700	39.5810	(76)
South	2.1300	46.7521	0.7200	0.7000	0.7700	34.7812	(78)
West	7.6100	19.6403	0.7200	0.7000	0.7700	52.2030	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	134.2100	251.8069	394.3104	552.6634	663.5319	674.5708	644.0430	561.3816	450.4591	292.8651	165.2642	111.7812	(83)
Total gains	802.2521	914.4656	1030.5394	1147.9668	1216.6766	1190.3953	1138.4272	1065.3958	978.3780	861.9414	779.9351	761.1907	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2337	61.3700	61.5043	62.1427	62.2637	62.8329	62.8329	62.9395	62.6124	62.2637	62.0195	61.7663	
alpha	5.0822	5.0913	5.1003	5.1428	5.1509	5.1889	5.1889	5.1960	5.1742	5.1509	5.1346	5.1178	
util living area													
	0.9956	0.9908	0.9765	0.9298	0.8192	0.6384	0.4747	0.5258	0.7799	0.9564	0.9912	0.9966	(86)
MIT	19.8852	20.0425	20.3002	20.6193	20.8574	20.9701	20.9946	20.9911	20.9179	20.5966	20.1794	19.8543	(87)
Th 2	19.9731	19.9751	19.9771	19.9866	19.9883	19.9966	19.9966	19.9981	19.9934	19.9883	19.9848	19.9810	(88)
util rest of house													
	0.9942	0.9878	0.9686	0.9065	0.7652	0.5505	0.3694	0.4164	0.6999	0.9370	0.9878	0.9955	(89)
MIT 2	18.4995	18.7295	19.1017	19.5528	19.8548	19.9776	19.9947	19.9946	19.9315	19.5331	18.9368	18.4603	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.7177	18.9363	19.2905	19.7207	20.0127	20.1339	20.1521	20.1515	20.0869	19.7006	19.1325	18.6798	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7177	18.9363	19.2905	19.7207	20.0127	20.1339	20.1521	20.1515	20.0869	19.7006	19.1325	18.6798	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9916	0.9836	0.9617	0.8992	0.7666	0.5631	0.3860	0.4335	0.7082	0.9299	0.9837	0.9934	(94)
Useful gains	795.5291	899.4402	991.0518	1032.1984	932.7529	670.3297	439.4819	461.8927	692.8593	801.5221	767.2065	756.1831	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1838.6689	1786.0456	1623.9687	1359.7619	1042.5632	687.7710	441.4695	465.4608	746.6823	1141.3822	1515.0461	1830.6652	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	776.0960	595.7989	470.8902	235.8457	81.6988	0.0000	0.0000	0.0000	0.0000	252.8559	538.4445	799.4147	(98)
Space heating												3751.0448	(98)
Space heating per m2											(98) / (4) =	33.3574	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4037.7231	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	776.0960	595.7989	470.8902	235.8457	81.6988	0.0000	0.0000	0.0000	0.0000	252.8559	538.4445	799.4147	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	835.4101	641.3335	506.8786	253.8706	87.9428	0.0000	0.0000	0.0000	0.0000	272.1808	579.5958	860.5109	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.8245	112.9309	88.8495	44.7337	17.0304	1.5237	0.0000	24.9512	47.9372	92.7029	128.7977	150.7465	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3604	89.3744	89.3764	89.3741	89.3313	86.7000	86.7000	86.7000	86.7000	89.0186	89.2640	89.3766	(217)
Fuel for water heating, kWh/month	169.9014	126.3572	99.4105	50.0522	19.0643	1.7574	0.0000	28.7787	55.2909	104.1389	144.2885	168.6643	(219)
Water heating fuel used												967.7043	(219)
Annual totals kWh/year													
Space heating fuel - main system												4037.7231	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												4840.8740	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4037.7231	3.4800	140.5128	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	967.7043	3.4800	33.6761	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	461.1129	13.1900	60.8208	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			272.4843	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7269	(257)
SAP value	89.8604	
SAP rating (Section 12)	90	(258)
SAP band	B	

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4037.7231	0.2160	872.1482	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	967.7043	0.2160	209.0241	(264)
Space and water heating			1081.1723	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			995.7691	(272)
CO2 emissions per m2			8.8600	(273)
EI value			91.5254	
EI rating			92	(274)
EI band			A	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.5400	(2b) =	111.8616	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6900	(2c) =	107.0082	(1c) - (3c)
Second floor	28.6300	(1d)	x 2.4600	(2d) =	70.4298	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.4500					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	289.2996	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1383	(8)
Pressure test			Yes	
Measured/design AP50			4.4500	
Infiltration rate			0.3608	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3220	0.2990	0.3067	0.2913	0.2913	0.2837	0.2760	0.2683	0.2607	0.2837	0.2683	0.2837	(22b)
Effective ac	0.5518	0.5447	0.5470	0.5424	0.5424	0.5402	0.5381	0.5360	0.5340	0.5402	0.5360	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5100	1.2357	19.1663			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Opening Type 9 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	8.5800	1.4900	7.0900	0.1900	1.3471			(29a)
External Wall	109.6400	16.1400	93.5000	0.2700	25.2450			(29a)
Knee Wall	13.5000		13.5000	0.1500	2.0250			(29a)
Main Roof	18.3700		18.3700	0.1600	2.9392			(30)
Sloping roof	10.4600	0.6500	9.8100	0.1300	1.2753			(30)
Semi exposed roof	10.1400		10.1400	0.1600	1.6224			(30)
Dormer roof	2.4300		2.4300	0.1600	0.3888			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			221.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6012			(33)
Party Wall			46.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8958	(36)
Total fabric heat loss (33) + (36) =	72.4970	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.6832	52.0015	52.2231	51.7855	51.7855	51.5751	51.3703	51.1711	50.9775	51.5751	51.1711	51.5751	(38)
Heat transfer coeff	125.1802	124.4985	124.7201	124.2825	124.2825	124.0721	123.8673	123.6681	123.4745	124.0721	123.6681	124.0721	(39)
Average = Sum(39)m / 12 =												124.1548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1132	1.1071	1.1091	1.1052	1.1052	1.1034	1.1015	1.0998	1.0980	1.1034	1.0998	1.1034	(40)
HLP (average)												1.1041	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8288	(42)
Average daily hot water use (litres/day)	101.3830	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	111.5213	107.4660	103.4107	99.3554	95.3001	91.2447	91.2447	95.3001	99.3554	103.4107	107.4660	111.5213 (44)
Energy conte	165.3829	144.6450	149.2606	130.1290	124.8619	107.7463	99.8428	114.5711	115.9394	135.1162	147.4899	160.1645 (45)
Energy content (annual)										Total = Sum(45)m =		1595.1500 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.8074	21.6967	22.3891	19.5194	18.7293	16.1620	14.9764	17.1857	17.3909	20.2674	22.1235	24.0247 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8641	10.7088	11.8399	11.4352	11.7945	11.3888	11.7527	11.7798	11.4141	11.8187	11.4625	11.8563 (61)
Total heat required for water heating calculated for each month												
	177.2470	155.3538	161.1005	141.5643	136.6564	119.1351	111.5955	126.3509	127.3535	146.9349	158.9525	172.0208 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2724 (H8)
Utilisation factor												0.5443 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.3830 (H14)
Volume ratio Veff/V												0.7398 (H15)
Solar storage volume factor												0.9397 (H16)
Solar input												-912.8396 (H17)
Solar input	-29.7790	-42.3439	-72.7790	-98.1957	-115.3367	-123.1979	-120.6070	-107.9469	-84.5150	-58.4308	-35.2208	-24.4870 (63)
										Solar input (sum of months) = Sum(63)m =		-912.8396 (63)
Output from w/h												
	147.4680	113.0099	88.3216	43.3686	21.3197	0.0000	0.0000	18.4040	42.8386	88.5042	123.7317	147.5338 (64)
										Total per year (kWh/year) = Sum(64)m =		834.4999 (64)
Heat gains from water heating, kWh/month												
	57.9558	50.7717	52.5891	46.1267	44.4652	38.6729	36.1359	41.0398	41.4034	47.8808	51.9060	56.2188 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	169.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.2753	57.9769	47.1500	35.6956	26.6829	22.5268	24.3410	31.6394	42.4663	53.9207	62.9334	67.0895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.4926	414.7522	404.0181	381.1664	352.3203	325.2089	307.0969	302.8373	313.5714	336.4231	365.2693	392.3806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	54.8013	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	-113.1504	(71)
Water heating gains (Table 5)	77.8976	75.5531	70.6843	64.0649	59.7651	53.7123	48.5698	55.1611	57.5047	64.3559	72.0917	75.5629	(72)
Total internal gains	668.0420	662.6587	636.2289	595.3034	553.1447	515.8246	494.3842	504.0142	527.9189	569.0763	614.6709	649.4094	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.7700	25.1925	0.7200	0.7000	0.7700	50.7705	(76)
South	2.1300	56.7559	0.7200	0.7000	0.7700	42.2235	(78)
West	7.6100	25.1925	0.7200	0.7000	0.7700	66.9608	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

Solar gains	169.8285	271.3661	428.2983	603.3593	687.9575	759.5724	719.5697	643.0482	516.5826	340.5427	208.4979	139.0030	(83)
Total gains	837.8706	934.0248	1064.5272	1198.6627	1241.1022	1275.3970	1213.9539	1147.0625	1044.5015	909.6190	823.1688	788.4124	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.3823	62.7239	62.6124	62.8329	62.8329	62.9395	63.0435	63.1451	63.2440	62.9395	63.1451	62.9395	
alpha	5.1588	5.1816	5.1742	5.1889	5.1889	5.1960	5.2029	5.2097	5.2163	5.1960	5.2097	5.1960	
util living area	0.9937	0.9885	0.9683	0.9024	0.7642	0.5427	0.3960	0.4178	0.6961	0.9283	0.9853	0.9950	(86)
MIT	20.0054	20.1319	20.3982	20.7073	20.9091	20.9873	20.9980	20.9974	20.9572	20.7080	20.3181	19.9886	(87)
Th 2	19.9901	19.9950	19.9934	19.9966	19.9966	19.9981	19.9996	20.0010	20.0024	19.9981	20.0010	19.9981	(88)
util rest of house	0.9915	0.9847	0.9578	0.8717	0.6998	0.4528	0.2955	0.3123	0.6052	0.8974	0.9795	0.9933	(89)
MIT 2	18.6869	18.8734	19.2529	19.6763	19.9187	19.9914	19.9990	20.0003	19.9745	19.6891	19.1489	18.6685	(90)
Living area fraction									fLA = Living area / (4) =			0.1575	(91)
MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8946	19.0716	19.4332	19.8387	20.0746	20.1482	20.1564	20.1573	20.1293	19.8496	19.3331	18.8764	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9800	0.9504	0.8661	0.7052	0.4666	0.3114	0.3289	0.6175	0.8918	0.9742	0.9906	(94)
Useful gains	828.0350	915.3169	1011.6897	1038.1409	875.2648	595.0649	377.9751	377.3141	645.0067	811.2076	801.8917	780.9686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1751.8426	1714.5449	1550.6738	1284.9204	941.3962	601.5278	378.5822	378.0964	670.3765	1048.3536	1413.9068	1721.6757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	687.3128	537.0812	401.0041	177.6813	49.2017	0.0000	0.0000	0.0000	0.0000	176.4366	440.6509	699.8861	(98)
Space heating												3169.2548	(98)
Space heating per m2											(98) / (4) =	28.1837	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3411.4691	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	687.3128	537.0812	401.0041	177.6813	49.2017	0.0000	0.0000	0.0000	0.0000	176.4366	440.6509	699.8861	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	739.8416	578.1284	431.6514	191.2608	52.9621	0.0000	0.0000	0.0000	0.0000	189.9210	474.3282	753.3758	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.4680	113.0099	88.3216	43.3686	21.3197	0.0000	0.0000	18.4040	42.8386	88.5042	123.7317	147.5338	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3176	89.3269	89.3051	89.2537	88.9080	86.7000	86.7000	86.7000	86.7000	88.8051	89.1784	89.3260	(217)
Fuel for water heating, kWh/month	165.1051	126.5128	98.8987	48.5902	23.9795	0.0000	0.0000	21.2272	49.4101	99.6612	138.7463	165.1633	(219)
Water heating fuel used												937.2944	(219)
Annual totals kWh/year													
Space heating fuel - main system												3411.4691	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												461.1129	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4084.1013	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3411.4691	7.3800	251.7664	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	937.2944	7.3800	69.1723	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	461.1129	28.6600	132.1550	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			352.0866	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3411.4691	0.2160	736.8773	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.2944	0.2160	202.4556	(264)
Space and water heating			939.3329	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	461.1129	0.5190	239.3176	(268)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-850.7751	0.5190	-441.5523 (269)
Total kg/year			801.9732 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3411.4691	1.2200	4161.9923	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	937.2944	1.2200	1143.4992	(264)
Space and water heating			5305.4915	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	461.1129	3.0700	1415.6165	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4492.9784	(272)
Primary energy kWh/m2/year			39.9553	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	763.75	(P1)
Transmission heat loss coefficient	72.50	(37)
Summer heat loss coefficient	836.25	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)
West	0.850	1.00	1.000	0.850	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	5.7700	125.2818	0.7200	0.7000	0.7650	250.8408
South	2.1300	118.5567	0.7200	0.7000	0.7650	87.6274
West	7.6100	125.2818	0.7200	0.7000	0.7650	330.8317
West	0.6500	188.6220	0.7200	0.7000	0.8500	47.2713
total:						716.5712

	Jun	Jul	Aug	
Solar gains	769	717	639	(P3)
Internal gains	513	491	501	
Total summer gains	1282	1208	1140	(P5)
Summer gain/loss ratio	1.53	1.44	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.18	18.99	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 363 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	18 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	89 B	**DER**	12.27	**TER**	16.54
Environmental	90 B	**% DER<TER**	25.82		
CO_2 Emissions (t/year)	0.96	**DFEE**	45.40	**TFEE**	50.99
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.95		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.54	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.27	$kgCO_2/m^2$	Pass
	-4.27 (-25.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.99	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.40	$kWh/m^2/yr$	
	-5.6 (-11.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Potterton ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	5.77 m², No overhang 2.13 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 364 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	20 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.95	**TER**	18.79
Environmental	89 B	**% DER<TER**	20.44		
CO_2 Emissions (t/year)	0.86	**DFEE**	49.64	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.95 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 5.18 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.50 m², No overhang
Windows facing East: 4.75 m², No overhang
Windows facing West: 6.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.5035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5457	0.5350	0.5243	0.4708	0.4601	0.4066	0.4066	0.3959	0.4280	0.4601	0.4815	0.5029	(22b)
Effective ac	0.6489	0.6431	0.6374	0.6108	0.6058	0.5827	0.5827	0.5784	0.5916	0.6058	0.6159	0.6265	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7850	43.3949	43.0125	41.2163	40.8802	39.3159	39.3159	39.0262	39.9184	40.8802	41.5601	42.2708	(38)
Heat transfer coeff	101.1207	100.7305	100.3481	98.5520	98.2159	96.6515	96.6515	96.3618	97.2541	98.2159	98.8957	99.6065	(39)
Average = Sum(39)m / 12 =												98.5503	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2784	1.2735	1.2686	1.2459	1.2417	1.2219	1.2219	1.2182	1.2295	1.2417	1.2503	1.2592	(40)
HLP (average)												1.2459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	450.8570	523.9690	610.3113	705.8961	768.7803	759.0088	722.6152	665.0522	590.5522	499.7538	440.3018	425.7222	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3218	54.5322	54.7400	55.7377	55.9284	56.8336	56.8336	57.0045	56.4815	55.9284	55.5439	55.1476	
alpha	4.6215	4.6355	4.6493	4.7158	4.7286	4.7889	4.7889	4.8003	4.7654	4.7286	4.7029	4.6765	
util living area													
	0.9984	0.9964	0.9897	0.9638	0.8883	0.7334	0.5685	0.6315	0.8748	0.9823	0.9968	0.9988	(86)
MIT	19.5630	19.7231	20.0109	20.4024	20.7308	20.9275	20.9830	20.9727	20.8193	20.3804	19.9089	19.5469	(87)
Th 2	19.8578	19.8617	19.8655	19.8834	19.8868	19.9025	19.9025	19.9054	19.8965	19.8868	19.8800	19.8729	(88)
util rest of house													
	0.9978	0.9951	0.9858	0.9493	0.8434	0.6379	0.4367	0.4981	0.8068	0.9729	0.9954	0.9983	(89)
MIT 2	17.9489	18.1853	18.6066	19.1787	19.6206	19.8540	19.8964	19.8942	19.7469	19.1583	18.4700	17.9358	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2615	18.4831	18.8786	19.4157	19.8356	20.0619	20.1068	20.1031	19.9546	19.3950	18.7487	18.2478	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2615	18.4831	18.8786	19.4157	19.8356	20.0619	20.1068	20.1031	19.9546	19.3950	18.7487	18.2478	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9810	0.9413	0.8410	0.6531	0.4623	0.5237	0.8111	0.9669	0.9933	0.9973	(94)
Useful gains	449.2842	520.1736	598.6975	664.4771	646.5294	495.7219	334.0856	348.2746	479.0129	483.1951	437.3372	424.5862	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1411.8009	1368.2345	1242.1712	1036.3401	799.0452	527.8984	338.9398	356.8333	569.3810	863.8088	1152.0077	1399.2527	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	716.1124	569.8969	478.7445	267.7414	113.4717	0.0000	0.0000	0.0000	0.0000	283.1766	514.5628	725.1519	(98)
Space heating												3668.8581	(98)
Space heating per m2											(98) / (4) =	46.3825	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3949.2553	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	716.1124	569.8969	478.7445	267.7414	113.4717	0.0000	0.0000	0.0000	0.0000	283.1766	514.5628	725.1519	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	770.8422	613.4520	515.3331	288.2038	122.1440	0.0000	0.0000	0.0000	0.0000	304.8187	553.8889	780.5725	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2909	89.2418	89.1247	88.8294	88.1913	86.7000	86.7000	86.7000	86.7000	88.8428	89.1739	89.3115	(217)
Fuel for water heating, kWh/month													
	181.8198	159.4750	165.6552	146.1459	142.1764	126.1921	118.3152	133.8039	134.8180	151.6688	163.3430	176.4515	(219)
Water heating fuel used												1799.8649	(219)
Annual totals kWh/year													
Space heating fuel - main system												3949.2553	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5634.3674	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3949.2553	0.2160	853.0391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.8649	0.2160	388.7708	(264)
Space and water heating			1241.8100	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1182.2533	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.9500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.4942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.4942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(76)
West	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	454.1583	517.4898	590.7231	671.0184	722.6612	710.8381	677.2846	628.2964	565.1407	489.0600	440.8077	430.7737	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9965	0.9902	0.9652	0.8895	0.7313	0.5618	0.6222	0.8697	0.9818	0.9967	0.9988	(86)
MIT	19.7243	19.8673	20.1264	20.4750	20.7712	20.9421	20.9878	20.9800	20.8523	20.4600	20.0313	19.7019	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9978	0.9953	0.9866	0.9516	0.8467	0.6408	0.4396	0.4979	0.8033	0.9724	0.9954	0.9983	(89)
MIT 2	18.2514	18.4618	18.8404	19.3468	19.7443	19.9430	19.9778	19.9757	19.8558	19.3343	18.7104	18.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9932	0.9823	0.9447	0.8453	0.6557	0.4634	0.5219	0.8087	0.9670	0.9934	0.9974	(94)
Useful gains	452.6357	513.9821	580.2826	633.8910	610.8462	466.0713	313.8404	327.8942	457.0336	472.9141	437.8813	429.6606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1303.8118	1263.5926	1146.9261	959.7421	740.0585	491.6845	317.3422	334.1484	530.5203	803.7285	1070.3374	1297.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating												3236.2880	(98)
Space heating per m2											(98) / (4) =	40.9139	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3464.9765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	678.0247	539.3343	451.3734	251.1914	102.9272	0.0000	0.0000	0.0000	0.0000	263.5181	487.5465	691.0610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7363	87.5409	87.0745	85.9666	83.8456	80.3000	80.3000	80.3000	80.3000	85.9680	87.2600	87.8196	(217)
Fuel for water heating, kWh/month													
	229.6607	201.8304	211.1162	189.6625	188.2719	173.1411	165.8823	184.9199	186.9622	198.8573	209.1333	224.0341	(219)
Water heating fuel used												2363.4720	(219)
Annual totals kWh/year													
Space heating fuel - main system												3464.9765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6266.4591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3464.9765	0.2160	748.4349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.4720	0.2160	510.5099	(264)
Space and water heating			1258.9449	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1486.2724	(272)
Emissions per m2 for space and water heating			15.9159	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9159 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.4057	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3449	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4397	0.4311	0.4225	0.3793	0.3707	0.3276	0.3276	0.3190	0.3449	0.3707	0.3880	0.4052	(22b)
Effective ac	0.5967	0.5929	0.5892	0.5720	0.5687	0.5537	0.5537	0.5509	0.5595	0.5687	0.5753	0.5821	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2608	40.0076	39.7593	38.5932	38.3750	37.3593	37.3593	37.1713	37.7506	38.3750	38.8164	39.2778	(38)
Heat transfer coeff	97.5965	97.3432	97.0949	95.9288	95.7107	94.6950	94.6950	94.5069	95.0862	95.7107	96.1520	96.6134	(39)
Average = Sum(39)m / 12 =												95.9278	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2338	1.2306	1.2275	1.2128	1.2100	1.1972	1.1972	1.1948	1.2021	1.2100	1.2156	1.2214	(40)
HLP (average)												1.2127	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225 (71)

Water heating gains (Table 5)

	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394 (72)

Total internal gains

	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419 (83)
Total gains	419.6078	493.4932	581.4405	679.2059	743.5063	735.7275	701.0260	641.2931	566.0207	472.9657	410.9653	395.2416 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2833	56.4298	56.5741	57.2618	57.3923	58.0079	58.0079	58.1233	57.7692	57.3923	57.1289	56.8560	
alpha	4.7522	4.7620	4.7716	4.8175	4.8262	4.8672	4.8672	4.8749	4.8513	4.8262	4.8086	4.7904	
util living area	0.9988	0.9972	0.9913	0.9672	0.8936	0.7406	0.5742	0.6414	0.8841	0.9853	0.9976	0.9991	(86)
MIT	19.5841	19.7420	20.0265	20.4086	20.7349	20.9280	20.9834	20.9724	20.8169	20.3783	19.9129	19.5605	(87)
Th 2	19.8930	19.8956	19.8981	19.9098	19.9120	19.9223	19.9223	19.9242	19.9183	19.9120	19.9076	19.9029	(88)
util rest of house	0.9984	0.9962	0.9880	0.9539	0.8505	0.6466	0.4437	0.5089	0.8195	0.9774	0.9966	0.9988	(89)
MIT 2	18.6033	18.7628	19.0476	19.4306	19.7316	19.8890	19.9181	19.9163	19.8132	19.4082	18.9432	18.5875	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7932	18.9524	19.2372	19.6200	19.9259	20.0902	20.1244	20.1208	20.0076	19.5961	19.1310	18.7759	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7932	18.9524	19.2372	19.6200	19.9259	20.0902	20.1244	20.1208	20.0076	19.5961	19.1310	18.7759	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9950	0.9854	0.9494	0.8512	0.6627	0.4693	0.5347	0.8259	0.9742	0.9955	0.9984	(94)
Useful gains	418.6907	491.0290	572.9232	644.8670	632.8539	487.5377	328.9651	342.8999	467.4918	460.7626	409.1329	394.5950	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1414.4880	1367.9089	1236.7176	1028.3552	787.3089	519.8987	333.7460	351.6440	561.7294	861.0192	1156.8077	1408.2291	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	740.8732	589.2633	493.8630	276.1115	114.9145	0.0000	0.0000	0.0000	0.0000	297.7909	538.3258	754.1438	(98)
Space heating												3805.2861	(98)
Space heating per m2											(98) / (4) =	48.1073	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	890.1330	700.7430	718.2526	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8560	0.9176	0.8881	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	761.9568	642.9700	637.8537	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.5588	909.1564	841.0208	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	136.5134	198.0426	151.1563	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												485.7124 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.1284	49.5107	37.7891	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												121.4281 (107)
Space cooling per m2												1.5351 (108)
Energy for space heating												48.1073 (99)
Energy for space cooling												1.5351 (108)
Total												49.6424 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(76)
West	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	409.7548	474.2291	549.6922	632.7914	686.4764	677.2708	645.4050	593.6224	529.0664	450.1056	398.6828	387.1364	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9990	0.9977	0.9928	0.9722	0.9055	0.7557	0.5863	0.6520	0.8924	0.9871	0.9979	0.9993	(86)
MIT	19.6720	19.8167	20.0798	20.4364	20.7460	20.9325	20.9853	20.9754	20.8293	20.4174	19.9820	19.6503	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9986	0.9968	0.9901	0.9610	0.8665	0.6663	0.4604	0.5248	0.8324	0.9802	0.9971	0.9990	(89)
MIT 2	18.7393	18.8857	19.1495	19.5084	19.7964	19.9504	19.9785	19.9769	19.8785	19.4958	19.0603	18.7253	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9879	0.9570	0.8669	0.6815	0.4850	0.5496	0.8383	0.9774	0.9962	0.9986	(94)
Useful gains	408.9897	472.2560	543.0206	605.6016	595.1005	461.5536	313.0474	326.2660	443.5413	439.9348	397.1521	386.5956	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1338.9200	1293.9186	1168.8068	970.7914	743.3907	492.0467	317.3502	334.1500	531.7563	814.6767	1094.9241	1332.8361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	691.8682	552.1573	465.5849	262.9366	110.3279	0.0000	0.0000	0.0000	0.0000	278.8080	502.3958	704.0029	(98)
Space heating												3568.0816	(98)
Space heating per m2											(98) / (4) =	45.1085	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9217	0.8939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.3769	605.7087	602.0755	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.2328	844.1448	785.3018	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.4162	177.3965	136.3204	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												433.1331	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   29.8541   44.3491   34.0801    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        108.2833 (107)
Space cooling per m2                                                                                                   1.3689 (108)
Energy for space heating                                                                                              45.1085 (99)
Energy for space cooling                                                                                               1.3689 (108)
Total                                                                                                                 46.4774 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   53.4 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.5035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4494	0.4173	0.4280	0.4066	0.4066	0.3959	0.3852	0.3745	0.3638	0.3959	0.3745	0.3959	(22b)
Effective ac	0.6010	0.5871	0.5916	0.5827	0.5827	0.5784	0.5742	0.5701	0.5662	0.5784	0.5701	0.5784	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5519	39.6133	39.9184	39.3159	39.3159	39.0262	38.7442	38.4699	38.2034	39.0262	38.4699	39.0262	(38)
Heat transfer coeff	97.8876	96.9489	97.2541	96.6515	96.6515	96.3618	96.0798	95.8056	95.5391	96.3618	95.8056	96.3618	(39)
Average = Sum(39)m / 12 =												96.4758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2375	1.2257	1.2295	1.2219	1.2219	1.2182	1.2147	1.2112	1.2078	1.2182	1.2112	1.2182	(40)
HLP (average)												1.2197	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1160	56.6593	56.4815	56.8336	56.8336	57.0045	57.1718	57.3354	57.4954	57.0045	57.3354	57.0045	
alpha	4.7411	4.7773	4.7654	4.7889	4.7889	4.8003	4.8115	4.8224	4.8330	4.8003	4.8224	4.8003	
util living area													
	0.9910	0.9855	0.9650	0.9016	0.7704	0.5563	0.4084	0.4307	0.7069	0.9251	0.9813	0.9925	(86)
MIT	19.9138	20.0426	20.3147	20.6490	20.8803	20.9801	20.9964	20.9955	20.9409	20.6601	20.2569	19.9113	(87)
Th 2	19.8901	19.8995	19.8965	19.9025	19.9025	19.9054	19.9083	19.9111	19.9137	19.9054	19.9111	19.9054	(88)
util rest of house													
	0.9880	0.9807	0.9533	0.8694	0.7025	0.4575	0.2959	0.3129	0.6099	0.8919	0.9738	0.9900	(89)
MIT 2	18.4818	18.6744	19.0605	19.5208	19.8005	19.8951	19.9073	19.9099	19.8755	19.5496	18.9940	18.4893	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9451	0.8638	0.7097	0.4761	0.3178	0.3358	0.6261	0.8867	0.9676	0.9862	(94)
Useful gains	641.7525	697.0847	759.9718	777.9575	662.8026	455.6028	289.1878	288.3318	488.5723	608.8300	613.4878	609.5189	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1356.6394	1322.3237	1196.5534	989.6443	725.8181	463.0420	289.9944	289.3450	514.1790	806.0373	1086.2967	1326.3962	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	531.8759	420.1606	324.8167	152.4145	46.8835	0.0000	0.0000	0.0000	0.0000	146.7223	340.4224	533.3567	(98)
Space heating												2496.6526	(98)
RHI space heating demand												2497	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.5035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5457	0.5350	0.5243	0.4708	0.4601	0.4066	0.4066	0.3959	0.4280	0.4601	0.4815	0.5029	(22b)
Effective ac	0.6489	0.6431	0.6374	0.6108	0.6058	0.5827	0.5827	0.5784	0.5916	0.6058	0.6159	0.6265	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7850	43.3949	43.0125	41.2163	40.8802	39.3159	39.3159	39.0262	39.9184	40.8802	41.5601	42.2708	(38)
Heat transfer coeff	101.1207	100.7305	100.3481	98.5520	98.2159	96.6515	96.6515	96.3618	97.2541	98.2159	98.8957	99.6065	(39)
Average = Sum(39)m / 12 =												98.5503	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2784	1.2735	1.2686	1.2459	1.2417	1.2219	1.2219	1.2182	1.2295	1.2417	1.2503	1.2592	(40)
HLP (average)												1.2459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3218	54.5322	54.7400	55.7377	55.9284	56.8336	56.8336	57.0045	56.4815	55.9284	55.5439	55.1476	
alpha	4.6215	4.6355	4.6493	4.7158	4.7286	4.7889	4.7889	4.8003	4.7654	4.7286	4.7029	4.6765	
util living area													
	0.9934	0.9883	0.9737	0.9285	0.8249	0.6494	0.4881	0.5388	0.7877	0.9525	0.9880	0.9946	(86)
MIT	19.7671	19.9212	20.1910	20.5441	20.8144	20.9569	20.9910	20.9859	20.8911	20.5351	20.0961	19.7480	(87)
Th 2	19.8578	19.8617	19.8655	19.8834	19.8868	19.9025	19.9025	19.9054	19.8965	19.8868	19.8800	19.8729	(88)
util rest of house													
	0.9912	0.9844	0.9648	0.9039	0.7684	0.5545	0.3710	0.4181	0.7034	0.9309	0.9833	0.9929	(89)
MIT 2	18.2459	18.4721	18.8624	19.3675	19.7136	19.8755	19.8995	19.9001	19.8149	19.3687	18.7404	18.2288	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5406	18.7527	19.1198	19.5954	19.9268	20.0849	20.1109	20.1104	20.0233	19.5946	19.0029	18.5231	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5406	18.7527	19.1198	19.5954	19.9268	20.0849	20.1109	20.1104	20.0233	19.5946	19.0029	18.5231	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9791	0.9570	0.8962	0.7707	0.5712	0.3937	0.4415	0.7142	0.9236	0.9780	0.9898	(94)
Useful gains	622.3341	686.3195	745.8533	773.9316	704.9188	511.7035	336.8779	353.3675	524.1181	604.3755	593.3959	595.0239	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1440.0147	1395.3931	1266.3686	1054.0556	808.0060	530.1287	339.3314	357.5395	576.0664	883.4102	1177.1484	1426.6714	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	608.3543	476.4975	387.2633	201.6893	76.6969	0.0000	0.0000	0.0000	0.0000	207.6018	420.3018	618.7457	(98)
Space heating												2997.1506	(98)
Space heating per m2											(98) / (4) =	37.8907	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3226.2116	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	608.3543	476.4975	387.2633	201.6893	76.6969	0.0000	0.0000	0.0000	0.0000	207.6018	420.3018	618.7457	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	654.8485	512.9144	416.8604	217.1036	82.5586	0.0000	0.0000	0.0000	0.0000	223.4680	452.4239	666.0342	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2064	89.1433	88.9934	88.6191	87.8873	86.7000	86.7000	86.7000	86.7000	88.6127	89.0541	89.2315	(217)
Fuel for water heating, kWh/month													
	181.9921	159.6513	165.8995	146.4927	142.6681	126.1921	118.3152	133.8039	134.8180	152.0626	163.5628	176.6099	(219)
Water heating fuel used												1802.0680	(219)
Annual totals kWh/year													
Space heating fuel - main system												3226.2116	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4913.5269	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3226.2116	3.4800	112.2722	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.0680	3.4800	62.7120	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			279.8482	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9471	(257)
SAP value		86.7878	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3226.2116	0.2160	696.8617	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.0680	0.2160	389.2467	(264)
Space and water heating			1086.1084	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1026.5517	(272)
CO2 emissions per m2			12.9800	(273)
EI value			88.9156	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8813 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8813 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.5035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4494	0.4173	0.4280	0.4066	0.4066	0.3959	0.3852	0.3745	0.3638	0.3959	0.3745	0.3959	(22b)
Effective ac	0.6010	0.5871	0.5916	0.5827	0.5827	0.5784	0.5742	0.5701	0.5662	0.5784	0.5701	0.5784	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5519	39.6133	39.9184	39.3159	39.3159	39.0262	38.7442	38.4699	38.2034	39.0262	38.4699	39.0262	(38)
Heat transfer coeff	97.8876	96.9489	97.2541	96.6515	96.6515	96.3618	96.0798	95.8056	95.5391	96.3618	95.8056	96.3618	(39)
Average = Sum(39)m / 12 =												96.4758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2375	1.2257	1.2295	1.2219	1.2219	1.2182	1.2147	1.2112	1.2078	1.2182	1.2112	1.2182	(40)
HLP (average)												1.2197	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1160	56.6593	56.4815	56.8336	56.8336	57.0045	57.1718	57.3354	57.4954	57.0045	57.3354	57.0045	
alpha	4.7411	4.7773	4.7654	4.7889	4.7889	4.8003	4.8115	4.8224	4.8330	4.8003	4.8224	4.8003	
util living area													
	0.9910	0.9855	0.9650	0.9016	0.7704	0.5563	0.4084	0.4307	0.7069	0.9251	0.9813	0.9925	(86)
MIT	19.9138	20.0426	20.3147	20.6490	20.8803	20.9801	20.9964	20.9955	20.9409	20.6601	20.2569	19.9113	(87)
Th 2	19.8901	19.8995	19.8965	19.9025	19.9025	19.9054	19.9083	19.9111	19.9137	19.9054	19.9111	19.9054	(88)
util rest of house													
	0.9880	0.9807	0.9533	0.8694	0.7025	0.4575	0.2959	0.3129	0.6099	0.8919	0.9738	0.9900	(89)
MIT 2	18.4818	18.6744	19.0605	19.5208	19.8005	19.8951	19.9073	19.9099	19.8755	19.5496	18.9940	18.4893	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9451	0.8638	0.7097	0.4761	0.3178	0.3358	0.6261	0.8867	0.9676	0.9862	(94)
Useful gains	641.7525	697.0847	759.9718	777.9575	662.8026	455.6028	289.1878	288.3318	488.5723	608.8300	613.4878	609.5189	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1356.6394	1322.3237	1196.5534	989.6443	725.8181	463.0420	289.9944	289.3450	514.1790	806.0373	1086.2967	1326.3962	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	531.8759	420.1606	324.8167	152.4145	46.8835	0.0000	0.0000	0.0000	0.0000	146.7223	340.4224	533.3567	(98)
Space heating												2496.6526	(98)
Space heating per m2											(98) / (4) =	31.5632	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2687.4624	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	531.8759	420.1606	324.8167	152.4145	46.8835	0.0000	0.0000	0.0000	0.0000	146.7223	340.4224	533.3567	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	572.5251	452.2720	349.6412	164.0630	50.4666	0.0000	0.0000	0.0000	0.0000	157.9357	366.4396	574.1191	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1307	89.0682	88.8749	88.3992	87.5481	86.7000	86.7000	86.7000	86.7000	88.3391	88.9166	89.1495	(217)
Fuel for water heating, kWh/month													
	182.1467	159.7859	166.1207	146.8571	143.2209	126.1921	118.3152	133.8039	134.8180	152.5335	163.8157	176.7722	(219)
Water heating fuel used												1804.3818	(219)
Annual totals kWh/year													
Space heating fuel - main system												2687.4624	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4303.3750	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2687.4624	7.3800	198.3347	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.3818	7.3800	133.1634	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			384.4828	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2687.4624	0.2160	580.4919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3818	0.2160	389.7465	(264)
Space and water heating			970.2383	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			872.4228	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2687.4624	1.2200	3278.7041	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3818	1.2200	2201.3458	(264)
Space and water heating			5480.0499	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4901.4495	(272)
Primary energy kWh/m2/year			61.9652	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£438	£367	£72
Space heating	£327	£327	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£384	£327	£58
Total cost of uses	£384	£327	£58
Delivered energy	54 kWh/m²	43 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	49 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			5.1800	
Infiltration rate			0.5035	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5457	0.5350	0.5243	0.4708	0.4601	0.4066	0.4066	0.3959	0.4280	0.4601	0.4815	0.5029	(22b)
Effective ac	0.6489	0.6431	0.6374	0.6108	0.6058	0.5827	0.5827	0.5784	0.5916	0.6058	0.6159	0.6265	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.7850	43.3949	43.0125	41.2163	40.8802	39.3159	39.3159	39.0262	39.9184	40.8802	41.5601	42.2708	(38)
Heat transfer coeff	101.1207	100.7305	100.3481	98.5520	98.2159	96.6515	96.6515	96.3618	97.2541	98.2159	98.8957	99.6065	(39)
Average = Sum(39)m / 12 =												98.5503	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2784	1.2735	1.2686	1.2459	1.2417	1.2219	1.2219	1.2182	1.2295	1.2417	1.2503	1.2592	(40)
HLP (average)												1.2459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419 (83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3218	54.5322	54.7400	55.7377	55.9284	56.8336	56.8336	57.0045	56.4815	55.9284	55.5439	55.1476	
alpha	4.6215	4.6355	4.6493	4.7158	4.7286	4.7889	4.7889	4.8003	4.7654	4.7286	4.7029	4.6765	
util living area													
	0.9934	0.9883	0.9737	0.9285	0.8249	0.6494	0.4881	0.5388	0.7877	0.9525	0.9880	0.9946	(86)
MIT	19.7671	19.9212	20.1910	20.5441	20.8144	20.9569	20.9910	20.9859	20.8911	20.5351	20.0961	19.7480	(87)
Th 2	19.8578	19.8617	19.8655	19.8834	19.8868	19.9025	19.9025	19.9054	19.8965	19.8868	19.8800	19.8729	(88)
util rest of house													
	0.9912	0.9844	0.9648	0.9039	0.7684	0.5545	0.3710	0.4181	0.7034	0.9309	0.9833	0.9929	(89)
MIT 2	18.2459	18.4721	18.8624	19.3675	19.7136	19.8755	19.8995	19.9001	19.8149	19.3687	18.7404	18.2288	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5406	18.7527	19.1198	19.5954	19.9268	20.0849	20.1109	20.1104	20.0233	19.5946	19.0029	18.5231	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5406	18.7527	19.1198	19.5954	19.9268	20.0849	20.1109	20.1104	20.0233	19.5946	19.0029	18.5231	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9791	0.9570	0.8962	0.7707	0.5712	0.3937	0.4415	0.7142	0.9236	0.9780	0.9898	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	622.3341	686.3195	745.8533	773.9316	704.9188	511.7035	336.8779	353.3675	524.1181	604.3755	593.3959	595.0239	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1440.0147	1395.3931	1266.3686	1054.0556	808.0060	530.1287	339.3314	357.5395	576.0664	883.4102	1177.1484	1426.6714	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	608.3543	476.4975	387.2633	201.6893	76.6969	0.0000	0.0000	0.0000	0.0000	207.6018	420.3018	618.7457	(98)

Space heating 2997.1506 (98)
Space heating per m2 (98) / (4) = 37.8907 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3226.2116 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	608.3543	476.4975	387.2633	201.6893	76.6969	0.0000	0.0000	0.0000	0.0000	207.6018	420.3018	618.7457	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	654.8485	512.9144	416.8604	217.1036	82.5586	0.0000	0.0000	0.0000	0.0000	223.4680	452.4239	666.0342	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2909	89.3208	89.3458	89.3908	89.5030	86.7000	86.7000	86.7000	86.7000	88.9650	89.1847	89.3019	(217)
Fuel for water heating, kWh/month	154.4708	113.7115	87.5665	41.1757	11.7059	0.0000	0.0000	21.4599	46.8301	92.9048	130.8446	153.5867	(219)
Water heating fuel used												854.2564	(219)

Annual totals kWh/year
Space heating fuel - main system 3226.2116 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) = -552.7634 -552.7634 (233)
Total delivered energy for all uses 4015.7153 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3226.2116	3.4800	112.2722	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.2564	3.4800	29.7281	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			253.4594	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8578 (257)
SAP value 88.0337
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3226.2116	0.2160	696.8617	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.2564	0.2160	184.5194	(264)
Space and water heating			881.3811	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			847.7744 (272)
CO2 emissions per m2			10.7200 (273)
EI value			90.8459
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.1800	
Infiltration rate		0.5035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4280	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4494	0.4173	0.4280	0.4066	0.4066	0.3959	0.3852	0.3745	0.3638	0.3959	0.3745	0.3959	(22b)
Effective ac	0.6010	0.5871	0.5916	0.5827	0.5827	0.5784	0.5742	0.5701	0.5662	0.5784	0.5701	0.5784	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5519	39.6133	39.9184	39.3159	39.3159	39.0262	38.7442	38.4699	38.2034	39.0262	38.4699	39.0262	(38)
Heat transfer coeff	97.8876	96.9489	97.2541	96.6515	96.6515	96.3618	96.0798	95.8056	95.5391	96.3618	95.8056	96.3618	(39)
Average = Sum(39)m / 12 =												96.4758	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2375	1.2257	1.2295	1.2219	1.2219	1.2182	1.2147	1.2112	1.2078	1.2182	1.2112	1.2182	(40)
HLP (average)												1.2197	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264 (83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1160	56.6593	56.4815	56.8336	56.8336	57.0045	57.1718	57.3354	57.4954	57.0045	57.3354	57.0045	
alpha	4.7411	4.7773	4.7654	4.7889	4.7889	4.8003	4.8115	4.8224	4.8330	4.8003	4.8224	4.8003	
util living area													
	0.9910	0.9855	0.9650	0.9016	0.7704	0.5563	0.4084	0.4307	0.7069	0.9251	0.9813	0.9925	(86)
MIT	19.9138	20.0426	20.3147	20.6490	20.8803	20.9801	20.9964	20.9955	20.9409	20.6601	20.2569	19.9113	(87)
Th 2	19.8901	19.8995	19.8965	19.9025	19.9025	19.9054	19.9083	19.9111	19.9137	19.9054	19.9111	19.9054	(88)
util rest of house													
	0.9880	0.9807	0.9533	0.8694	0.7025	0.4575	0.2959	0.3129	0.6099	0.8919	0.9738	0.9900	(89)
MIT 2	18.4818	18.6744	19.0605	19.5208	19.8005	19.8951	19.9073	19.9099	19.8755	19.5496	18.9940	18.4893	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7592	18.9394	19.3034	19.7393	20.0096	20.1052	20.1183	20.1201	20.0819	19.7647	19.2386	18.7647	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9451	0.8638	0.7097	0.4761	0.3178	0.3358	0.6261	0.8867	0.9676	0.9862	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	641.7525	697.0847	759.9718	777.9575	662.8026	455.6028	289.1878	288.3318	488.5723	608.8300	613.4878	609.5189 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1356.6394	1322.3237	1196.5534	989.6443	725.8181	463.0420	289.9944	289.3450	514.1790	806.0373	1086.2967	1326.3962 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	531.8759	420.1606	324.8167	152.4145	46.8835	0.0000	0.0000	0.0000	0.0000	146.7223	340.4224	533.3567 (98)
Space heating												2496.6526 (98)
Space heating per m2											(98) / (4) =	31.5632 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2687.4624 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	531.8759	420.1606	324.8167	152.4145	46.8835	0.0000	0.0000	0.0000	0.0000	146.7223	340.4224	533.3567	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	572.5251	452.2720	349.6412	164.0630	50.4666	0.0000	0.0000	0.0000	0.0000	157.9357	366.4396	574.1191	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2378	89.2576	89.2624	89.2734	89.1052	86.7000	86.7000	86.7000	86.7000	88.7554	89.0864	89.2381	(217)
Fuel for water heating, kWh/month													
	149.9727	114.0185	87.3235	40.0893	16.7684	0.0000	0.0000	14.5776	41.4721	88.7764	125.6445	150.3203	(219)
Water heating fuel used												828.9633	(219)
Annual totals kWh/year													
Space heating fuel - main system												2687.4624	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3377.9565	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2687.4624	7.3800	198.3347	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	828.9633	7.3800	61.1775	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			326.8269	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2687.4624	0.2160	580.4919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	828.9633	0.2160	179.0561	(264)
Space and water heating			759.5480	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			687.6824	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2687.4624	1.2200	3278.7041	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	828.9633	1.2200	1011.3352	(264)
Space and water heating			4290.0393	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3864.9389	(272)
Primary energy kWh/m2/year			48.8614	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.5000	87.1704	0.7200	0.7000	0.7650	15.1242
East	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
West	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
total:						502.8945

	Jun	Jul	Aug	
Solar gains	541	503	441	(P3)
Internal gains	425	408	416	
Total summer gains	966	911	857	(P5)
Summer gain/loss ratio	1.62	1.52	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.07	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 364 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	20 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.95	**TER**	18.79
Environmental	89 B	**% DER<TER**	20.44		
CO_2 Emissions (t/year)	0.86	**DFEE**	49.64	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.12		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.95	$kgCO_2/m^2$	Pass
	-3.84 (-20.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.64	$kWh/m^2/yr$	
	-3.8 (-7.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.18 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.50 m², No overhang
Windows facing East	4.75 m², No overhang
Windows facing West	6.47 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.18 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 365 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	22 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.78	**TER**	18.70
Environmental	89 B	**% DER<TER**	20.96		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.99	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.78 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.95 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.75 m², No overhang
Windows facing South: 0.50 m², No overhang
Windows facing West: 6.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.4920	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5332	0.5228	0.5123	0.4600	0.4496	0.3973	0.3973	0.3869	0.4182	0.4496	0.4705	0.4914	(22b)
Effective ac	0.6422	0.6367	0.6312	0.6058	0.6011	0.5789	0.5789	0.5748	0.5875	0.6011	0.6107	0.6207	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3313	42.9588	42.5937	40.8786	40.5577	39.0640	39.0640	38.7874	39.6394	40.5577	41.2069	41.8855	(38)
Heat transfer coeff	100.6670	100.2945	99.9293	98.2143	97.8934	96.3996	96.3996	96.1230	96.9750	97.8934	98.5425	99.2212	(39)
Average = Sum(39)m / 12 =												98.2127	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2727	1.2679	1.2633	1.2416	1.2376	1.2187	1.2187	1.2152	1.2260	1.2376	1.2458	1.2544	(40)
HLP (average)												1.2416	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	457.1646	533.7917	621.3140	715.4609	775.7929	764.3461	728.4368	673.0240	601.0948	509.9519	447.6888	431.2291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5666	54.7693	54.9694	55.9293	56.1126	56.9821	56.9821	57.1461	56.6440	56.1126	55.7430	55.3617	
alpha	4.6378	4.6513	4.6646	4.7286	4.7408	4.7988	4.7988	4.8097	4.7763	4.7408	4.7162	4.6908	
util living area													
	0.9983	0.9961	0.9889	0.9618	0.8848	0.7289	0.5633	0.6243	0.8680	0.9808	0.9965	0.9987	(86)
MIT	19.5776	19.7412	20.0292	20.4158	20.7382	20.9298	20.9838	20.9742	20.8274	20.3947	19.9222	19.5596	(87)
Th 2	19.8623	19.8660	19.8697	19.8868	19.8900	19.9051	19.9051	19.9079	19.8993	19.8900	19.8835	19.8767	(88)
util rest of house													
	0.9977	0.9947	0.9848	0.9467	0.8391	0.6334	0.4327	0.4918	0.7983	0.9707	0.9951	0.9982	(89)
MIT 2	17.9733	18.2146	18.6358	19.1996	19.6320	19.8583	19.8992	19.8973	19.7577	19.1806	18.4919	17.9569	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2841	18.5103	18.9057	19.4352	19.8462	20.0658	20.1093	20.1058	19.9649	19.4158	18.7689	18.2673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2841	18.5103	18.9057	19.4352	19.8462	20.0658	20.1093	20.1058	19.9649	19.4158	18.7689	18.2673	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9922	0.9797	0.9387	0.8370	0.6487	0.4581	0.5173	0.8032	0.9645	0.9928	0.9972	(94)
Useful gains	455.4858	529.6474	608.7068	671.5937	649.3275	495.8500	333.6701	348.1544	482.8230	491.8440	444.4778	430.0214	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.7323	1365.0365	1239.6902	1034.7047	797.4616	526.9011	338.2913	356.2151	568.7447	863.0070	1149.8833	1395.7739	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	708.4714	561.3815	469.4517	261.4399	110.2118	0.0000	0.0000	0.0000	0.0000	276.1453	507.8920	718.5198	(98)
Space heating												3613.5133	(98)
Space heating per m2											(98) / (4) =	45.6828	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3889.6806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	708.4714	561.3815	469.4517	261.4399	110.2118	0.0000	0.0000	0.0000	0.0000	276.1453	507.8920	718.5198	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	762.6172	604.2858	505.3301	281.4207	118.6349	0.0000	0.0000	0.0000	0.0000	297.2500	546.7083	773.4336	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2856	89.2339	89.1131	88.8124	88.1681	86.7000	86.7000	86.7000	86.7000	88.8249	89.1665	89.3071	(217)
Fuel for water heating, kWh/month													
	181.8306	159.4892	165.6767	146.1739	142.2138	126.1921	118.3152	133.8039	134.8180	151.6993	163.3565	176.4603	(219)
Water heating fuel used												1800.0295	(219)
Annual totals kWh/year													
Space heating fuel - main system												3889.6806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5574.9574	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3889.6806	0.2160	840.1710	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.0295	0.2160	388.8064	(264)
Space and water heating			1228.9774	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1169.4207	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7800	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.3242	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3242	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	459.6774	526.0846	600.3505	679.3876	728.7972	715.5082	682.3785	635.2717	574.3655	497.9833	447.2713	435.5922	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9983	0.9963	0.9895	0.9635	0.8867	0.7279	0.5581	0.6165	0.8636	0.9804	0.9965	0.9987	(86)
MIT	19.7308	19.8772	20.1372	20.4832	20.7753	20.9433	20.9882	20.9808	20.8578	20.4696	20.0389	19.7075	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9977	0.9950	0.9856	0.9494	0.8433	0.6374	0.4365	0.4928	0.7958	0.9703	0.9951	0.9983	(89)
MIT 2	18.2608	18.4764	18.8560	19.3581	19.7490	19.9440	19.9779	19.9761	19.8612	19.3477	18.7213	18.2337	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9812	0.9424	0.8421	0.6523	0.4601	0.5166	0.8017	0.9648	0.9930	0.9973	(94)
Useful gains	458.0554	522.2711	589.0734	640.2623	613.6941	466.7357	313.9674	328.2108	460.4959	480.4618	444.1185	434.4112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1304.6257	1264.8403	1148.2584	960.7034	740.4706	491.7722	317.3589	334.1897	531.0060	804.8636	1071.2668	1297.9090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating												3205.2717	(98)
Space heating per m2											(98) / (4) =	40.5218	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3431.7684	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	674.3558	534.2682	445.4321	247.0209	100.9868	0.0000	0.0000	0.0000	0.0000	258.4100	483.4547	687.8398	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7257	87.5215	87.0449	85.9249	83.8019	80.3000	80.3000	80.3000	80.3000	85.9192	87.2417	87.8106	(217)
Fuel for water heating, kWh/month													
	229.6885	201.8751	211.1880	189.7546	188.3700	173.1411	165.8823	184.9199	186.9622	198.9702	209.1771	224.0570	(219)
Water heating fuel used												2363.9861	(219)
Annual totals kWh/year													
Space heating fuel - main system												3431.7684	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6233.7652	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3431.7684	0.2160	741.2620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.9861	0.2160	510.6210	(264)
Space and water heating			1251.8830	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1479.2105	(272)
Emissions per m2 for space and water heating			15.8266	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8266 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.3942	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3351	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4272	0.4189	0.4105	0.3686	0.3602	0.3183	0.3183	0.3100	0.3351	0.3602	0.3770	0.3937	(22b)
Effective ac	0.5913	0.5877	0.5842	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5711	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.8963	39.6572	39.4228	38.3218	38.1159	37.1570	37.1570	36.9794	37.5263	38.1159	38.5326	38.9682	(38)
Heat transfer coeff	97.2320	96.9928	96.7584	95.6575	95.4515	94.4926	94.4926	94.3151	94.8620	95.4515	95.8682	96.3039	(39)
Average = Sum(39)m / 12 =												95.6565	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2292	1.2262	1.2232	1.2093	1.2067	1.1946	1.1946	1.1924	1.1993	1.2067	1.2120	1.2175	(40)
HLP (average)												1.2093	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.4456	(42)
Average daily hot water use (litres/day)											92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	425.9154	503.3159	592.4432	688.7707	750.5189	741.0648	706.8475	649.2649	576.5633	483.1638	418.3523	400.7485	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4943	56.6336	56.7708	57.4242	57.5481	58.1321	58.1321	58.2416	57.9058	57.5481	57.2980	57.0388	
alpha	4.7663	4.7756	4.7847	4.8283	4.8365	4.8755	4.8755	4.8828	4.8604	4.8365	4.8199	4.8026	
util living area													
	0.9987	0.9970	0.9906	0.9653	0.8901	0.7361	0.5691	0.6341	0.8774	0.9840	0.9974	0.9991	(86)
MIT	19.5974	19.7589	20.0438	20.4214	20.7419	20.9302	20.9841	20.9739	20.8250	20.3921	19.9254	19.5720	(87)
Th 2	19.8967	19.8991	19.9015	19.9125	19.9146	19.9243	19.9243	19.9261	19.9206	19.9146	19.9104	19.9060	(88)
util rest of house													
	0.9983	0.9959	0.9871	0.9514	0.8463	0.6421	0.4396	0.5025	0.8109	0.9754	0.9963	0.9988	(89)
MIT 2	18.6194	18.7824	19.0673	19.4449	19.7396	19.8922	19.9203	19.9187	19.8210	19.4236	18.9579	18.6014	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8088	18.9715	19.2564	19.6340	19.9337	20.0933	20.1264	20.1231	20.0155	19.6112	19.1453	18.7894	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8088	18.9715	19.2564	19.6340	19.9337	20.0933	20.1264	20.1231	20.0155	19.6112	19.1453	18.7894	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9843	0.9469	0.8472	0.6583	0.4650	0.5281	0.8179	0.9721	0.9952	0.9983	(94)
Useful gains	424.9277	500.5968	583.1172	652.2226	635.8279	487.8092	328.6589	342.9011	471.5930	469.6841	416.3477	400.0553	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1410.7213	1364.8392	1234.2918	1026.7907	785.9205	519.0736	333.2170	351.1402	561.1555	860.1325	1154.7610	1405.0154	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	733.4304	580.7709	484.4739	269.6890	111.6689	0.0000	0.0000	0.0000	0.0000	290.4936	531.6576	747.6903	(98)
Space heating												3749.8746	(98)
Space heating per m2											(98) / (4) =	47.4068	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	888.2307	699.2454	716.7944	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8595	0.9202	0.8924	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	763.4322	643.4658	639.6917	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7972	915.9608	850.3385	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	139.9428	202.7362	156.7212	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												499.4002 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.9857	50.6841	39.1803	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												124.8500 (107)
Space cooling per m2												1.5784 (108)
Energy for space heating												47.4068 (99)
Energy for space cooling												1.5784 (108)
Total												48.9851 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	415.2740	482.8240	559.3195	641.1606	692.6124	681.9410	650.4988	600.5977	538.2912	459.0289	405.1465	391.9549	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9989	0.9975	0.9922	0.9708	0.9028	0.7523	0.5823	0.6459	0.8867	0.9860	0.9978	0.9992	(86)
MIT	19.6785	19.8268	20.0908	20.4450	20.7504	20.9339	20.9857	20.9764	20.8354	20.4272	19.9896	19.6560	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9985	0.9966	0.9893	0.9590	0.8632	0.6626	0.4570	0.5192	0.8250	0.9785	0.9968	0.9989	(89)
MIT 2	18.7458	18.8958	19.1603	19.5165	19.8000	19.9512	19.9786	19.9772	19.8829	19.5053	19.0678	18.7310	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9955	0.9870	0.9550	0.8637	0.6780	0.4815	0.5439	0.8314	0.9757	0.9959	0.9985	(94)
Useful gains	414.4514	480.6553	552.0451	612.3297	598.2419	462.3329	313.2042	326.6667	447.5476	447.8568	403.4790	391.3762	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1339.5148	1294.8339	1169.7945	971.5266	743.7278	492.1263	317.3670	334.1920	532.1796	815.5373	1095.6064	1333.3522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2471	547.1280	459.6055	258.6218	108.2415	0.0000	0.0000	0.0000	0.0000	273.5543	498.3317	700.8301	(98)
Space heating												3534.5602	(98)
Space heating per m2											(98) / (4) =	44.6847	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8617	0.9235	0.8971	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.3441	606.8899	604.2870	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	888.6914	850.0987	793.4548	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.9301	180.9473	140.7409	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.6182	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   30.4825   45.2368   35.1852    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.9046 (107)
Space cooling per m2                                                                                                     1.4021 (108)
Energy for space heating                                                                                                44.6847 (99)
Energy for space cooling                                                                                                 1.4021 (108)
Total                                                                                                                   46.0868 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    53.0 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.4920	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4391	0.4078	0.4182	0.3973	0.3973	0.3869	0.3764	0.3659	0.3555	0.3869	0.3659	0.3869	(22b)
Effective ac	0.5964	0.5831	0.5875	0.5789	0.5789	0.5748	0.5708	0.5670	0.5632	0.5748	0.5670	0.5748	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2442	39.3480	39.6394	39.0640	39.0640	38.7874	38.5181	38.2563	38.0018	38.7874	38.2563	38.7874	(38)
Heat transfer coeff	97.5799	96.6836	96.9750	96.3996	96.3996	96.1230	95.8538	95.5919	95.3374	96.1230	95.5919	96.1230	(39)
Average = Sum(39)m / 12 =												96.2318	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2336	1.2223	1.2260	1.2187	1.2187	1.2152	1.2118	1.2085	1.2053	1.2152	1.2085	1.2152	(40)
HLP (average)												1.2166	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2929	56.8147	56.6440	56.9821	56.9821	57.1461	57.3066	57.4636	57.6170	57.1461	57.4636	57.1461	
alpha	4.7529	4.7876	4.7763	4.7988	4.7988	4.8097	4.8204	4.8309	4.8411	4.8097	4.8309	4.8097	
util living area													
	0.9905	0.9846	0.9631	0.8981	0.7663	0.5526	0.4051	0.4260	0.6989	0.9209	0.9802	0.9922	(86)
MIT	19.9272	20.0576	20.3293	20.6583	20.8838	20.9808	20.9965	20.9957	20.9440	20.6711	20.2691	19.9225	(87)
Th 2	19.8932	19.9022	19.8993	19.9051	19.9051	19.9079	19.9106	19.9132	19.9158	19.9079	19.9132	19.9079	(88)
util rest of house													
	0.9874	0.9796	0.9508	0.8653	0.6982	0.4544	0.2937	0.3096	0.6021	0.8865	0.9724	0.9895	(89)
MIT 2	18.5034	18.6978	19.0829	19.5345	19.8063	19.8979	19.9097	19.9121	19.8798	19.5653	19.0128	18.5073	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8599	0.7057	0.4730	0.3154	0.3323	0.6185	0.8815	0.9659	0.9856	(94)
Useful gains	648.7120	705.8065	768.2537	782.3727	663.3645	454.9571	288.7238	287.9194	489.3213	615.0025	620.9608	615.5846	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1354.3294	1320.8108	1195.1498	988.3009	724.4436	462.1236	289.4945	288.8756	513.4808	805.4574	1085.5560	1324.7083	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	524.9793	413.2829	317.6107	148.2683	45.4428	0.0000	0.0000	0.0000	0.0000	141.6984	334.5085	527.5880	(98)
Space heating												2453.3790	(98)
RHI space heating demand												2453	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.9500
Infiltration rate		0.4920 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5332	0.5228	0.5123	0.4600	0.4496	0.3973	0.3973	0.3869	0.4182	0.4496	0.4705	0.4914	(22b)
Effective ac	0.6422	0.6367	0.6312	0.6058	0.6011	0.5789	0.5789	0.5748	0.5875	0.6011	0.6107	0.6207	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss	(33) + (36) = 57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3313	42.9588	42.5937	40.8786	40.5577	39.0640	39.0640	38.7874	39.6394	40.5577	41.2069	41.8855	(38)
Heat transfer coeff	100.6670	100.2945	99.9293	98.2143	97.8934	96.3996	96.3996	96.1230	96.9750	97.8934	98.5425	99.2212	(39)
Average = Sum(39)m / 12 =												98.2127	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2727	1.2679	1.2633	1.2416	1.2376	1.2187	1.2187	1.2152	1.2260	1.2376	1.2458	1.2544	(40)
HLP (average)												1.2416	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5666	54.7693	54.9694	55.9293	56.1126	56.9821	56.9821	57.1461	56.6440	56.1126	55.7430	55.3617	
alpha	4.6378	4.6513	4.6646	4.7286	4.7408	4.7988	4.7988	4.8097	4.7763	4.7408	4.7162	4.6908	
util living area													
	0.9931	0.9876	0.9722	0.9255	0.8207	0.6452	0.4839	0.5330	0.7801	0.9497	0.9873	0.9944	(86)
MIT	19.7817	19.9390	20.2083	20.5559	20.8200	20.9583	20.9914	20.9867	20.8964	20.5478	20.1091	19.7607	(87)
Th 2	19.8623	19.8660	19.8697	19.8868	19.8900	19.9051	19.9051	19.9079	19.8993	19.8900	19.8835	19.8767	(88)
util rest of house													
	0.9908	0.9835	0.9628	0.9002	0.7637	0.5506	0.3679	0.4135	0.6952	0.9271	0.9824	0.9926	(89)
MIT 2	18.2703	18.5008	18.8899	19.3856	19.7226	19.8790	19.9021	19.9028	19.8222	19.3880	18.7616	18.2500	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5630	18.7793	19.1453	19.6123	19.9352	20.0881	20.1131	20.1127	20.0302	19.6126	19.0226	18.5426	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5630	18.7793	19.1453	19.6123	19.9352	20.0881	20.1131	20.1127	20.0302	19.6126	19.0226	18.5426	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9549	0.8927	0.7663	0.5673	0.3904	0.4366	0.7065	0.9198	0.9770	0.9894	(94)
Useful gains	628.2666	695.1736	754.7221	779.4485	706.3431	511.2855	336.3236	352.9377	525.8546	611.3166	600.0147	600.2589	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1435.8139	1392.0194	1263.6337	1052.0992	806.1703	529.0486	338.6629	356.8773	575.0856	882.2777	1174.8832	1423.0857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.8151	468.2804	378.6302	196.3085	74.2714	0.0000	0.0000	0.0000	0.0000	201.5951	413.9053	612.1832	(98)
Space heating												2945.9892	(98)
Space heating per m2											(98) / (4) =	37.2439	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3171.1402	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.8151	468.2804	378.6302	196.3085	74.2714	0.0000	0.0000	0.0000	0.0000	201.5951	413.9053	612.1832	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	646.7332	504.0693	407.5675	211.3117	79.9477	0.0000	0.0000	0.0000	0.0000	217.0022	445.5386	658.9700	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1996	89.1332	88.9787	88.5983	87.8634	86.7000	86.7000	86.7000	86.7000	88.5901	89.0445	89.2258	(217)
Fuel for water heating, kWh/month													
	182.0059	159.6693	165.9270	146.5271	142.7069	126.1921	118.3152	133.8039	134.8180	152.1014	163.5804	176.6211	(219)
Water heating fuel used												1802.2684	(219)
Annual totals kWh/year													
Space heating fuel - main system												3171.1402	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4858.6558	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3171.1402	3.4800	110.3557	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.2684	3.4800	62.7189	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			277.9387	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9406	(257)
SAP value		86.8780	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3171.1402	0.2160	684.9663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.2684	0.2160	389.2900	(264)
Space and water heating			1074.2562	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1014.6996	(272)
CO2 emissions per m2			12.8300	(273)
EI value			89.0435	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.4920	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4391	0.4078	0.4182	0.3973	0.3973	0.3869	0.3764	0.3659	0.3555	0.3869	0.3659	0.3869	(22b)
Effective ac	0.5964	0.5831	0.5875	0.5789	0.5789	0.5748	0.5708	0.5670	0.5632	0.5748	0.5670	0.5748	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2442	39.3480	39.6394	39.0640	39.0640	38.7874	38.5181	38.2563	38.0018	38.7874	38.2563	38.7874	(38)
Heat transfer coeff	97.5799	96.6836	96.9750	96.3996	96.3996	96.1230	95.8538	95.5919	95.3374	96.1230	95.5919	96.1230	(39)
Average = Sum(39)m / 12 =												96.2318	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2336	1.2223	1.2260	1.2187	1.2187	1.2152	1.2118	1.2085	1.2053	1.2152	1.2085	1.2152	(40)
HLP (average)												1.2166	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2929	56.8147	56.6440	56.9821	56.9821	57.1461	57.3066	57.4636	57.6170	57.1461	57.4636	57.1461	
alpha	4.7529	4.7876	4.7763	4.7988	4.7988	4.8097	4.8204	4.8309	4.8411	4.8097	4.8309	4.8097	
util living area													
	0.9905	0.9846	0.9631	0.8981	0.7663	0.5526	0.4051	0.4260	0.6989	0.9209	0.9802	0.9922	(86)
MIT	19.9272	20.0576	20.3293	20.6583	20.8838	20.9808	20.9965	20.9957	20.9440	20.6711	20.2691	19.9225	(87)
Th 2	19.8932	19.9022	19.8993	19.9051	19.9051	19.9079	19.9106	19.9132	19.9158	19.9079	19.9132	19.9079	(88)
util rest of house													
	0.9874	0.9796	0.9508	0.8653	0.6982	0.4544	0.2937	0.3096	0.6021	0.8865	0.9724	0.9895	(89)
MIT 2	18.5034	18.6978	19.0829	19.5345	19.8063	19.8979	19.9097	19.9121	19.8798	19.5653	19.0128	18.5073	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8599	0.7057	0.4730	0.3154	0.3323	0.6185	0.8815	0.9659	0.9856	(94)
Useful gains	648.7120	705.8065	768.2537	782.3727	663.3645	454.9571	288.7238	287.9194	489.3213	615.0025	620.9608	615.5846	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1354.3294	1320.8108	1195.1498	988.3009	724.4436	462.1236	289.4945	288.8756	513.4808	805.4574	1085.5560	1324.7083	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	524.9793	413.2829	317.6107	148.2683	45.4428	0.0000	0.0000	0.0000	0.0000	141.6984	334.5085	527.5880	(98)
Space heating												2453.3790	(98)
Space heating per m2											(98) / (4) =	31.0162	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2640.8816	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	524.9793	413.2829	317.6107	148.2683	45.4428	0.0000	0.0000	0.0000	0.0000	141.6984	334.5085	527.5880	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	565.1015	444.8686	341.8845	159.5999	48.9158	0.0000	0.0000	0.0000	0.0000	152.5279	360.0738	567.9096	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1230	89.0580	88.8592	88.3772	87.5288	86.7000	86.7000	86.7000	86.7000	88.3112	88.9046	89.1433	(217)
Fuel for water heating, kWh/month													
	182.1624	159.8042	166.1500	146.8936	143.2525	126.1921	118.3152	133.8039	134.8180	152.5816	163.8378	176.7846	(219)
Water heating fuel used												1804.5958	(219)
Annual totals kWh/year													
Space heating fuel - main system												2640.8816	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4257.0082	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2640.8816	7.3800	194.8971	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.5958	7.3800	133.1792	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			381.0610	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2640.8816	0.2160	570.4304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5958	0.2160	389.7927	(264)
Space and water heating			960.2231	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			862.4076	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2640.8816	1.2200	3221.8755	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5958	1.2200	2201.6069	(264)
Space and water heating			5423.4825	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4844.8820	(272)
Primary energy kWh/m2/year			61.2501	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£435	£363	£72
Space heating	£323	£323	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£381	£323	£58
Total cost of uses	£380	£323	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.4920	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5332	0.5228	0.5123	0.4600	0.4496	0.3973	0.3973	0.3869	0.4182	0.4496	0.4705	0.4914	(22b)
Effective ac	0.6422	0.6367	0.6312	0.6058	0.6011	0.5789	0.5789	0.5748	0.5875	0.6011	0.6107	0.6207	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3313	42.9588	42.5937	40.8786	40.5577	39.0640	39.0640	38.7874	39.6394	40.5577	41.2069	41.8855	(38)
Heat transfer coeff	100.6670	100.2945	99.9293	98.2143	97.8934	96.3996	96.3996	96.1230	96.9750	97.8934	98.5425	99.2212	(39)
Average = Sum(39)m / 12 =												98.2127	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2727	1.2679	1.2633	1.2416	1.2376	1.2187	1.2187	1.2152	1.2260	1.2376	1.2458	1.2544	(40)
HLP (average)												1.2416	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)											Total = Sum(45)m =	1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488 (83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5666	54.7693	54.9694	55.9293	56.1126	56.9821	56.9821	57.1461	56.6440	56.1126	55.7430	55.3617	
alpha	4.6378	4.6513	4.6646	4.7286	4.7408	4.7988	4.7988	4.8097	4.7763	4.7408	4.7162	4.6908	
util living area													
	0.9931	0.9876	0.9722	0.9255	0.8207	0.6452	0.4839	0.5330	0.7801	0.9497	0.9873	0.9944	(86)
MIT	19.7817	19.9390	20.2083	20.5559	20.8200	20.9583	20.9914	20.9867	20.8964	20.5478	20.1091	19.7607	(87)
Th 2	19.8623	19.8660	19.8697	19.8868	19.8900	19.9051	19.9051	19.9079	19.8993	19.8900	19.8835	19.8767	(88)
util rest of house													
	0.9908	0.9835	0.9628	0.9002	0.7637	0.5506	0.3679	0.4135	0.6952	0.9271	0.9824	0.9926	(89)
MIT 2	18.2703	18.5008	18.8899	19.3856	19.7226	19.8790	19.9021	19.9028	19.8222	19.3880	18.7616	18.2500	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5630	18.7793	19.1453	19.6123	19.9352	20.0881	20.1131	20.1127	20.0302	19.6126	19.0226	18.5426	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5630	18.7793	19.1453	19.6123	19.9352	20.0881	20.1131	20.1127	20.0302	19.6126	19.0226	18.5426	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9549	0.8927	0.7663	0.5673	0.3904	0.4366	0.7065	0.9198	0.9770	0.9894	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	628.2666	695.1736	754.7221	779.4485	706.3431	511.2855	336.3236	352.9377	525.8546	611.3166	600.0147	600.2589	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1435.8139	1392.0194	1263.6337	1052.0992	806.1703	529.0486	338.6629	356.8773	575.0856	882.2777	1174.8832	1423.0857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	600.8151	468.2804	378.6302	196.3085	74.2714	0.0000	0.0000	0.0000	0.0000	201.5951	413.9053	612.1832	(98)
Space heating												2945.9892	(98)
Space heating per m2											(98) / (4) =	37.2439	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3171.1402	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.8151	468.2804	378.6302	196.3085	74.2714	0.0000	0.0000	0.0000	0.0000	201.5951	413.9053	612.1832	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	646.7332	504.0693	407.5675	211.3117	79.9477	0.0000	0.0000	0.0000	0.0000	217.0022	445.5386	658.9700	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2847	89.3125	89.3354	89.3791	89.4917	86.7000	86.7000	86.7000	86.7000	88.9454	89.1761	89.2967	(217)
Fuel for water heating, kWh/month	154.4814	113.7221	87.5767	41.1811	11.7074	0.0000	0.0000	21.4599	46.8301	92.9252	130.8571	153.5957	(219)
Water heating fuel used												854.3367	(219)
Annual totals kWh/year													
Space heating fuel - main system												3171.1402	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												3960.7241	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3171.1402	3.4800	110.3557	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3367	3.4800	29.7309	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			251.5457	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8513	(257)
SAP value		88.1240	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3171.1402	0.2160	684.9663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3367	0.2160	184.5367	(264)
Space and water heating			869.5030	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			835.8963 (272)
CO2 emissions per m2			10.5700 (273)
EI value			90.9742
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9500	
Infiltration rate		0.4920	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4391	0.4078	0.4182	0.3973	0.3973	0.3869	0.3764	0.3659	0.3555	0.3869	0.3659	0.3869	(22b)
Effective ac	0.5964	0.5831	0.5875	0.5789	0.5789	0.5748	0.5708	0.5670	0.5632	0.5748	0.5670	0.5748	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2442	39.3480	39.6394	39.0640	39.0640	38.7874	38.5181	38.2563	38.0018	38.7874	38.2563	38.7874	(38)
Heat transfer coeff	97.5799	96.6836	96.9750	96.3996	96.3996	96.1230	95.8538	95.5919	95.3374	96.1230	95.5919	96.1230	(39)
Average = Sum(39)m / 12 =												96.2318	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2336	1.2223	1.2260	1.2187	1.2187	1.2152	1.2118	1.2085	1.2053	1.2152	1.2085	1.2152	(40)
HLP (average)												1.2166	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3979 (H8)
Utilisation factor												0.5110 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2821 (H14)
Volume ratio Veff/V												0.8127 (H15)
Solar storage volume factor												0.9585 (H16)
Solar input												-874.1284 (H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2929	56.8147	56.6440	56.9821	56.9821	57.1461	57.3066	57.4636	57.6170	57.1461	57.4636	57.1461	
alpha	4.7529	4.7876	4.7763	4.7988	4.7988	4.8097	4.8204	4.8309	4.8411	4.8097	4.8309	4.8097	
util living area													
	0.9905	0.9846	0.9631	0.8981	0.7663	0.5526	0.4051	0.4260	0.6989	0.9209	0.9802	0.9922	(86)
MIT	19.9272	20.0576	20.3293	20.6583	20.8838	20.9808	20.9965	20.9957	20.9440	20.6711	20.2691	19.9225	(87)
Th 2	19.8932	19.9022	19.8993	19.9051	19.9051	19.9079	19.9106	19.9132	19.9158	19.9079	19.9132	19.9079	(88)
util rest of house													
	0.9874	0.9796	0.9508	0.8653	0.6982	0.4544	0.2937	0.3096	0.6021	0.8865	0.9724	0.9895	(89)
MIT 2	18.5034	18.6978	19.0829	19.5345	19.8063	19.8979	19.9097	19.9121	19.8798	19.5653	19.0128	18.5073	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7792	18.9612	19.3243	19.7521	20.0150	20.1076	20.1202	20.1220	20.0859	19.7794	19.2561	18.7814	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8599	0.7057	0.4730	0.3154	0.3323	0.6185	0.8815	0.9659	0.9856	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	648.7120	705.8065	768.2537	782.3727	663.3645	454.9571	288.7238	287.9194	489.3213	615.0025	620.9608	615.5846 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1354.3294	1320.8108	1195.1498	988.3009	724.4436	462.1236	289.4945	288.8756	513.4808	805.4574	1085.5560	1324.7083 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	524.9793	413.2829	317.6107	148.2683	45.4428	0.0000	0.0000	0.0000	0.0000	141.6984	334.5085	527.5880 (98)

Space heating 2453.3790 (98)
Space heating per m2 (98) / (4) = 31.0162 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2640.8816 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.9793	413.2829	317.6107	148.2683	45.4428	0.0000	0.0000	0.0000	0.0000	141.6984	334.5085	527.5880	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	565.1015	444.8686	341.8845	159.5999	48.9158	0.0000	0.0000	0.0000	0.0000	152.5279	360.0738	567.9096	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2310	89.2491	89.2509	89.2594	89.0864	86.7000	86.7000	86.7000	86.7000	88.7297	89.0757	89.2324	(217)
Fuel for water heating, kWh/month	149.9843	114.0294	87.3347	40.0956	16.7720	0.0000	0.0000	14.5776	41.4721	88.8022	125.6596	150.3299	(219)
Water heating fuel used												829.0573	(219)

Annual totals kWh/year
Space heating fuel - main system 2640.8816 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) = -626.4799 -626.4799 (233)
Total delivered energy for all uses 3331.4697 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2640.8816	7.3800	194.8971	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0573	7.3800	61.1844	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			323.3962	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2640.8816	0.2160	570.4304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0573	0.2160	179.0764	(264)
Space and water heating			749.5068	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			677.6413	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2640.8816	1.2200	3221.8755	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0573	1.2200	1011.4499	(264)
Space and water heating			4233.3255	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3808.2250	(272)
Primary energy kWh/m2/year			48.1444	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
South	0.5000	118.5567	0.7200	0.7000	0.7650	20.5698
West	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
total:						508.3400

	Jun	Jul	Aug	
Solar gains	546	508	449	(P3)
Internal gains	425	408	416	
Total summer gains	971	916	865	(P5)
Summer gain/loss ratio	1.63	1.53	1.45	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.28	19.08	19.00	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 365 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	22 Goldcrest Road, Boorley Green, Southampton, SO32 2BZ		

SAP Rating	87 B	**DER**	14.78	**TER**	18.70
Environmental	89 B	**% DER<TER**	20.96		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.99	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.70	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.78	$kgCO_2/m^2$	Pass
	-3.92 (-21.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.99	$kWh/m^2/yr$	
	-4.0 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.95 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.75 m², No overhang 0.50 m², No overhang 6.47 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.95 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 366 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.31	**TER**	18.44
Environmental	88 B	**% DER<TER**	22.38		
CO_2 Emissions (t/year)	1.01	**DFEE**	53.35	**TFEE**	58.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.44 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.31 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.77 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.30 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 5.23 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 6.67 m², No overhang
Windows facing West: 7.18 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

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10 Key features
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.7700	
Infiltration rate		0.4371	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3387	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4319	0.4234	0.4150	0.3726	0.3642	0.3218	0.3218	0.3133	0.3387	0.3642	0.3811	0.3980	(22b)
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.2922	48.9912	48.6963	47.3109	47.0517	45.8450	45.8450	45.6216	46.3098	47.0517	47.5760	48.1242	(38)
Heat transfer coeff	139.2539	138.9529	138.6580	137.2726	137.0134	135.8067	135.8067	135.5833	136.2715	137.0134	137.5378	138.0860	(39)
Average = Sum(39)m / 12 =												137.2713	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4294	1.4263	1.4233	1.4091	1.4064	1.3940	1.3940	1.3917	1.3988	1.4064	1.4118	1.4174	(40)
HLP (average)												1.4091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Total per year (kWh/year) = Sum(64)m =												1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	417.1807	415.0021	399.9443	375.5234	350.5213	326.5507	311.0480	317.3593	329.9595	354.6058	382.9520	404.4103	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.7200	0.7000	0.7700	4.8281	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	6.6700	46.7521	0.7200	0.7000	0.7700	108.9157	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	216.0016	384.6450	562.4444	744.0384	866.6713	872.4437	836.3102	744.7009	626.2201	435.6594	261.9637	182.6454	(83)
Total gains	633.1823	799.6471	962.3887	1119.5618	1217.1925	1198.9945	1147.3582	1062.0602	956.1796	790.2652	644.9157	587.0557	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5823	48.6875	48.7911	49.2835	49.3768	49.8155	49.8155	49.8976	49.6456	49.3768	49.1885	48.9932	
alpha	4.2388	4.2458	4.2527	4.2856	4.2918	4.3210	4.3210	4.3265	4.3097	4.2918	4.2792	4.2662	
util living area													
	0.9971	0.9918	0.9768	0.9314	0.8291	0.6643	0.5054	0.5615	0.8048	0.9629	0.9936	0.9979	(86)
MIT	19.4458	19.6746	20.0170	20.4308	20.7559	20.9329	20.9837	20.9748	20.8425	20.3884	19.8305	19.4060	(87)
Th 2	19.7409	19.7432	19.7455	19.7564	19.7584	19.7679	19.7679	19.7697	19.7643	19.7584	19.7543	19.7500	(88)
util rest of house													
	0.9960	0.9890	0.9685	0.9063	0.7695	0.5599	0.3716	0.4237	0.7162	0.9443	0.9910	0.9971	(89)
MIT 2	17.6992	18.0337	18.5289	19.1151	19.5325	19.7266	19.7626	19.7604	19.6467	19.0723	18.2700	17.6471	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.0542	18.3672	18.8313	19.3825	19.7812	19.9718	20.0108	20.0072	19.8897	19.3398	18.5872	18.0046	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0542	18.3672	18.8313	19.3825	19.7812	19.9718	20.0108	20.0072	19.8897	19.3398	18.5872	18.0046	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9843	0.9601	0.8969	0.7708	0.5785	0.3989	0.4517	0.7266	0.9357	0.9871	0.9954	(94)
Useful gains	629.2839	787.1128	923.9978	1004.1800	938.1762	693.5947	457.6835	479.7170	694.7646	739.4812	636.5914	584.3793	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1915.3276	1871.3044	1709.8352	1438.9631	1107.2279	729.5270	463.2117	489.0791	788.9736	1197.4745	1579.9183	1906.2208	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	956.8165	728.5768	584.6630	313.0439	125.7744	0.0000	0.0000	0.0000	0.0000	340.7470	679.1953	983.4500	(98)
Space heating												4712.2670	(98)
Space heating per m2											(98) / (4) =	48.3706	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5072.4080	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	956.8165	728.5768	584.6630	313.0439	125.7744	0.0000	0.0000	0.0000	0.0000	340.7470	679.1953	983.4500	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1029.9424	784.2592	629.3467	336.9686	135.3869	0.0000	0.0000	0.0000	0.0000	366.7891	731.1037	1058.6114	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3953	89.3326	89.2028	88.8960	88.2248	86.7000	86.7000	86.7000	86.7000	88.9284	89.2878	89.4192	(217)
Fuel for water heating, kWh/month													
	193.2727	169.5274	176.0742	155.2787	151.0570	134.0367	125.5844	142.1462	143.2609	161.1153	173.5552	187.5331	(219)
Water heating fuel used												1912.4417	(219)
Annual totals kWh/year													
Space heating fuel - main system												5072.4080	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6764.6350	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5072.4080	0.2160	1095.6401	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.4417	0.2160	413.0874	(264)
Space and water heating			1508.7275	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1394.4361	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.3100	ZC1
Total Floor Area	TFA	97.4200	
Assumed number of occupants	N	2.7143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3338	ZC2
CO2 emissions from cooking, equation (L16)		1.8902	ZC3
Total CO2 emissions		31.5340	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5340	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1192	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3692	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6837	47.2620	43.7911	45.2508	47.2620	47.6837	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (64)
								Total per year (kWh/year) = Sum(64)m =				2130.4990 (64)
Heat gains from water heating, kWh/month												
	66.2554	58.3120	61.0384	54.0289	52.2191	45.8130	43.6205	48.8892	49.4374	56.4615	60.0545	64.5668 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	89.0530	86.7738	82.0409	75.0402	70.1870	63.6292	58.6297	65.7112	68.6630	75.8891	83.4090	86.7833	(72)
Total internal gains													
	430.4164	428.2307	413.1638	388.1707	362.4878	337.8443	322.3490	329.3371	342.6228	367.8413	396.1910	417.6510	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1700	10.6334	0.6300	0.7000	0.7700	3.8022	(74)
Northeast	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(75)
East	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	6.0000	46.7521	0.6300	0.7000	0.7700	85.7282	(78)
West	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(80)

Solar gains	169.9737	302.6670	442.5459	585.3998	681.8702	686.4076	657.9806	585.9142	492.7152	342.8008	206.1390	143.7273 (83)
Total gains	600.3901	730.8977	855.7097	973.5705	1044.3580	1024.2519	980.3295	915.2513	835.3380	710.6421	602.3300	561.3783 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area													
	0.9977	0.9940	0.9833	0.9489	0.8624	0.7046	0.5395	0.5943	0.8330	0.9709	0.9950	0.9983	(86)
MIT	19.5804	19.7740	20.0741	20.4458	20.7550	20.9324	20.9844	20.9759	20.8475	20.4274	19.9266	19.5432	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house													
	0.9969	0.9919	0.9772	0.9296	0.8112	0.6059	0.4085	0.4611	0.7537	0.9562	0.9930	0.9977	(89)
MIT 2	17.9639	18.2473	18.6828	19.2140	19.6200	19.8187	19.8570	19.8543	19.7406	19.1995	18.4765	17.9142	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2924	18.5576	18.9656	19.4643	19.8506	20.0450	20.0862	20.0823	19.9656	19.4490	18.7713	18.2453	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2924	18.5576	18.9656	19.4643	19.8506	20.0450	20.0862	20.0823	19.9656	19.4490	18.7713	18.2453	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9885	0.9708	0.9213	0.8109	0.6231	0.4352	0.4881	0.7622	0.9491	0.9900	0.9964	(94)
Useful gains	597.5328	722.5076	830.7307	896.9211	846.9029	638.2129	426.6884	446.6993	636.7240	674.4674	596.2945	559.3797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1768.9331	1723.6723	1570.6113	1320.6191	1017.3842	674.9768	432.1517	455.8750	729.0531	1104.5584	1461.2006	1763.9148	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	871.5218	672.7827	550.4712	305.0626	126.8381	0.0000	0.0000	0.0000	0.0000	319.9877	622.7324	896.1741	(98)
Space heating												4365.5706	(98)
Space heating per m2											(98) / (4) =	44.8119	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4674.0585	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	871.5218	672.7827	550.4712	305.0626	126.8381	0.0000	0.0000	0.0000	0.0000	319.9877	622.7324	896.1741	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	933.1069	720.3241	589.3696	326.6195	135.8010	0.0000	0.0000	0.0000	0.0000	342.5993	666.7371	959.5012	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2295	87.9948	87.5076	86.4461	84.3432	80.3000	80.3000	80.3000	80.3000	86.4514	87.7890	88.3170	(217)
Fuel for water heating, kWh/month													
	240.1786	212.2792	224.2298	201.6565	200.1070	185.1171	177.3563	197.7107	199.8942	211.0469	219.6757	234.1902	(219)
Water heating fuel used												2503.4422	(219)
Annual totals kWh/year													
Space heating fuel - main system												4674.0585	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.4259	(232)
Total delivered energy for all uses												7650.9266	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4674.0585	0.2160	1009.5966	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2503.4422	0.2160	540.7435	(264)
Space and water heating			1550.3401	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.4259	0.5190	206.7830	(268)
Total CO2, kg/m2/year			1796.0482	(272)
Emissions per m2 for space and water heating			15.9140	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1226	(272b)
Emissions per m2 for pumps and fans			0.3996	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9140 * 1.00) + 2.1226 + 0.3996, rounded to 2 d.p.			18.4400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		4.7700	
Infiltration rate		0.3577	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2772	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3534	0.3465	0.3395	0.3049	0.2980	0.2633	0.2633	0.2564	0.2772	0.2980	0.3118	0.3257	(22b)
Effective ac	0.5624	0.5600	0.5576	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5486	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7314	46.5299	46.3324	45.4049	45.2313	44.4234	44.4234	44.2738	44.7346	45.2313	45.5824	45.9494	(38)
Heat transfer coeff	136.6931	136.4916	136.2942	135.3666	135.1930	134.3851	134.3851	134.2355	134.6963	135.1930	135.5441	135.9111	(39)
Average = Sum(39)m / 12 =												135.3657	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4031	1.4011	1.3990	1.3895	1.3877	1.3794	1.3794	1.3779	1.3826	1.3877	1.3913	1.3951	(40)
HLP (average)												1.3895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196	(72)
Total internal gains													
	384.2469	382.8934	369.5490	347.4597	323.9722	302.1328	288.4394	292.4302	304.2044	326.4377	352.0614	372.2982	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.7200	0.7000	0.7700	4.8281	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	6.6700	46.7521	0.7200	0.7000	0.7700	108.9157	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	216.0016	384.6450	562.4444	744.0384	866.6713	872.4437	836.3102	744.7009	626.2201	435.6594	261.9637	182.6454	(83)
Total gains	600.2484	767.5384	931.9935	1091.4981	1190.6435	1174.5765	1124.7496	1037.1311	930.4244	762.0970	614.0251	554.9435	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4925	49.5655	49.6373	49.9775	50.0416	50.3425	50.3425	50.3986	50.2262	50.0416	49.9120	49.7772	
alpha	4.2995	4.3044	4.3092	4.3318	4.3361	4.3562	4.3562	4.3599	4.3484	4.3361	4.3275	4.3185	
util living area													
	0.9976	0.9929	0.9789	0.9350	0.8340	0.6701	0.5101	0.5686	0.8126	0.9666	0.9947	0.9983	(86)
MIT	19.4482	19.6767	20.0188	20.4297	20.7558	20.9324	20.9837	20.9743	20.8397	20.3815	19.8242	19.4041	(87)
Th 2	19.7609	19.7625	19.7641	19.7714	19.7728	19.7791	19.7791	19.7803	19.7767	19.7728	19.7700	19.7671	(88)
util rest of house													
	0.9968	0.9905	0.9713	0.9111	0.7756	0.5663	0.3763	0.4307	0.7258	0.9496	0.9925	0.9977	(89)
MIT 2	18.3647	18.5932	18.9317	19.3307	19.6176	19.7505	19.7755	19.7738	19.6941	19.2956	18.7469	18.3256	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5849	18.8134	19.1526	19.5540	19.8489	19.9908	20.0211	20.0178	19.9269	19.5163	18.9658	18.5448	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5849	18.8134	19.1526	19.5540	19.8489	19.9908	20.0211	20.0178	19.9269	19.5163	18.9658	18.5448	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9878	0.9663	0.9060	0.7798	0.5856	0.4038	0.4590	0.7381	0.9449	0.9904	0.9968	(94)
Useful gains	597.6360	758.1998	900.5867	988.8754	928.4131	687.8687	454.1758	476.0244	686.7868	720.0741	608.1068	553.1948	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1952.6514	1899.0684	1724.4814	1442.2013	1101.6809	724.4380	459.7392	485.6370	784.8640	1205.4161	1608.3428	1949.6152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1008.1314	766.6637	612.9777	326.3947	128.9113	0.0000	0.0000	0.0000	0.0000	361.0944	720.1699	1038.9368	(98)
Space heating												4963.2799	(98)
Space heating per m2											(98) / (4) =	50.9472	(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calculated for June, July and August. See Table 10b													
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1263.2199	994.4497	1020.1897	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8707	0.9248	0.9004	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1099.9263	919.6824	918.5587	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1476.4447	1415.9758	1315.3715	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	271.0932	369.2423	295.2288	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												935.5643 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	67.7733	92.3106	73.8072	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												233.8911 (107)
Space cooling per m2												2.4009 (108)
Energy for space heating												50.9472 (99)
Energy for space cooling												2.4009 (108)
Total												53.3481 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.3336	382.9704	369.6116	347.5071	324.0076	302.1627	288.4717	292.4722	304.2607	326.5093	352.1450	372.3873 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.1700	10.6334	0.6300	0.7000	0.7700	3.8022	(74)
Northeast	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(75)
East	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	6.0000	46.7521	0.6300	0.7000	0.7700	85.7282	(78)
West	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(80)

Solar gains	169.9737	302.6670	442.5459	585.3998	681.8702	686.4076	657.9806	585.9142	492.7152	342.8008	206.1390	143.7273 (83)
Total gains	554.3073	685.6374	812.1575	932.9069	1005.8778	988.5703	946.4523	878.3865	796.9759	669.3101	558.2840	516.1146 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area	0.9984	0.9954	0.9863	0.9557	0.8753	0.7222	0.5565	0.6150	0.8511	0.9766	0.9964	0.9988	(86)
MIT	19.5375	19.7327	20.0361	20.4155	20.7360	20.9251	20.9823	20.9723	20.8310	20.3932	19.8860	19.5010	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house	0.9978	0.9938	0.9812	0.9385	0.8267	0.6238	0.4225	0.4791	0.7756	0.9644	0.9948	0.9984	(89)
MIT 2	18.5172	18.7130	19.0149	19.3892	19.6800	19.8288	19.8582	19.8562	19.7676	19.3755	18.8729	18.4860	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.7246	18.9202	19.2225	19.5978	19.8946	20.0516	20.0867	20.0831	19.9838	19.5824	19.0788	18.6923	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7246	18.9202	19.2225	19.5978	19.8946	20.0516	20.0867	20.0831	19.9838	19.5824	19.0788	18.6923	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9919	0.9776	0.9337	0.8287	0.6416	0.4500	0.5069	0.7853	0.9605	0.9933	0.9978	(94)
Useful gains	552.6295	680.1134	793.9450	871.0178	833.5375	634.3075	425.9467	445.2630	625.8306	642.8846	554.5585	514.9787	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1823.5690	1769.4358	1602.9789	1337.3075	1022.8755	675.7938	432.2147	455.9725	731.3131	1121.2029	1499.7046	1820.0499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	945.5789	732.0246	601.9212	335.7286	140.8675	0.0000	0.0000	0.0000	0.0000	355.8688	680.5052	970.9730	(98)
Space heating												4763.4679	(98)
Space heating per m2											(98) / (4) =	48.8962	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1165.2410	917.3174	940.8984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8529	0.9148	0.8890	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	993.8775	839.1281	836.4359	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1259.0746	1207.6194	1129.8818	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	190.9419	274.1575	218.3237	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												683.4232 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	47.7355	68.5394	54.5809	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												170.8558 (107)
Space cooling per m2												1.7538 (108)
Energy for space heating												48.8962 (99)
Energy for space cooling												1.7538 (108)
Total												50.6500 (109)
Target Fabric Energy Efficiency (TFEE)												58.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.7700	
Infiltration rate		0.4371	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3387	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3557	0.3303	0.3387	0.3218	0.3218	0.3133	0.3049	0.2964	0.2879	0.3133	0.2964	0.3133	(22b)
Effective ac	0.5633	0.5545	0.5574	0.5518	0.5518	0.5491	0.5465	0.5439	0.5415	0.5491	0.5439	0.5491	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7984	46.0745	46.3098	45.8450	45.8450	45.6216	45.4041	45.1926	44.9870	45.6216	45.1926	45.6216	(38)
Heat transfer coeff	136.7601	136.0362	136.2715	135.8067	135.8067	135.5833	135.3658	135.1543	134.9487	135.5833	135.1543	135.5833	(39)
Average = Sum(39)m / 12 =												135.6712	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4038	1.3964	1.3988	1.3940	1.3940	1.3917	1.3895	1.3873	1.3852	1.3917	1.3873	1.3917	(40)
HLP (average)												1.3926	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602 (64)
RHI water heating demand												1691 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	13.4839	0.7200	0.7000	0.7700	6.1224	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	6.6700	56.7559	0.7200	0.7000	0.7700	132.2210	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	268.8422	407.8363	602.4147	804.4050	893.1341	977.9679	929.5646	846.1278	709.2464	498.7005	325.0639	223.4202	(83)
Total gains	888.4683	1022.8031	1193.4854	1358.2273	1408.5746	1459.0911	1390.6436	1315.9987	1200.5559	1027.4838	895.5730	825.7345	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4682	49.7315	49.6456	49.8155	49.8155	49.8976	49.9777	50.0560	50.1322	49.8976	50.0560	49.8976	
alpha	4.2979	4.3154	4.3097	4.3210	4.3210	4.3265	4.3318	4.3371	4.3421	4.3265	4.3371	4.3265	
util living area													
	0.9878	0.9778	0.9459	0.8640	0.7237	0.5132	0.3761	0.3960	0.6533	0.8943	0.9736	0.9905	(86)
MIT	19.7799	19.9522	20.2817	20.6417	20.8754	20.9778	20.9954	20.9944	20.9391	20.6466	20.1696	19.7521	(87)
Th 2	19.7604	19.7661	19.7643	19.7679	19.7679	19.7697	19.7714	19.7731	19.7747	19.7697	19.7731	19.7697	(88)
util rest of house													
	0.9837	0.9706	0.9284	0.8226	0.6476	0.4099	0.2595	0.2738	0.5479	0.8503	0.9631	0.9872	(89)
MIT 2	18.1972	18.4483	18.9114	19.3932	19.6668	19.7589	19.7703	19.7718	19.7381	19.4165	18.7686	18.1638	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9778	0.9625	0.9181	0.8179	0.6573	0.4304	0.2833	0.2988	0.5670	0.8458	0.9548	0.9821	(94)
Useful gains	868.7793	984.4335	1095.7827	1110.8863	925.8682	627.9852	393.9595	393.1928	680.7294	869.0201	855.0599	810.9950	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1862.5174	1830.2253	1661.1405	1378.0235	1006.6577	638.1370	395.1760	394.6849	712.8204	1120.7971	1507.4239	1828.5619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	739.3412	568.3721	420.6263	192.3388	60.1074	0.0000	0.0000	0.0000	0.0000	187.3220	469.7021	757.0698	(98)
Space heating												3394.8797	(98)
RHI space heating demand												3395	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.7700	
Infiltration rate		0.4371	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3387	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4319	0.4234	0.4150	0.3726	0.3642	0.3218	0.3218	0.3133	0.3387	0.3642	0.3811	0.3980	(22b)
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.2922	48.9912	48.6963	47.3109	47.0517	45.8450	45.8450	45.6216	46.3098	47.0517	47.5760	48.1242	(38)
Heat transfer coeff	139.2539	138.9529	138.6580	137.2726	137.0134	135.8067	135.8067	135.5833	136.2715	137.0134	137.5378	138.0860	(39)
Average = Sum(39)m / 12 =												137.2713	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4294	1.4263	1.4233	1.4091	1.4064	1.3940	1.3940	1.3917	1.3988	1.4064	1.4118	1.4174	(40)
HLP (average)												1.4091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.7200	0.7000	0.7700	4.8281	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	6.6700	46.7521	0.7200	0.7000	0.7700	108.9157	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	216.0016	384.6450	562.4444	744.0384	866.6713	872.4437	836.3102	744.7009	626.2201	435.6594	261.9637	182.6454	(83)
Total gains	835.6277	999.6118	1153.5152	1297.8607	1382.1118	1353.5669	1297.3892	1214.5719	1117.5295	964.4426	832.4728	784.9597	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5823	48.6875	48.7911	49.2835	49.3768	49.8155	49.8155	49.8976	49.6456	49.3768	49.1885	48.9932	
alpha	4.2388	4.2458	4.2527	4.2856	4.2918	4.3210	4.3210	4.3265	4.3097	4.2918	4.2792	4.2662	
util living area													
	0.9916	0.9816	0.9576	0.8957	0.7767	0.6047	0.4517	0.4991	0.7358	0.9307	0.9837	0.9935	(86)
MIT	19.6268	19.8473	20.1680	20.5411	20.8151	20.9532	20.9894	20.9839	20.8911	20.5143	19.9944	19.5843	(87)
Th 2	19.7409	19.7432	19.7455	19.7564	19.7584	19.7679	19.7679	19.7697	19.7643	19.7584	19.7543	19.7500	(88)
util rest of house													
	0.9888	0.9757	0.9436	0.8623	0.7107	0.5034	0.3297	0.3727	0.6403	0.9005	0.9773	0.9913	(89)
MIT 2	17.9620	18.2816	18.7393	19.2559	19.5941	19.7403	19.7646	19.7640	19.6881	19.2373	18.5052	17.9066	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.3004	18.5999	19.0297	19.5171	19.8422	19.9868	20.0135	20.0120	19.9326	19.4968	18.8078	18.2476	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3004	18.5999	19.0297	19.5171	19.8422	19.9868	20.0135	20.0120	19.9326	19.4968	18.8078	18.2476	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9681	0.9334	0.8546	0.7156	0.5224	0.3546	0.3984	0.6547	0.8924	0.9704	0.9873	(94)
Useful gains	822.3079	967.7183	1076.6489	1109.1987	989.0987	707.0995	460.0759	483.9329	731.6246	860.7058	807.8260	775.0260	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1949.6072	1903.6347	1737.3435	1457.4427	1115.5947	731.5698	463.5809	489.7209	794.8227	1218.9820	1610.2708	1939.7795	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	838.7107	628.9358	491.5568	250.7357	94.1130	0.0000	0.0000	0.0000	0.0000	266.5574	577.7603	866.5767	(98)
Space heating												4014.9464	(98)
Space heating per m2											(98) / (4) =	41.2128	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4321.7937	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	838.7107	628.9358	491.5568	250.7357	94.1130	0.0000	0.0000	0.0000	0.0000	266.5574	577.7603	866.5767	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	902.8102	677.0030	529.1246	269.8984	101.3057	0.0000	0.0000	0.0000	0.0000	286.9294	621.9164	932.8059	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3368	89.2607	89.1036	88.7371	87.9964	86.7000	86.7000	86.7000	86.7000	88.7548	89.2037	89.3652	(217)
Fuel for water heating, kWh/month													
	193.3994	169.6640	176.2702	155.5566	151.4489	134.0367	125.5844	142.1462	143.2609	161.4305	173.7188	187.6464	(219)
Water heating fuel used												1914.1631	(219)
Annual totals kWh/year													
Space heating fuel - main system												4321.7937	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6015.7421	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4321.7937	3.4800	150.3984	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.1631	3.4800	66.6129	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			307.9650	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9082	(257)
SAP value		87.3307	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4321.7937	0.2160	933.5074	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.1631	0.2160	413.4592	(264)
Space and water heating			1346.9667	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total kg/year			1232.6752	(272)
CO2 emissions per m2			12.6500	(273)
EI value			88.4020	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8821 = 3.945, stars = 4
Water heating environmental impact	0.216 / 0.8821 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.7700	
Infiltration rate		0.4371	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3387	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3557	0.3303	0.3387	0.3218	0.3218	0.3133	0.3049	0.2964	0.2879	0.3133	0.2964	0.3133	(22b)
Effective ac	0.5633	0.5545	0.5574	0.5518	0.5518	0.5491	0.5465	0.5439	0.5415	0.5491	0.5439	0.5491	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7984	46.0745	46.3098	45.8450	45.8450	45.6216	45.4041	45.1926	44.9870	45.6216	45.1926	45.6216	(38)
Heat transfer coeff	136.7601	136.0362	136.2715	135.8067	135.8067	135.5833	135.3658	135.1543	134.9487	135.5833	135.1543	135.5833	(39)
Average = Sum(39)m / 12 =												135.6712	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4038	1.3964	1.3988	1.3940	1.3940	1.3917	1.3895	1.3873	1.3852	1.3917	1.3873	1.3917	(40)
HLP (average)												1.3926	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	13.4839	0.7200	0.7000	0.7700	6.1224	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	6.6700	56.7559	0.7200	0.7000	0.7700	132.2210	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	268.8422	407.8363	602.4147	804.4050	893.1341	977.9679	929.5646	846.1278	709.2464	498.7005	325.0639	223.4202	(83)
Total gains	888.4683	1022.8031	1193.4854	1358.2273	1408.5746	1459.0911	1390.6436	1315.9987	1200.5559	1027.4838	895.5730	825.7345	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4682	49.7315	49.6456	49.8155	49.8155	49.8976	49.9777	50.0560	50.1322	49.8976	50.0560	49.8976	
alpha	4.2979	4.3154	4.3097	4.3210	4.3210	4.3265	4.3318	4.3371	4.3421	4.3265	4.3371	4.3265	
util living area													
	0.9878	0.9778	0.9459	0.8640	0.7237	0.5132	0.3761	0.3960	0.6533	0.8943	0.9736	0.9905	(86)
MIT	19.7799	19.9522	20.2817	20.6417	20.8754	20.9778	20.9954	20.9944	20.9391	20.6466	20.1696	19.7521	(87)
Th 2	19.7604	19.7661	19.7643	19.7679	19.7679	19.7697	19.7714	19.7731	19.7747	19.7697	19.7731	19.7697	(88)
util rest of house													
	0.9837	0.9706	0.9284	0.8226	0.6476	0.4099	0.2595	0.2738	0.5479	0.8503	0.9631	0.9872	(89)
MIT 2	18.1972	18.4483	18.9114	19.3932	19.6668	19.7589	19.7703	19.7718	19.7381	19.4165	18.7686	18.1638	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9778	0.9625	0.9181	0.8179	0.6573	0.4304	0.2833	0.2988	0.5670	0.8458	0.9548	0.9821	(94)
Useful gains	868.7793	984.4335	1095.7827	1110.8863	925.8682	627.9852	393.9595	393.1928	680.7294	869.0201	855.0599	810.9950	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1862.5174	1830.2253	1661.1405	1378.0235	1006.6577	638.1370	395.1760	394.6849	712.8204	1120.7971	1507.4239	1828.5619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	739.3412	568.3721	420.6263	192.3388	60.1074	0.0000	0.0000	0.0000	0.0000	187.3220	469.7021	757.0698	(98)
Space heating												3394.8797	(98)
Space heating per m2											(98) / (4) =	34.8479	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3654.3377	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.3412	568.3721	420.6263	192.3388	60.1074	0.0000	0.0000	0.0000	0.0000	187.3220	469.7021	757.0698	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	795.8463	611.8107	452.7732	207.0385	64.7012	0.0000	0.0000	0.0000	0.0000	201.6384	505.5997	814.9298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2758	89.2073	89.0068	88.5347	87.6700	86.7000	86.7000	86.7000	86.7000	88.4846	89.0843	89.3023	(217)
Fuel for water heating, kWh/month													
	193.5314	169.7656	176.4619	155.9123	152.0129	134.0367	125.5844	142.1462	143.2609	161.9234	173.9516	187.7786	(219)
Water heating fuel used												1916.3657	(219)
Annual totals kWh/year													
Space heating fuel - main system												3654.3377	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												5273.7217	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3654.3377	7.3800	269.6901	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1916.3657	7.3800	141.4278	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			433.0030	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3654.3377	0.2160	789.3369	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.3657	0.2160	413.9350	(264)
Space and water heating			1203.2719	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			1049.1384	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3654.3377	1.2200	4458.2920	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.3657	1.2200	2337.9662	(264)
Space and water heating			6796.2581	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			5884.5243	(272)
Primary energy kWh/m2/year			60.4037	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-193 kg (18.4%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£60	1.98 kg/m²	B 88	B 90
	Total Savings	£60	1.98 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£135	£150	-£14
Mains gas	£518	£443	£75
Space heating	£398	£398	£0
Water heating	£141	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£433	£373	£61
Total cost of uses	£433	£373	£60
Delivered energy	54 kWh/m²	44 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	49 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1986	(8)
Pressure test			Yes	
Measured/design AP50			4.7700	
Infiltration rate			0.4371	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3387	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4319	0.4234	0.4150	0.3726	0.3642	0.3218	0.3218	0.3133	0.3387	0.3642	0.3811	0.3980	(22b)
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.2922	48.9912	48.6963	47.3109	47.0517	45.8450	45.8450	45.6216	46.3098	47.0517	47.5760	48.1242	(38)
Heat transfer coeff	139.2539	138.9529	138.6580	137.2726	137.0134	135.8067	135.8067	135.5833	136.2715	137.0134	137.5378	138.0860	(39)
Average = Sum(39)m / 12 =												137.2713	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4294	1.4263	1.4233	1.4091	1.4064	1.3940	1.3940	1.3917	1.3988	1.4064	1.4118	1.4174	(40)
HLP (average)												1.4091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1683	(H8)
Utilisation factor												0.5751	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-866.8465	(H17)
Solar input	-25.1368	-41.9461	-71.4391	-95.7424	-118.2817	-116.2897	-114.7529	-100.2602	-78.5238	-53.6225	-29.8159	-21.0352	(63)
								Solar input (sum of months) = Sum(63)m =				-866.8465	(63)
Output from w/h													
	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
								Total per year (kWh/year) = Sum(64)m =				830.1649	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.7200	0.7000	0.7700	4.8281	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	6.6700	46.7521	0.7200	0.7000	0.7700	108.9157	(78)
West	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(80)

Solar gains	216.0016	384.6450	562.4444	744.0384	866.6713	872.4437	836.3102	744.7009	626.2201	435.6594	261.9637	182.6454	(83)
Total gains	835.6277	999.6118	1153.5152	1297.8607	1382.1118	1353.5669	1297.3892	1214.5719	1117.5295	964.4426	832.4728	784.9597	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5823	48.6875	48.7911	49.2835	49.3768	49.8155	49.8155	49.8976	49.6456	49.3768	49.1885	48.9932	
alpha	4.2388	4.2458	4.2527	4.2856	4.2918	4.3210	4.3210	4.3265	4.3097	4.2918	4.2792	4.2662	
util living area													
	0.9916	0.9816	0.9576	0.8957	0.7767	0.6047	0.4517	0.4991	0.7358	0.9307	0.9837	0.9935	(86)
MIT	19.6268	19.8473	20.1680	20.5411	20.8151	20.9532	20.9894	20.9839	20.8911	20.5143	19.9944	19.5843	(87)
Th 2	19.7409	19.7432	19.7455	19.7564	19.7584	19.7679	19.7679	19.7697	19.7643	19.7584	19.7543	19.7500	(88)
util rest of house													
	0.9888	0.9757	0.9436	0.8623	0.7107	0.5034	0.3297	0.3727	0.6403	0.9005	0.9773	0.9913	(89)
MIT 2	17.9620	18.2816	18.7393	19.2559	19.5941	19.7403	19.7646	19.7640	19.6881	19.2373	18.5052	17.9066	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3004	18.5999	19.0297	19.5171	19.8422	19.9868	20.0135	20.0120	19.9326	19.4968	18.8078	18.2476	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3004	18.5999	19.0297	19.5171	19.8422	19.9868	20.0135	20.0120	19.9326	19.4968	18.8078	18.2476	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9681	0.9334	0.8546	0.7156	0.5224	0.3546	0.3984	0.6547	0.8924	0.9704	0.9873	(94)
Useful gains	822.3079	967.7183	1076.6489	1109.1987	989.0987	707.0995	460.0759	483.9329	731.6246	860.7058	807.8260	775.0260	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1949.6072	1903.6347	1737.3435	1457.4427	1115.5947	731.5698	463.5809	489.7209	794.8227	1218.9820	1610.2708	1939.7795	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	838.7107	628.9358	491.5568	250.7357	94.1130	0.0000	0.0000	0.0000	0.0000	266.5574	577.7603	866.5767	(98)
Space heating												4014.9464	(98)
Space heating per m2											(98) / (4) =	41.2128	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4321.7937	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	838.7107	628.9358	491.5568	250.7357	94.1130	0.0000	0.0000	0.0000	0.0000	266.5574	577.7603	866.5767	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	902.8102	677.0030	529.1246	269.8984	101.3057	0.0000	0.0000	0.0000	0.0000	286.9294	621.9164	932.8059	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4061	89.4107	89.4104	89.4236	89.4465	86.7000	86.7000	86.7000	86.7000	89.0726	89.3131	89.4223	(217)
Fuel for water heating, kWh/month	165.1341	122.4654	95.7652	47.2963	16.7564	0.0000	0.0000	26.5058	52.6913	100.6536	140.1225	164.0032	(219)
Water heating fuel used												931.3938	(219)
Annual totals kWh/year													
Space heating fuel - main system												4321.7937	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												5082.9728	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4321.7937	3.4800	150.3984	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	931.3938	3.4800	32.4125	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			280.3596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8268	(257)
SAP value	88.4663	
SAP rating (Section 12)	88	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4321.7937	0.2160	933.5074	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	931.3938	0.2160	201.1811 (264)
Space and water heating			1134.6885 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.8950	0.5190	205.9885 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1046.3471 (272)
CO2 emissions per m2			10.7400 (273)
EI value			90.1551
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986 (8)
Pressure test		Yes
Measured/design AP50		4.7700
Infiltration rate		0.4371 (18)
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3387 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3557	0.3303	0.3387	0.3218	0.3218	0.3133	0.3049	0.2964	0.2879	0.3133	0.2964	0.3133	(22b)
Effective ac	0.5633	0.5545	0.5574	0.5518	0.5518	0.5491	0.5465	0.5439	0.5415	0.5491	0.5439	0.5491	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss	(33) + (36) = 89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7984	46.0745	46.3098	45.8450	45.8450	45.6216	45.4041	45.1926	44.9870	45.6216	45.1926	45.6216	(38)
Heat transfer coeff	136.7601	136.0362	136.2715	135.8067	135.8067	135.5833	135.3658	135.1543	134.9487	135.5833	135.1543	135.5833	(39)
Average = Sum(39)m / 12 =												135.6712	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4038	1.3964	1.3988	1.3940	1.3940	1.3917	1.3895	1.3873	1.3852	1.3917	1.3873	1.3917	(40)
HLP (average)												1.3926	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3075 (H8)
Utilisation factor												0.5346 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6652 (H14)
Volume ratio Veff/V												0.7601 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-901.7521 (H17)
Solar input	-29.4173	-41.8296	-71.8950	-97.0030	-113.9358	-121.7015	-119.1421	-106.6358	-83.4884	-57.7210	-34.7930	-24.1896 (63)
								Solar input (sum of months) = Sum(63)m =				-901.7521 (63)
Output from w/h												
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010 (64)
								Total per year (kWh/year) = Sum(64)m =				805.0602 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	13.4839	0.7200	0.7000	0.7700	6.1224	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	6.6700	56.7559	0.7200	0.7000	0.7700	132.2210	(78)
West	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(80)

Solar gains	268.8422	407.8363	602.4147	804.4050	893.1341	977.9679	929.5646	846.1278	709.2464	498.7005	325.0639	223.4202 (83)
Total gains	888.4683	1022.8031	1193.4854	1358.2273	1408.5746	1459.0911	1390.6436	1315.9987	1200.5559	1027.4838	895.5730	825.7345 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4682	49.7315	49.6456	49.8155	49.8155	49.8976	49.9777	50.0560	50.1322	49.8976	50.0560	49.8976	
alpha	4.2979	4.3154	4.3097	4.3210	4.3210	4.3265	4.3318	4.3371	4.3421	4.3265	4.3371	4.3265	
util living area													
	0.9878	0.9778	0.9459	0.8640	0.7237	0.5132	0.3761	0.3960	0.6533	0.8943	0.9736	0.9905	(86)
MIT	19.7799	19.9522	20.2817	20.6417	20.8754	20.9778	20.9954	20.9944	20.9391	20.6466	20.1696	19.7521	(87)
Th 2	19.7604	19.7661	19.7643	19.7679	19.7679	19.7697	19.7714	19.7731	19.7747	19.7697	19.7731	19.7697	(88)
util rest of house													
	0.9837	0.9706	0.9284	0.8226	0.6476	0.4099	0.2595	0.2738	0.5479	0.8503	0.9631	0.9872	(89)
MIT 2	18.1972	18.4483	18.9114	19.3932	19.6668	19.7589	19.7703	19.7718	19.7381	19.4165	18.7686	18.1638	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5189	18.7540	19.1899	19.6469	19.9124	20.0066	20.0193	20.0203	19.9822	19.6665	19.0534	18.4866	(93)

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8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9778	0.9625	0.9181	0.8179	0.6573	0.4304	0.2833	0.2988	0.5670	0.8458	0.9548	0.9821	(94)
Useful gains	868.7793	984.4335	1095.7827	1110.8863	925.8682	627.9852	393.9595	393.1928	680.7294	869.0201	855.0599	810.9950	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1862.5174	1830.2253	1661.1405	1378.0235	1006.6577	638.1370	395.1760	394.6849	712.8204	1120.7971	1507.4239	1828.5619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	739.3412	568.3721	420.6263	192.3388	60.1074	0.0000	0.0000	0.0000	0.0000	187.3220	469.7021	757.0698	(98)
Space heating												3394.8797	(98)
Space heating per m2											(98) / (4) =	34.8479	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3654.3377	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.3412	568.3721	420.6263	192.3388	60.1074	0.0000	0.0000	0.0000	0.0000	187.3220	469.7021	757.0698	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	795.8463	611.8107	452.7732	207.0385	64.7012	0.0000	0.0000	0.0000	0.0000	201.6384	505.5997	814.9298	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3643	89.3667	89.3447	89.3203	89.0997	86.7000	86.7000	86.7000	86.7000	88.8716	89.2291	89.3744	(217)
Fuel for water heating, kWh/month													
	160.4213	122.6560	95.3253	45.9397	21.6991	0.0000	0.0000	19.1523	46.9652	96.2695	134.6766	160.5617	(219)
Water heating fuel used												903.6666	(219)
Annual totals kWh/year													
Space heating fuel - main system												3654.3377	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												4311.0226	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3654.3377	7.3800	269.6901	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	903.6666	7.3800	66.6906	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			372.5958	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3654.3377	0.2160	789.3369	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.6666	0.2160	195.1920	(264)
Space and water heating			984.5289	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			856.3454	(272)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3654.3377	1.2200	4458.2920	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.6666	1.2200	1102.4733	(264)
Space and water heating			5560.7653	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			4802.5314	(272)
Primary energy kWh/m2/year			49.2972	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		664.69 (P1)
Transmission heat loss coefficient		89.96 (37)
Summer heat loss coefficient		754.65 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
North East	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.3000	87.1704	0.7200	0.7000	0.8865	45.5685
North East	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
East	5.2300	125.2818	0.7200	0.7000	0.8865	263.4762
South East	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
South	6.6700	118.5567	0.7200	0.7000	0.8865	317.9828
West	7.1800	125.2818	0.7200	0.7000	0.8865	361.7130
total:						1084.4560

	Jun	Jul	Aug	
Solar gains	1160	1084	984	(P3)
Internal gains	478	458	467	
Total summer gains	1638	1543	1451	(P5)
Summer gain/loss ratio	2.17	2.04	1.92	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.82	19.59	19.47	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 366 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.31	**TER**	18.44
Environmental	88 B	**% DER<TER**	22.38		
CO_2 Emissions (t/year)	1.01	**DFEE**	53.35	**TFEE**	58.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.44	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.31	$kgCO_2/m^2$	Pass
	-4.13 (-22.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.25	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.35	$kWh/m^2/yr$	
	-4.9 (-8.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.77 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.30 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	5.23 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	6.67 m², No overhang
Windows facing West	7.18 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.77 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 367 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.96	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.58		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.64	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.31 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.97 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 3.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	99.7997	99.5973	99.3988	98.4666	98.2922	97.4802	97.4802	97.3299	97.7930	98.2922	98.6450	99.0139	(39)
Average = Sum(39)m / 12 =												98.4657	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2425	1.2400	1.2375	1.2259	1.2238	1.2136	1.2136	1.2118	1.2175	1.2238	1.2281	1.2327	(40)
HLP (average)												1.2259	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	480.3544	558.9358	632.7224	710.0836	765.2170	755.3745	718.7678	664.5325	604.5084	529.9443	472.0724	453.1310	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8897	56.0033	56.1151	56.6464	56.7469	57.2196	57.2196	57.3080	57.0366	56.7469	56.5440	56.3333	
alpha	4.7260	4.7336	4.7410	4.7764	4.7831	4.8146	4.8146	4.8205	4.8024	4.7831	4.7696	4.7556	
util living area													
	0.9980	0.9956	0.9886	0.9641	0.8917	0.7406	0.5756	0.6373	0.8698	0.9787	0.9959	0.9985	(86)
MIT	19.6348	19.7954	20.0611	20.4154	20.7326	20.9255	20.9825	20.9720	20.8279	20.4190	19.9613	19.6051	(87)
Th 2	19.8861	19.8881	19.8901	19.8993	19.9010	19.9091	19.9091	19.9106	19.9060	19.9010	19.8975	19.8939	(88)
util rest of house													
	0.9973	0.9940	0.9843	0.9498	0.8479	0.6458	0.4435	0.5038	0.8007	0.9677	0.9942	0.9980	(89)
MIT 2	18.0732	18.3090	18.6964	19.2090	19.6352	19.8589	19.9027	19.8990	19.7643	19.2227	18.5584	18.0352	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4654	18.6823	19.0391	19.5120	19.9108	20.1267	20.1738	20.1684	20.0314	19.5231	18.9107	18.4294	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4654	18.6823	19.0391	19.5120	19.9108	20.1267	20.1738	20.1684	20.0314	19.5231	18.9107	18.4294	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9915	0.9798	0.9433	0.8483	0.6665	0.4769	0.5374	0.8101	0.9624	0.9920	0.9969	(94)
Useful gains	478.4196	554.1963	619.9426	669.8099	649.1613	503.4418	342.8039	357.1115	489.7324	510.0216	468.2754	451.7331	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1413.6997	1372.6770	1246.3694	1044.9245	807.0575	538.7454	348.3787	366.7809	580.0518	877.0722	1165.0675	1408.9081	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	695.8484	550.0190	466.0615	270.0825	117.4748	0.0000	0.0000	0.0000	0.0000	273.0857	501.6903	712.1381	(98)
Space heating												3586.4004	(98)
Space heating per m2											(98) / (4) =	44.6514	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3860.4956	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	695.8484	550.0190	466.0615	270.0825	117.4748	0.0000	0.0000	0.0000	0.0000	273.0857	501.6903	712.1381	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	749.0295	592.0549	501.6809	290.7239	126.4530	0.0000	0.0000	0.0000	0.0000	293.9566	540.0326	766.5642	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2739	89.2201	89.1055	88.8317	88.2146	86.7000	86.7000	86.7000	86.7000	88.8130	89.1564	89.3001	(217)
Fuel for water heating, kWh/month													
	182.8691	160.4030	166.6094	146.9453	142.9148	126.8734	118.9465	134.5283	135.5512	152.5539	164.2823	177.4564	(219)
Water heating fuel used												1809.9337	(219)
Annual totals kWh/year													
Space heating fuel - main system												3860.4956	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5470.6536	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3860.4956	0.2160	833.8670	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.9337	0.2160	390.9457	(264)
Space and water heating			1224.8127	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1121.1292	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9600	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.4183	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4183	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	480.3303	548.5553	610.7956	675.1283	719.9672	708.0563	674.2973	628.2200	577.7358	515.8772	469.0317	455.1010	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9958	0.9897	0.9680	0.9016	0.7538	0.5863	0.6448	0.8748	0.9797	0.9960	0.9985	(86)
MIT	19.6999	19.8481	20.0967	20.4337	20.7378	20.9280	20.9837	20.9743	20.8378	20.4499	20.0162	19.6754	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9974	0.9944	0.9859	0.9552	0.8611	0.6624	0.4573	0.5153	0.8087	0.9692	0.9943	0.9980	(89)
MIT 2	18.1959	18.4138	18.7770	19.2676	19.6796	19.9041	19.9475	19.9445	19.8147	19.2984	18.6681	18.1667	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9921	0.9818	0.9493	0.8612	0.6822	0.4899	0.5478	0.8178	0.9643	0.9922	0.9970	(94)
Useful gains	478.4399	544.2395	599.7028	640.8760	620.0445	483.0671	330.3568	344.1585	472.4752	497.4728	465.3646	453.7157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1367.5006	1325.8481	1201.9011	1004.2723	775.0289	517.3141	335.5929	353.0854	557.7293	844.7947	1124.2214	1360.8599	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating												3419.3913	(98)
Space heating per m2											(98) / (4) =	42.5721	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3661.0185	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	708.2026	562.3565	479.6954	280.1342	123.4565	0.0000	0.0000	0.0000	0.0000	276.6676	507.8982	722.6074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8122	87.6137	87.1957	86.2211	84.2601	80.3000	80.3000	80.3000	80.3000	86.0739	87.3350	87.8960	(217)
Fuel for water heating, kWh/month													
	230.4920	202.8741	212.0892	190.2387	188.4713	174.1812	166.8789	186.0308	188.0853	199.8058	210.2089	224.8356	(219)
Water heating fuel used												2374.1918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3661.0185	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6465.8770	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3661.0185	0.2160	790.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2374.1918	0.2160	512.8254	(264)
Space and water heating			1303.6054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1527.1215	(272)
Emissions per m2 for space and water heating			16.2301	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2301 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			19.0100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	99.7997	99.5973	99.3988	98.4666	98.2922	97.4802	97.4802	97.3299	97.7930	98.2922	98.6450	99.0139	(39)
Average = Sum(39)m / 12 =												98.4657	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2425	1.2400	1.2375	1.2259	1.2238	1.2136	1.2136	1.2118	1.2175	1.2238	1.2281	1.2327	(40)
HLP (average)												1.2259	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	448.9589	528.3179	603.7192	683.2741	739.8322	731.9945	697.0900	640.6719	579.8706	503.0363	442.6007	422.5087	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8897	56.0033	56.1151	56.6464	56.7469	57.2196	57.2196	57.3080	57.0366	56.7469	56.5440	56.3333	
alpha	4.7260	4.7336	4.7410	4.7764	4.7831	4.8146	4.8146	4.8205	4.8024	4.7831	4.7696	4.7556	
util living area													
	0.9985	0.9965	0.9905	0.9688	0.9018	0.7559	0.5910	0.6561	0.8839	0.9826	0.9969	0.9989	(86)
MIT	19.5990	19.7609	20.0295	20.3893	20.7151	20.9185	20.9804	20.9684	20.8126	20.3909	19.9279	19.5700	(87)
Th 2	19.8861	19.8881	19.8901	19.8993	19.9010	19.9091	19.9091	19.9106	19.9060	19.9010	19.8975	19.8939	(88)
util rest of house													
	0.9980	0.9953	0.9870	0.9560	0.8605	0.6620	0.4566	0.5210	0.8188	0.9733	0.9956	0.9985	(89)
MIT 2	18.6127	18.7757	19.0440	19.4036	19.7055	19.8710	19.9041	19.9014	19.7986	19.4112	18.9502	18.5899	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8604	19.0231	19.2915	19.6511	19.9591	20.1340	20.1744	20.1694	20.0532	19.6572	19.1957	18.8360	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8604	19.0231	19.2915	19.6511	19.9591	20.1340	20.1744	20.1694	20.0532	19.6572	19.1957	18.8360	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9939	0.9844	0.9524	0.8631	0.6833	0.4908	0.5553	0.8293	0.9706	0.9944	0.9980	(94)
Useful gains	447.7524	525.1054	594.3078	650.7541	638.5568	500.1530	342.1401	355.7699	480.8886	488.2268	440.1353	421.6557	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1453.1224	1406.6251	1271.4603	1058.6259	811.8010	539.4599	348.4351	366.8725	582.1855	890.2498	1193.1808	1449.1693	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	747.9953	592.3812	503.8014	293.6676	128.8937	0.0000	0.0000	0.0000	0.0000	299.1051	542.1928	764.4701	(98)
Space heating												3872.5072	(98)
Space heating per m2											(98) / (4) =	48.2135	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.3140	721.3536	739.7069	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8417	0.9071	0.8766	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	771.2823	654.3390	648.4534	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.8524	905.1638	840.8282	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	127.1305	186.6136	143.1269	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											456.8710	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	31.7826	46.6534	35.7817	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											114.2177	(107)
Space cooling per m2											1.4220	(108)
Energy for space heating											48.2135	(99)
Energy for space cooling											1.4220	(108)
Total											49.6355	(109)
Dwelling Fabric Energy Efficiency (DFEE)											49.6	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	435.7810	505.0528	569.5362	636.6897	683.5830	674.3054	642.2442	593.3557	541.4628	476.7068	426.6718	411.3224	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9987	0.9971	0.9923	0.9745	0.9162	0.7774	0.6112	0.6746	0.8963	0.9852	0.9974	0.9991	(86)
MIT	19.6486	19.7985	20.0510	20.3951	20.7112	20.9170	20.9804	20.9687	20.8143	20.4083	19.9678	19.6248	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9983	0.9961	0.9894	0.9638	0.8797	0.6878	0.4789	0.5428	0.8365	0.9773	0.9963	0.9987	(89)
MIT 2	18.6936	18.8450	19.0981	19.4451	19.7417	19.9137	19.9485	19.9461	19.8409	19.4634	19.0234	18.6773	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9873	0.9606	0.8814	0.7079	0.5126	0.5763	0.8458	0.9748	0.9953	0.9983	(94)
Useful gains	434.7788	502.5118	562.2844	611.5752	602.4901	477.3505	329.2056	341.9343	457.9757	464.6995	424.6466	410.6112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.9778	1355.5168	1223.7242	1015.8833	778.7721	517.7254	335.5873	353.0628	559.0133	855.4308	1148.1975	1395.9287	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	719.5960	573.2194	492.1111	291.1018	131.1538	0.0000	0.0000	0.0000	0.0000	290.7040	520.9566	733.0762	(98)
Space heating												3751.9191	(98)
Space heating per m2											(98) / (4) =	46.7121	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8361	0.9046	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	731.0951	622.6930	617.2615	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.4235	841.0582	785.5237	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.5165	162.4637	125.1871	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.1673	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.8791	40.6159	31.2968	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												98.7918 (107)
Space cooling per m2												1.2300 (108)
Energy for space heating												46.7121 (99)
Energy for space cooling												1.2300 (108)
Total												47.9421 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3600	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	98.1217	97.6346	97.7930	97.4802	97.4802	97.3299	97.1835	97.0412	96.9028	97.3299	97.0412	97.3299	(39)
Average = Sum(39)m / 12 =												97.3890	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2216	1.2156	1.2175	1.2136	1.2136	1.2118	1.2100	1.2082	1.2065	1.2118	1.2082	1.2118	(40)
HLP (average)												1.2125	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8455	57.1291	57.0366	57.2196	57.2196	57.3080	57.3943	57.4785	57.5605	57.3080	57.4785	57.3080	
alpha	4.7897	4.8086	4.8024	4.8146	4.8146	4.8205	4.8263	4.8319	4.8374	4.8205	4.8319	4.8205	
util living area													
	0.9895	0.9835	0.9634	0.9041	0.7765	0.5625	0.4142	0.4369	0.7069	0.9177	0.9781	0.9914	(86)
MIT	19.9600	20.0788	20.3350	20.6478	20.8779	20.9795	20.9962	20.9952	20.9411	20.6795	20.2869	19.9433	(87)
Th 2	19.9027	19.9076	19.9060	19.9091	19.9091	19.9106	19.9120	19.9135	19.9148	19.9106	19.9135	19.9106	(88)
util rest of house													
	0.9861	0.9781	0.9512	0.8725	0.7094	0.4634	0.3007	0.3178	0.6100	0.8825	0.9696	0.9885	(89)
MIT 2	18.5575	18.7321	19.0961	19.5250	19.8044	19.8999	19.9111	19.9122	19.8767	19.5780	19.0380	18.5392	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7204	0.4879	0.3293	0.3479	0.6320	0.8803	0.9638	0.9847	(94)
Useful gains	673.3935	727.5207	777.5658	784.6743	670.7385	465.7800	298.7116	298.0804	500.2830	630.3747	645.2587	639.0096	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1374.6583	1344.4569	1213.3360	1004.7228	738.3160	474.0931	299.6707	299.2921	527.5404	822.8855	1111.2773	1352.0880	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.7410	414.5811	324.2130	158.4349	50.2777	0.0000	0.0000	0.0000	0.0000	143.2280	335.5334	530.5304	(98)
Space heating												2478.5394	(98)
RHI space heating demand												2479	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	99.7997	99.5973	99.3988	98.4666	98.2922	97.4802	97.4802	97.3299	97.7930	98.2922	98.6450	99.0139	(39)
Average = Sum(39)m / 12 =												98.4657	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2425	1.2400	1.2375	1.2259	1.2238	1.2136	1.2136	1.2118	1.2175	1.2238	1.2281	1.2327	(40)
HLP (average)												1.2259	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902 (83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8897	56.0033	56.1151	56.6464	56.7469	57.2196	57.2196	57.3080	57.0366	56.7469	56.5440	56.3333	
alpha	4.7260	4.7336	4.7410	4.7764	4.7831	4.8146	4.8146	4.8205	4.8024	4.7831	4.7696	4.7556	
util living area													
	0.9924	0.9862	0.9714	0.9285	0.8279	0.6557	0.4937	0.5436	0.7821	0.9460	0.9858	0.9939	(86)
MIT	19.8373	19.9914	20.2388	20.5564	20.8167	20.9559	20.9908	20.9857	20.8968	20.5686	20.1458	19.8045	(87)
Th 2	19.8861	19.8881	19.8901	19.8993	19.9010	19.9091	19.9091	19.9106	19.9060	19.9010	19.8975	19.8939	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9041	0.7723	0.5610	0.3761	0.4226	0.6977	0.9222	0.9804	0.9919	(89)
MIT 2	18.3677	18.5919	18.9482	19.3968	19.7294	19.8813	19.9059	19.9051	19.8290	19.4242	18.8242	18.3255	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7368	18.9434	19.2723	19.6880	20.0024	20.1512	20.1784	20.1764	20.0972	19.7116	19.1561	18.6969	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7368	18.9434	19.2723	19.6880	20.0024	20.1512	20.1784	20.1764	20.0972	19.7116	19.1561	18.6969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8985	0.7780	0.5832	0.4058	0.4531	0.7141	0.9171	0.9754	0.9888	(94)
Useful gains	651.5221	719.7017	766.6468	780.6836	709.7521	520.9405	346.0192	362.8510	534.5418	628.5271	623.5442	622.3632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1440.7845	1398.6797	1269.5473	1062.2564	816.0648	541.1295	348.8207	367.5606	586.4805	895.5983	1189.2724	1435.3961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	587.2113	456.2732	374.1580	202.7324	79.0966	0.0000	0.0000	0.0000	0.0000	198.7010	407.3243	604.8965	(98)
Space heating												2910.3932	(98)
Space heating per m2										(98) / (4) =		36.2350	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3132.8237	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	587.2113	456.2732	374.1580	202.7324	79.0966	0.0000	0.0000	0.0000	0.0000	198.7010	407.3243	604.8965	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	632.0896	491.1445	402.7535	218.2265	85.1417	0.0000	0.0000	0.0000	0.0000	213.8869	438.4545	651.1264	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1839	89.1147	88.9672	88.6189	87.9063	86.7000	86.7000	86.7000	86.7000	88.5746	89.0309	89.2164	(217)
Fuel for water heating, kWh/month													
	183.0535	160.5927	166.8683	147.2982	143.4160	126.8734	118.9465	134.5283	135.5512	152.9645	164.5138	177.6227	(219)
Water heating fuel used												1812.2293	(219)
Annual totals kWh/year													
Space heating fuel - main system												3132.8237	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4745.2773	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3132.8237	3.4800	109.0223	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.2293	3.4800	63.0656	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			265.7374	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8906	(257)
SAP value		87.5762	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3132.8237	0.2160	676.6899	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.2293	0.2160	391.4415	(264)
Space and water heating			1068.1314	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			964.4479	(272)
CO2 emissions per m2			12.0100	(273)
EI value			89.6875	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	98.1217	97.6346	97.7930	97.4802	97.4802	97.3299	97.1835	97.0412	96.9028	97.3299	97.0412	97.3299	(39)
Average = Sum(39)m / 12 =												97.3890	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2216	1.2156	1.2175	1.2136	1.2136	1.2118	1.2100	1.2082	1.2065	1.2118	1.2082	1.2118	(40)
HLP (average)												1.2125	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103 (83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8455	57.1291	57.0366	57.2196	57.2196	57.3080	57.3943	57.4785	57.5605	57.3080	57.4785	57.3080	
alpha	4.7897	4.8086	4.8024	4.8146	4.8146	4.8205	4.8263	4.8319	4.8374	4.8205	4.8319	4.8205	
util living area													
	0.9895	0.9835	0.9634	0.9041	0.7765	0.5625	0.4142	0.4369	0.7069	0.9177	0.9781	0.9914	(86)
MIT	19.9600	20.0788	20.3350	20.6478	20.8779	20.9795	20.9962	20.9952	20.9411	20.6795	20.2869	19.9433	(87)
Th 2	19.9027	19.9076	19.9060	19.9091	19.9091	19.9106	19.9120	19.9135	19.9148	19.9106	19.9135	19.9106	(88)
util rest of house													
	0.9861	0.9781	0.9512	0.8725	0.7094	0.4634	0.3007	0.3178	0.6100	0.8825	0.9696	0.9885	(89)
MIT 2	18.5575	18.7321	19.0961	19.5250	19.8044	19.8999	19.9111	19.9122	19.8767	19.5780	19.0380	18.5392	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7204	0.4879	0.3293	0.3479	0.6320	0.8803	0.9638	0.9847	(94)
Useful gains	673.3935	727.5207	777.5658	784.6743	670.7385	465.7800	298.7116	298.0804	500.2830	630.3747	645.2587	639.0096	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1374.6583	1344.4569	1213.3360	1004.7228	738.3160	474.0931	299.6707	299.2921	527.5404	822.8855	1111.2773	1352.0880	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.7410	414.5811	324.2130	158.4349	50.2777	0.0000	0.0000	0.0000	0.0000	143.2280	335.5334	530.5304	(98)
Space heating												2478.5394	(98)
Space heating per m2											(98) / (4) =	30.8583	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2667.9649	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	521.7410	414.5811	324.2130	158.4349	50.2777	0.0000	0.0000	0.0000	0.0000	143.2280	335.5334	530.5304	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	561.6157	446.2660	348.9914	170.5435	54.1202	0.0000	0.0000	0.0000	0.0000	154.1744	361.1770	571.0768	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1161	89.0565	88.8698	88.4257	87.5889	86.7000	86.7000	86.7000	86.7000	88.3155	88.9029	89.1433	(217)
Fuel for water heating, kWh/month													
	183.1929	160.6976	167.0513	147.6200	143.9358	126.8734	118.9465	134.5283	135.5512	153.4133	164.7507	177.7685	(219)
Water heating fuel used												1814.3295	(219)
Annual totals kWh/year													
Space heating fuel - main system												2667.9649	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4207.4010	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2667.9649	7.3800	196.8958	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.3295	7.3800	133.8975	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			359.0089	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2667.9649	0.2160	576.2804	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3295	0.2160	391.8952	(264)
Space and water heating			968.1756	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			825.5059	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2667.9649	1.2200	3254.9172	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3295	1.2200	2213.4820	(264)
Space and water heating			5468.3992	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4624.4764	(272)
Primary energy kWh/m2/year			57.5757	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£438	£366	£72
Space heating	£325	£325	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£359	£302	£58
Total cost of uses	£359	£301	£58
Delivered energy	52 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	99.7997	99.5973	99.3988	98.4666	98.2922	97.4802	97.4802	97.3299	97.7930	98.2922	98.6450	99.0139	(39)
Average = Sum(39)m / 12 =												98.4657	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2425	1.2400	1.2375	1.2259	1.2238	1.2136	1.2136	1.2118	1.2175	1.2238	1.2281	1.2327	(40)
HLP (average)												1.2259	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8897	56.0033	56.1151	56.6464	56.7469	57.2196	57.2196	57.3080	57.0366	56.7469	56.5440	56.3333	
alpha	4.7260	4.7336	4.7410	4.7764	4.7831	4.8146	4.8146	4.8205	4.8024	4.7831	4.7696	4.7556	
util living area													
	0.9924	0.9862	0.9714	0.9285	0.8279	0.6557	0.4937	0.5436	0.7821	0.9460	0.9858	0.9939	(86)
MIT	19.8373	19.9914	20.2388	20.5564	20.8167	20.9559	20.9908	20.9857	20.8968	20.5686	20.1458	19.8045	(87)
Th 2	19.8861	19.8881	19.8901	19.8993	19.9010	19.9091	19.9091	19.9106	19.9060	19.9010	19.8975	19.8939	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9041	0.7723	0.5610	0.3761	0.4226	0.6977	0.9222	0.9804	0.9919	(89)
MIT 2	18.3677	18.5919	18.9482	19.3968	19.7294	19.8813	19.9059	19.9051	19.8290	19.4242	18.8242	18.3255	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7368	18.9434	19.2723	19.6880	20.0024	20.1512	20.1784	20.1764	20.0972	19.7116	19.1561	18.6969	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7368	18.9434	19.2723	19.6880	20.0024	20.1512	20.1784	20.1764	20.0972	19.7116	19.1561	18.6969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8985	0.7780	0.5832	0.4058	0.4531	0.7141	0.9171	0.9754	0.9888	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	651.5221	719.7017	766.6468	780.6836	709.7521	520.9405	346.0192	362.8510	534.5418	628.5271	623.5442	622.3632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1440.7845	1398.6797	1269.5473	1062.2564	816.0648	541.1295	348.8207	367.5606	586.4805	895.5983	1189.2724	1435.3961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	587.2113	456.2732	374.1580	202.7324	79.0966	0.0000	0.0000	0.0000	0.0000	198.7010	407.3243	604.8965	(98)
Space heating												2910.3932	(98)
Space heating per m2											(98) / (4) =	36.2350	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3132.8237	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	587.2113	456.2732	374.1580	202.7324	79.0966	0.0000	0.0000	0.0000	0.0000	198.7010	407.3243	604.8965	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	632.0896	491.1445	402.7535	218.2265	85.1417	0.0000	0.0000	0.0000	0.0000	213.8869	438.4545	651.1264	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2702	89.2966	89.3260	89.3876	89.5013	86.7000	86.7000	86.7000	86.7000	88.9308	89.1636	89.2879	(217)
Fuel for water heating, kWh/month	155.4485	114.5094	88.2958	41.6990	12.1300	0.0000	0.0000	21.8859	47.3296	93.6181	131.6964	154.5324	(219)
Water heating fuel used												861.1451	(219)
Annual totals kWh/year													
Space heating fuel - main system												3132.8237	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3844.1931	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3132.8237	3.4800	109.0223	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.1451	3.4800	29.9678	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			239.2347	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8018	(257)
SAP value		88.8152	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3132.8237	0.2160	676.6899	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.1451	0.2160	186.0073	(264)
Space and water heating			862.6972	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			784.9637 (272)
CO2 emissions per m2			9.7700 (273)
EI value			91.6067
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3600	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	98.1217	97.6346	97.7930	97.4802	97.4802	97.3299	97.1835	97.0412	96.9028	97.3299	97.0412	97.3299	(39)
Average = Sum(39)m / 12 =												97.3890	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2216	1.2156	1.2175	1.2136	1.2136	1.2118	1.2100	1.2082	1.2065	1.2118	1.2082	1.2118	(40)
HLP (average)												1.2125	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
								Total per year (kWh/year) = Sum(64)m =				743.5253	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8455	57.1291	57.0366	57.2196	57.2196	57.3080	57.3943	57.4785	57.5605	57.3080	57.4785	57.3080	
alpha	4.7897	4.8086	4.8024	4.8146	4.8146	4.8205	4.8263	4.8319	4.8374	4.8205	4.8319	4.8205	
util living area													
	0.9895	0.9835	0.9634	0.9041	0.7765	0.5625	0.4142	0.4369	0.7069	0.9177	0.9781	0.9914	(86)
MIT	19.9600	20.0788	20.3350	20.6478	20.8779	20.9795	20.9962	20.9952	20.9411	20.6795	20.2869	19.9433	(87)
Th 2	19.9027	19.9076	19.9060	19.9091	19.9091	19.9106	19.9120	19.9135	19.9148	19.9106	19.9135	19.9106	(88)
util rest of house													
	0.9861	0.9781	0.9512	0.8725	0.7094	0.4634	0.3007	0.3178	0.6100	0.8825	0.9696	0.9885	(89)
MIT 2	18.5575	18.7321	19.0961	19.5250	19.8044	19.8999	19.9111	19.9122	19.8767	19.5780	19.0380	18.5392	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9097	19.0703	19.4072	19.8069	20.0740	20.1710	20.1836	20.1842	20.1440	19.8546	19.3516	18.8918	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7204	0.4879	0.3293	0.3479	0.6320	0.8803	0.9638	0.9847	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	673.3935	727.5207	777.5658	784.6743	670.7385	465.7800	298.7116	298.0804	500.2830	630.3747	645.2587	639.0096 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1374.6583	1344.4569	1213.3360	1004.7228	738.3160	474.0931	299.6707	299.2921	527.5404	822.8855	1111.2773	1352.0880 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	521.7410	414.5811	324.2130	158.4349	50.2777	0.0000	0.0000	0.0000	0.0000	143.2280	335.5334	530.5304 (98)
Space heating												2478.5394 (98)
Space heating per m2											(98) / (4) =	30.8583 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2667.9649 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	521.7410	414.5811	324.2130	158.4349	50.2777	0.0000	0.0000	0.0000	0.0000	143.2280	335.5334	530.5304	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	561.6157	446.2660	348.9914	170.5435	54.1202	0.0000	0.0000	0.0000	0.0000	154.1744	361.1770	571.0768	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2244	89.2473	89.2574	89.2866	89.1320	86.7000	86.7000	86.7000	86.7000	88.7322	89.0737	89.2321	(217)
Fuel for water heating, kWh/month													
	150.9193	114.7911	88.0229	40.5824	17.1784	0.0000	0.0000	14.9624	41.9393	89.4550	126.4626	151.2384	(219)
Water heating fuel used												835.5519	(219)

Annual totals kWh/year	
Space heating fuel - main system	2667.9649 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	355.6668 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =	-705.5602 -705.5602 (233)
Total delivered energy for all uses	3278.6234 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2667.9649	7.3800	196.8958	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.5519	7.3800	61.6637	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			301.1051	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2667.9649	0.2160	576.2804	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5519	0.2160	180.4792	(264)
Space and water heating			756.7596	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			640.0399	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2667.9649	1.2200	3254.9172	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5519	1.2200	1019.3734	(264)
Space and water heating			4274.2906	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3583.8677	(272)
Primary energy kWh/m2/year			44.6199	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.9700	87.1704	0.7200	0.7000	0.7650	241.0805
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	3.6100	118.5567	0.7200	0.7000	0.7650	148.5141
total:						496.5388

	Jun	Jul	Aug	
Solar gains	535	497	436	(P3)
Internal gains	429	411	419	
Total summer gains	964	908	855	(P5)
Summer gain/loss ratio	1.58	1.49	1.41	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.96	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 367 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.96	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.58		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.64	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.96	$kgCO_2/m^2$	Pass
	-5.05 (-26.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.64	$kWh/m^2/yr$	
	-5.5 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.97 m², No overhang 2.46 m², No overhang 3.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 368 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	5 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.99	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.42		
CO_2 Emissions (t/year)	0.80	**DFEE**	49.79	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.99 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.49 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum: 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.97 m², No overhang
Windows facing South: 3.61 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value: 0.00 W/m²K
Thermal bridging y-value: 0.030 W/m²K
Photovoltaic array: 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	480.3544	558.9358	632.7224	710.0836	765.2170	755.3745	718.7678	664.5325	604.5084	529.9443	472.0724	453.1310	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9980	0.9956	0.9886	0.9642	0.8920	0.7412	0.5763	0.6380	0.8702	0.9788	0.9959	0.9985	(86)
MIT	19.6305	19.7914	20.0576	20.4130	20.7310	20.9250	20.9823	20.9718	20.8270	20.4170	19.9584	19.6014	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9973	0.9940	0.9844	0.9499	0.8483	0.6464	0.4439	0.5043	0.8012	0.9677	0.9942	0.9980	(89)
MIT 2	18.0652	18.3014	18.6896	19.2042	19.6318	19.8570	19.9012	19.8975	19.7619	19.2185	18.5529	18.0283	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4583	18.6756	19.0331	19.5078	19.9078	20.1252	20.1727	20.1673	20.0294	19.5195	18.9059	18.4234	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4583	18.6756	19.0331	19.5078	19.9078	20.1252	20.1727	20.1673	20.0294	19.5195	18.9059	18.4234	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9915	0.9798	0.9434	0.8487	0.6670	0.4774	0.5379	0.8105	0.9625	0.9920	0.9969	(94)
Useful gains	478.4165	554.1954	619.9579	669.8940	649.4459	503.8389	343.1564	357.4372	489.9657	510.0524	468.2745	451.7307	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1416.7305	1375.5057	1248.8277	1046.5955	808.3024	539.4083	348.7873	367.1908	580.8122	878.3917	1167.0166	1411.4985	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	698.1056	551.9206	467.8791	271.2251	118.1892	0.0000	0.0000	0.0000	0.0000	274.0445	503.0943	714.0673	(98)
Space heating												3598.5256	(98)
Space heating per m2											(98) / (4) =	44.8024	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3873.5475	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	698.1056	551.9206	467.8791	271.2251	118.1892	0.0000	0.0000	0.0000	0.0000	274.0445	503.0943	714.0673	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	751.4592	594.1018	503.6374	291.9538	127.2220	0.0000	0.0000	0.0000	0.0000	294.9887	541.5439	768.6408	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2755	89.2219	89.1078	88.8347	88.2194	86.7000	86.7000	86.7000	86.7000	88.8155	89.1580	89.3014	(217)
Fuel for water heating, kWh/month													
	182.8658	160.3997	166.6051	146.9404	142.9070	126.8734	118.9465	134.5283	135.5512	152.5496	164.2794	177.4538	(219)
Water heating fuel used												1809.9000	(219)
Annual totals kWh/year													
Space heating fuel - main system												3873.5475	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5483.6719	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3873.5475	0.2160	836.6863	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.9000	0.2160	390.9384	(264)
Space and water heating			1227.6247	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1123.9411	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9900	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.4483	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4483	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	480.3303	548.5553	610.7956	675.1283	719.9672	708.0563	674.2973	628.2200	577.7358	515.8772	469.0317	455.1010	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9958	0.9897	0.9680	0.9016	0.7538	0.5863	0.6448	0.8748	0.9797	0.9960	0.9985	(86)
MIT	19.6999	19.8481	20.0967	20.4337	20.7378	20.9280	20.9837	20.9743	20.8378	20.4499	20.0162	19.6754	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9974	0.9944	0.9859	0.9552	0.8611	0.6624	0.4573	0.5153	0.8087	0.9692	0.9943	0.9980	(89)
MIT 2	18.1959	18.4138	18.7770	19.2676	19.6796	19.9041	19.9475	19.9445	19.8147	19.2984	18.6681	18.1667	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9921	0.9818	0.9493	0.8612	0.6822	0.4899	0.5478	0.8178	0.9643	0.9922	0.9970	(94)
Useful gains	478.4399	544.2395	599.7028	640.8760	620.0445	483.0671	330.3568	344.1585	472.4752	497.4728	465.3646	453.7157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1367.5006	1325.8481	1201.9011	1004.2723	775.0289	517.3141	335.5929	353.0854	557.7293	844.7947	1124.2214	1360.8599	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating												3419.3913	(98)
Space heating per m2											(98) / (4) =	42.5721	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3661.0185	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	708.2026	562.3565	479.6954	280.1342	123.4565	0.0000	0.0000	0.0000	0.0000	276.6676	507.8982	722.6074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8122	87.6137	87.1957	86.2211	84.2601	80.3000	80.3000	80.3000	80.3000	86.0739	87.3350	87.8960	(217)
Fuel for water heating, kWh/month													
	230.4920	202.8741	212.0892	190.2387	188.4713	174.1812	166.8789	186.0308	188.0853	199.8058	210.2089	224.8356	(219)
Water heating fuel used												2374.1918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3661.0185	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6465.8770	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3661.0185	0.2160	790.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2374.1918	0.2160	512.8254	(264)
Space and water heating			1303.6054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1527.1215	(272)
Emissions per m2 for space and water heating			16.2301	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2301 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			19.0100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	448.9589	528.3179	603.7192	683.2741	739.8322	731.9945	697.0900	640.6719	579.8706	503.0363	442.6007	422.5087	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9985	0.9965	0.9906	0.9689	0.9021	0.7565	0.5917	0.6567	0.8842	0.9827	0.9969	0.9989	(86)
MIT	19.5948	19.7570	20.0259	20.3869	20.7135	20.9179	20.9802	20.9681	20.8116	20.3889	19.9251	19.5664	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9980	0.9953	0.9870	0.9562	0.8609	0.6625	0.4570	0.5214	0.8192	0.9734	0.9956	0.9985	(89)
MIT 2	18.6064	18.7698	19.0386	19.3997	19.7025	19.8693	19.9026	19.9000	19.7964	19.4077	18.9458	18.5845	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8546	19.0177	19.2866	19.6476	19.9564	20.1326	20.1732	20.1682	20.0513	19.6541	19.1917	18.8311	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8546	19.0177	19.2866	19.6476	19.9564	20.1326	20.1732	20.1682	20.0513	19.6541	19.1917	18.8311	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9939	0.9844	0.9525	0.8635	0.6838	0.4913	0.5558	0.8297	0.9706	0.9944	0.9980	(94)
Useful gains	447.7501	525.1042	594.3187	650.8246	638.8171	500.5350	342.4875	356.0870	481.0991	488.2495	440.1341	421.6539	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1456.3885	1409.6628	1274.0855	1060.3902	813.0895	540.1304	348.8445	367.2837	582.9657	891.6481	1195.2717	1451.9619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	750.4270	594.4234	505.7465	294.8872	129.6587	0.0000	0.0000	0.0000	0.0000	300.1285	543.6990	766.5491	(98)
Space heating												3885.5195	(98)
Space heating per m2											(98) / (4) =	48.3755	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.6917	722.4381	740.7629	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8410	0.9065	0.8760	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	771.7381	654.8995	648.8977	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.8524	905.1638	840.8282	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	126.8022	186.1966	142.7964	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											455.7952	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	31.7006	46.5492	35.6991	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											113.9488	(107)
Space cooling per m2											1.4187	(108)
Energy for space heating											48.3755	(99)
Energy for space cooling											1.4187	(108)
Total											49.7942	(109)
Dwelling Fabric Energy Efficiency (DFEE)											49.8	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	435.7810	505.0528	569.5362	636.6897	683.5830	674.3054	642.2442	593.3557	541.4628	476.7068	426.6718	411.3224	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9987	0.9971	0.9923	0.9745	0.9162	0.7774	0.6112	0.6746	0.8963	0.9852	0.9974	0.9991	(86)
MIT	19.6486	19.7985	20.0510	20.3951	20.7112	20.9170	20.9804	20.9687	20.8143	20.4083	19.9678	19.6248	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9983	0.9961	0.9894	0.9638	0.8797	0.6878	0.4789	0.5428	0.8365	0.9773	0.9963	0.9987	(89)
MIT 2	18.6936	18.8450	19.0981	19.4451	19.7417	19.9137	19.9485	19.9461	19.8409	19.4634	19.0234	18.6773	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9873	0.9606	0.8814	0.7079	0.5126	0.5763	0.8458	0.9748	0.9953	0.9983	(94)
Useful gains	434.7788	502.5118	562.2844	611.5752	602.4901	477.3505	329.2056	341.9343	457.9757	464.6995	424.6466	410.6112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.9778	1355.5168	1223.7242	1015.8833	778.7721	517.7254	335.5873	353.0628	559.0133	855.4308	1148.1975	1395.9287	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	719.5960	573.2194	492.1111	291.1018	131.1538	0.0000	0.0000	0.0000	0.0000	290.7040	520.9566	733.0762	(98)
Space heating												3751.9191	(98)
Space heating per m2											(98) / (4) =	46.7121	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8361	0.9046	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	731.0951	622.6930	617.2615	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.4235	841.0582	785.5237	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.5165	162.4637	125.1871	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.1673	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.8791	40.6159	31.2968	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												98.7918 (107)
Space cooling per m2												1.2300 (108)
Energy for space heating												46.7121 (99)
Energy for space cooling												1.2300 (108)
Total												47.9421 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103 (83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9895	0.9835	0.9635	0.9044	0.7770	0.5632	0.4148	0.4375	0.7074	0.9179	0.9782	0.9914	(86)
MIT	19.9571	20.0764	20.3328	20.6462	20.8771	20.9793	20.9961	20.9952	20.9407	20.6782	20.2852	19.9410	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9861	0.9782	0.9513	0.8728	0.7099	0.4639	0.3009	0.3181	0.6104	0.8827	0.9697	0.9885	(89)
MIT 2	18.5521	18.7275	19.0916	19.5218	19.8023	19.8984	19.9097	19.9110	19.8753	19.5753	19.0347	18.5350	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9727	0.9442	0.8694	0.7209	0.4884	0.3297	0.3482	0.6324	0.8805	0.9638	0.9847	(94)
Useful gains	673.4045	727.5445	777.6487	784.9099	671.2046	466.2625	299.0093	298.3593	500.6321	630.5311	645.2860	639.0150	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1376.6934	1346.1825	1214.9692	1005.9602	739.2470	474.6569	299.9792	299.5835	528.0675	823.8290	1112.4231	1353.6555	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	523.2469	415.7247	325.3665	159.1562	50.6236	0.0000	0.0000	0.0000	0.0000	143.8136	336.3387	531.6925	(98)
Space heating												2485.9628	(98)
RHI space heating demand												2486	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1445	(8)
Pressure test				Yes	
Measured/design AP50				4.4900	
Infiltration rate				0.3690	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902 (83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9924	0.9862	0.9715	0.9288	0.8285	0.6564	0.4943	0.5443	0.7827	0.9461	0.9858	0.9939	(86)
MIT	19.8330	19.9873	20.2352	20.5541	20.8154	20.9555	20.9907	20.9855	20.8961	20.5667	20.1429	19.8007	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9899	0.9818	0.9619	0.9044	0.7729	0.5615	0.3765	0.4230	0.6982	0.9224	0.9804	0.9919	(89)
MIT 2	18.3595	18.5842	18.9413	19.3922	19.7262	19.8796	19.9044	19.9037	19.8268	19.4202	18.8186	18.3185	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7295	18.9366	19.2663	19.6840	19.9997	20.1498	20.1772	20.1753	20.0953	19.7081	19.1512	18.6908	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7295	18.9366	19.2663	19.6840	19.9997	20.1498	20.1772	20.1753	20.0953	19.7081	19.1512	18.6908	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9767	0.9550	0.8987	0.7786	0.5837	0.4062	0.4536	0.7146	0.9172	0.9754	0.9888	(94)
Useful gains	651.5282	719.7277	766.7310	780.9056	710.2414	521.4419	346.4005	363.2204	534.9456	628.6543	623.5647	622.3655	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1443.8727	1401.5643	1272.0614	1063.9781	817.3564	541.8097	349.2337	367.9773	587.2754	896.9619	1191.2643	1438.0341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	589.5043	458.1942	375.9658	203.8122	79.6936	0.0000	0.0000	0.0000	0.0000	199.6209	408.7437	606.8575	(98)
Space heating												2922.3921	(98)
Space heating per m2											(98) / (4) =	36.3844	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3145.7397	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	589.5043	458.1942	375.9658	203.8122	79.6936	0.0000	0.0000	0.0000	0.0000	199.6209	408.7437	606.8575	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	634.5579	493.2123	404.6995	219.3889	85.7843	0.0000	0.0000	0.0000	0.0000	214.8771	439.9825	653.2373	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1861	89.1172	88.9704	88.6230	87.9120	86.7000	86.7000	86.7000	86.7000	88.5782	89.0331	89.2182	(217)
Fuel for water heating, kWh/month													
	183.0491	160.5882	166.8624	147.2914	143.4068	126.8734	118.9465	134.5283	135.5512	152.9583	164.5098	177.6193	(219)
Water heating fuel used												1812.1847	(219)
Annual totals kWh/year													
Space heating fuel - main system												3145.7397	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4758.1487	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3145.7397	3.4800	109.4717	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.1847	3.4800	63.0640	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			266.1854	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8921	(257)
SAP value		87.5552	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3145.7397	0.2160	679.4798	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.1847	0.2160	391.4319	(264)
Space and water heating			1070.9117	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			967.2281	(272)
CO2 emissions per m2			12.0400	(273)
EI value			89.6578	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103 (83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9895	0.9835	0.9635	0.9044	0.7770	0.5632	0.4148	0.4375	0.7074	0.9179	0.9782	0.9914	(86)
MIT	19.9571	20.0764	20.3328	20.6462	20.8771	20.9793	20.9961	20.9952	20.9407	20.6782	20.2852	19.9410	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9861	0.9782	0.9513	0.8728	0.7099	0.4639	0.3009	0.3181	0.6104	0.8827	0.9697	0.9885	(89)
MIT 2	18.5521	18.7275	19.0916	19.5218	19.8023	19.8984	19.9097	19.9110	19.8753	19.5753	19.0347	18.5350	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9727	0.9442	0.8694	0.7209	0.4884	0.3297	0.3482	0.6324	0.8805	0.9638	0.9847	(94)
Useful gains	673.4045	727.5445	777.6487	784.9099	671.2046	466.2625	299.0093	298.3593	500.6321	630.5311	645.2860	639.0150	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1376.6934	1346.1825	1214.9692	1005.9602	739.2470	474.6569	299.9792	299.5835	528.0675	823.8290	1112.4231	1353.6555	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	523.2469	415.7247	325.3665	159.1562	50.6236	0.0000	0.0000	0.0000	0.0000	143.8136	336.3387	531.6925	(98)
Space heating												2485.9628	(98)
Space heating per m2											(98) / (4) =	30.9507	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2675.9556	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	523.2469	415.7247	325.3665	159.1562	50.6236	0.0000	0.0000	0.0000	0.0000	143.8136	336.3387	531.6925	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	563.2368	447.4970	350.2330	171.3200	54.4925	0.0000	0.0000	0.0000	0.0000	154.8048	362.0438	572.3278	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1178	89.0582	88.8723	88.4293	87.5933	86.7000	86.7000	86.7000	86.7000	88.3187	88.9045	89.1445	(217)
Fuel for water heating, kWh/month													
	183.1893	160.6945	167.0466	147.6140	143.9285	126.8734	118.9465	134.5283	135.5512	153.4077	164.7477	177.7660	(219)
Water heating fuel used												1814.2938	(219)
Annual totals kWh/year													
Space heating fuel - main system												2675.9556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4215.3560	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2675.9556	7.3800	197.4855	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.2938	7.3800	133.8949	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			359.5959	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2675.9556	0.2160	578.0064	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.2938	0.2160	391.8875	(264)
Space and water heating			969.8939	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			827.2242	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2675.9556	1.2200	3264.6659	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.2938	1.2200	2213.4384	(264)
Space and water heating			5478.1043	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4634.1814	(272)
Primary energy kWh/m2/year			57.6965	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£438	£366	£72
Space heating	£326	£326	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£359	£302	£58
Total cost of uses	£360	£302	£58
Delivered energy	52 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9924	0.9862	0.9715	0.9288	0.8285	0.6564	0.4943	0.5443	0.7827	0.9461	0.9858	0.9939	(86)
MIT	19.8330	19.9873	20.2352	20.5541	20.8154	20.9555	20.9907	20.9855	20.8961	20.5667	20.1429	19.8007	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9899	0.9818	0.9619	0.9044	0.7729	0.5615	0.3765	0.4230	0.6982	0.9224	0.9804	0.9919	(89)
MIT 2	18.3595	18.5842	18.9413	19.3922	19.7262	19.8796	19.9044	19.9037	19.8268	19.4202	18.8186	18.3185	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7295	18.9366	19.2663	19.6840	19.9997	20.1498	20.1772	20.1753	20.0953	19.7081	19.1512	18.6908	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7295	18.9366	19.2663	19.6840	19.9997	20.1498	20.1772	20.1753	20.0953	19.7081	19.1512	18.6908	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9767	0.9550	0.8987	0.7786	0.5837	0.4062	0.4536	0.7146	0.9172	0.9754	0.9888	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	651.5282	719.7277	766.7310	780.9056	710.2414	521.4419	346.4005	363.2204	534.9456	628.6543	623.5647	622.3655	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1443.8727	1401.5643	1272.0614	1063.9781	817.3564	541.8097	349.2337	367.9773	587.2754	896.9619	1191.2643	1438.0341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	589.5043	458.1942	375.9658	203.8122	79.6936	0.0000	0.0000	0.0000	0.0000	199.6209	408.7437	606.8575	(98)
Space heating												2922.3921	(98)
Space heating per m2											(98) / (4) =	36.3844	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3145.7397	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	589.5043	458.1942	375.9658	203.8122	79.6936	0.0000	0.0000	0.0000	0.0000	199.6209	408.7437	606.8575	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	634.5579	493.2123	404.6995	219.3889	85.7843	0.0000	0.0000	0.0000	0.0000	214.8771	439.9825	653.2373	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2722	89.2987	89.3283	89.3899	89.5039	86.7000	86.7000	86.7000	86.7000	88.9339	89.1655	89.2895	(217)
Fuel for water heating, kWh/month	155.4450	114.5068	88.2935	41.6979	12.1296	0.0000	0.0000	21.8859	47.3296	93.6148	131.6935	154.5297	(219)
Water heating fuel used												861.1264	(219)
Annual totals kWh/year													
Space heating fuel - main system												3145.7397	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3857.0904	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3145.7397	3.4800	109.4717	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.1264	3.4800	29.9672	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			239.6835	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8033 (257)
SAP value		88.7942
SAP rating (Section 12)		89 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3145.7397	0.2160	679.4798	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.1264	0.2160	186.0033	(264)
Space and water heating			865.4831	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			787.7495 (272)
CO2 emissions per m2			9.8100 (273)
EI value			91.5769
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9895	0.9835	0.9635	0.9044	0.7770	0.5632	0.4148	0.4375	0.7074	0.9179	0.9782	0.9914	(86)
MIT	19.9571	20.0764	20.3328	20.6462	20.8771	20.9793	20.9961	20.9952	20.9407	20.6782	20.2852	19.9410	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9861	0.9782	0.9513	0.8728	0.7099	0.4639	0.3009	0.3181	0.6104	0.8827	0.9697	0.9885	(89)
MIT 2	18.5521	18.7275	19.0916	19.5218	19.8023	19.8984	19.9097	19.9110	19.8753	19.5753	19.0347	18.5350	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9049	19.0662	19.4033	19.8041	20.0722	20.1698	20.1826	20.1832	20.1429	19.8522	19.3487	18.8881	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9727	0.9442	0.8694	0.7209	0.4884	0.3297	0.3482	0.6324	0.8805	0.9638	0.9847	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	673.4045	727.5445	777.6487	784.9099	671.2046	466.2625	299.0093	298.3593	500.6321	630.5311	645.2860	639.0150 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1376.6934	1346.1825	1214.9692	1005.9602	739.2470	474.6569	299.9792	299.5835	528.0675	823.8290	1112.4231	1353.6555 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	523.2469	415.7247	325.3665	159.1562	50.6236	0.0000	0.0000	0.0000	0.0000	143.8136	336.3387	531.6925 (98)
Space heating												2485.9628 (98)
Space heating per m2											(98) / (4) =	30.9507 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2675.9556 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.2469	415.7247	325.3665	159.1562	50.6236	0.0000	0.0000	0.0000	0.0000	143.8136	336.3387	531.6925	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	563.2368	447.4970	350.2330	171.3200	54.4925	0.0000	0.0000	0.0000	0.0000	154.8048	362.0438	572.3278	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2260	89.2487	89.2592	89.2888	89.1360	86.7000	86.7000	86.7000	86.7000	88.7352	89.0752	89.2333	(217)
Fuel for water heating, kWh/month	150.9167	114.7893	88.0211	40.5814	17.1776	0.0000	0.0000	14.9624	41.9393	89.4520	126.4605	151.2365	(219)
Water heating fuel used												835.5368	(219)
Annual totals kWh/year													
Space heating fuel - main system												2675.9556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3286.5990	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2675.9556	7.3800	197.4855	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.5368	7.3800	61.6626	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			301.6937	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2675.9556	0.2160	578.0064	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5368	0.2160	180.4760	(264)
Space and water heating			758.4824	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			641.7627	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2675.9556	1.2200	3264.6659	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5368	1.2200	1019.3549	(264)
Space and water heating			4284.0208	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3593.5979	(272)
Primary energy kWh/m2/year			44.7410	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.9700	87.1704	0.7200	0.7000	0.7650	241.0805
South	3.6100	118.5567	0.7200	0.7000	0.7650	148.5141
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						496.5388

	Jun	Jul	Aug	
Solar gains	535	497	436	(P3)
Internal gains	429	411	419	
Total summer gains	964	908	855	(P5)
Summer gain/loss ratio	1.58	1.49	1.41	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.96	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 368 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	5 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.99	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.42		
CO_2 Emissions (t/year)	0.80	**DFEE**	49.79	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.99	$kgCO_2/m^2$	Pass
	-5.02 (-26.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.79	$kWh/m^2/yr$	
	-5.3 (-9.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.97 m², No overhang 3.61 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 369 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.96	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.58		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.64	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.96		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.32 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.97 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 3.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3200	
Infiltration rate		0.3605	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3907	0.3830	0.3754	0.3371	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600	(22b)
Effective ac	0.5763	0.5734	0.5704	0.5568	0.5543	0.5424	0.5424	0.5402	0.5469	0.5543	0.5594	0.5648	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4874	39.2844	39.0853	38.1505	37.9756	37.1614	37.1614	37.0107	37.4750	37.9756	38.3294	38.6994	(38)
Heat transfer coeff	99.8142	99.6112	99.4122	98.4774	98.3025	97.4883	97.4883	97.3375	97.8019	98.3025	98.6563	99.0262	(39)
Average = Sum(39)m / 12 =												98.4765	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2402	1.2377	1.2261	1.2239	1.2137	1.2137	1.2119	1.2177	1.2239	1.2283	1.2329	(40)
HLP (average)												1.2261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	480.3544	558.9358	632.7224	710.0836	765.2170	755.3745	718.7678	664.5325	604.5084	529.9443	472.0724	453.1310	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8816	55.9955	56.1076	56.6402	56.7410	57.2149	57.2149	57.3035	57.0314	56.7410	56.5375	56.3263	
alpha	4.7254	4.7330	4.7405	4.7760	4.7827	4.8143	4.8143	4.8202	4.8021	4.7827	4.7692	4.7551	
util living area													
	0.9980	0.9956	0.9886	0.9641	0.8917	0.7406	0.5757	0.6374	0.8698	0.9787	0.9959	0.9985	(86)
MIT	19.6345	19.7952	20.0609	20.4153	20.7325	20.9255	20.9825	20.9720	20.8279	20.4189	19.9611	19.6049	(87)
Th 2	19.8860	19.8880	19.8900	19.8992	19.9009	19.9090	19.9090	19.9105	19.9059	19.9009	19.8974	19.8938	(88)
util rest of house													
	0.9973	0.9940	0.9843	0.9498	0.8479	0.6459	0.4435	0.5039	0.8008	0.9677	0.9942	0.9980	(89)
MIT 2	18.0728	18.3086	18.6960	19.2088	19.6351	19.8588	19.9026	19.8989	19.7642	19.2225	18.5581	18.0348	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4650	18.6819	19.0388	19.5117	19.9106	20.1266	20.1738	20.1684	20.0313	19.5229	18.9104	18.4291	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4650	18.6819	19.0388	19.5117	19.9106	20.1266	20.1738	20.1684	20.0313	19.5229	18.9104	18.4291	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9915	0.9798	0.9433	0.8484	0.6665	0.4770	0.5374	0.8102	0.9624	0.9920	0.9969	(94)
Useful gains	478.4194	554.1962	619.9435	669.8145	649.1769	503.4636	342.8233	357.1294	489.7452	510.0233	468.2754	451.7330	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1413.8662	1372.8324	1246.5045	1045.0163	807.1259	538.7818	348.4011	366.8034	580.0936	877.1447	1165.1745	1409.0504	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	695.9724	550.1235	466.1614	270.1453	117.5140	0.0000	0.0000	0.0000	0.0000	273.1383	501.7674	712.2441	(98)
Space heating												3587.0664	(98)
Space heating per m2											(98) / (4) =	44.6597	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3861.2125	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	695.9724	550.1235	466.1614	270.1453	117.5140	0.0000	0.0000	0.0000	0.0000	273.1383	501.7674	712.2441	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	749.1629	592.1674	501.7884	290.7915	126.4952	0.0000	0.0000	0.0000	0.0000	294.0133	540.1156	766.6783	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2739	89.2202	89.1056	88.8319	88.2149	86.7000	86.7000	86.7000	86.7000	88.8131	89.1565	89.3001	(217)
Fuel for water heating, kWh/month													
	182.8689	160.4028	166.6092	146.9451	142.9144	126.8734	118.9465	134.5283	135.5512	152.5537	164.2821	177.4562	(219)
Water heating fuel used												1809.9318	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2125	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5471.3687	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2125	0.2160	834.0219	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.9318	0.2160	390.9453	(264)
Space and water heating			1224.9672	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1121.2836	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9600	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.4183	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4183	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	480.3303	548.5553	610.7956	675.1283	719.9672	708.0563	674.2973	628.2200	577.7358	515.8772	469.0317	455.1010	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9958	0.9897	0.9680	0.9016	0.7538	0.5863	0.6448	0.8748	0.9797	0.9960	0.9985	(86)
MIT	19.6999	19.8481	20.0967	20.4337	20.7378	20.9280	20.9837	20.9743	20.8378	20.4499	20.0162	19.6754	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9974	0.9944	0.9859	0.9552	0.8611	0.6624	0.4573	0.5153	0.8087	0.9692	0.9943	0.9980	(89)
MIT 2	18.1959	18.4138	18.7770	19.2676	19.6796	19.9041	19.9475	19.9445	19.8147	19.2984	18.6681	18.1667	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9921	0.9818	0.9493	0.8612	0.6822	0.4899	0.5478	0.8178	0.9643	0.9922	0.9970	(94)
Useful gains	478.4399	544.2395	599.7028	640.8760	620.0445	483.0671	330.3568	344.1585	472.4752	497.4728	465.3646	453.7157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1367.5006	1325.8481	1201.9011	1004.2723	775.0289	517.3141	335.5929	353.0854	557.7293	844.7947	1124.2214	1360.8599	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating												3419.3913	(98)
Space heating per m2											(98) / (4) =	42.5721	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3661.0185	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	708.2026	562.3565	479.6954	280.1342	123.4565	0.0000	0.0000	0.0000	0.0000	276.6676	507.8982	722.6074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8122	87.6137	87.1957	86.2211	84.2601	80.3000	80.3000	80.3000	80.3000	86.0739	87.3350	87.8960	(217)
Fuel for water heating, kWh/month													
	230.4920	202.8741	212.0892	190.2387	188.4713	174.1812	166.8789	186.0308	188.0853	199.8058	210.2089	224.8356	(219)
Water heating fuel used												2374.1918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3661.0185	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6465.8770	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3661.0185	0.2160	790.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2374.1918	0.2160	512.8254	(264)
Space and water heating			1303.6054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1527.1215	(272)
Emissions per m2 for space and water heating			16.2301	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2301 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			19.0100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3200	
Infiltration rate		0.3605	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3907	0.3830	0.3754	0.3371	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600	(22b)
Effective ac	0.5763	0.5734	0.5704	0.5568	0.5543	0.5424	0.5424	0.5402	0.5469	0.5543	0.5594	0.5648	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4874	39.2844	39.0853	38.1505	37.9756	37.1614	37.1614	37.0107	37.4750	37.9756	38.3294	38.6994	(38)
Heat transfer coeff	99.8142	99.6112	99.4122	98.4774	98.3025	97.4883	97.4883	97.3375	97.8019	98.3025	98.6563	99.0262	(39)
Average = Sum(39)m / 12 =												98.4765	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2402	1.2377	1.2261	1.2239	1.2137	1.2137	1.2119	1.2177	1.2239	1.2283	1.2329	(40)
HLP (average)												1.2261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	448.9589	528.3179	603.7192	683.2741	739.8322	731.9945	697.0900	640.6719	579.8706	503.0363	442.6007	422.5087	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8816	55.9955	56.1076	56.6402	56.7410	57.2149	57.2149	57.3035	57.0314	56.7410	56.5375	56.3263	
alpha	4.7254	4.7330	4.7405	4.7760	4.7827	4.8143	4.8143	4.8202	4.8021	4.7827	4.7692	4.7551	
util living area													
	0.9985	0.9965	0.9905	0.9688	0.9018	0.7560	0.5910	0.6561	0.8839	0.9826	0.9969	0.9989	(86)
MIT	19.5988	19.7607	20.0293	20.3892	20.7150	20.9184	20.9804	20.9683	20.8126	20.3908	19.9278	19.5698	(87)
Th 2	19.8860	19.8880	19.8900	19.8992	19.9009	19.9090	19.9090	19.9105	19.9059	19.9009	19.8974	19.8938	(88)
util rest of house													
	0.9980	0.9953	0.9870	0.9560	0.8606	0.6620	0.4566	0.5210	0.8188	0.9733	0.9956	0.9985	(89)
MIT 2	18.6124	18.7754	19.0438	19.4034	19.7054	19.8709	19.9041	19.9014	19.7985	19.4110	18.9499	18.5896	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8601	19.0228	19.2912	19.6509	19.9589	20.1340	20.1744	20.1693	20.0531	19.6570	19.1955	18.8358	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8601	19.0228	19.2912	19.6509	19.9589	20.1340	20.1744	20.1693	20.0531	19.6570	19.1955	18.8358	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9939	0.9844	0.9524	0.8631	0.6833	0.4908	0.5553	0.8293	0.9706	0.9944	0.9980	(94)
Useful gains	447.7523	525.1053	594.3084	650.7580	638.5711	500.1740	342.1592	355.7873	480.9002	488.2281	440.1352	421.6556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1453.3018	1406.7919	1271.6045	1058.7228	811.8717	539.4967	348.4575	366.8951	582.2283	890.3266	1193.2956	1449.3227	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	748.1288	592.4934	503.9083	293.7346	128.9357	0.0000	0.0000	0.0000	0.0000	299.1613	542.2755	764.5843	(98)
Space heating												3873.2219	(98)
Space heating per m2											(98) / (4) =	48.2224	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.3897	721.4131	739.7649	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8417	0.9071	0.8766	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	771.3074	654.3698	648.4779	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.8524	905.1638	840.8282	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	127.1124	186.5907	143.1087	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												456.8118 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	31.7781	46.6477	35.7772	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												114.2029 (107)
Space cooling per m2												1.4218 (108)
Energy for space heating												48.2224 (99)
Energy for space cooling												1.4218 (108)
Total												49.6442 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	435.7810	505.0528	569.5362	636.6897	683.5830	674.3054	642.2442	593.3557	541.4628	476.7068	426.6718	411.3224	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9987	0.9971	0.9923	0.9745	0.9162	0.7774	0.6112	0.6746	0.8963	0.9852	0.9974	0.9991	(86)
MIT	19.6486	19.7985	20.0510	20.3951	20.7112	20.9170	20.9804	20.9687	20.8143	20.4083	19.9678	19.6248	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9983	0.9961	0.9894	0.9638	0.8797	0.6878	0.4789	0.5428	0.8365	0.9773	0.9963	0.9987	(89)
MIT 2	18.6936	18.8450	19.0981	19.4451	19.7417	19.9137	19.9485	19.9461	19.8409	19.4634	19.0234	18.6773	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9873	0.9606	0.8814	0.7079	0.5126	0.5763	0.8458	0.9748	0.9953	0.9983	(94)
Useful gains	434.7788	502.5118	562.2844	611.5752	602.4901	477.3505	329.2056	341.9343	457.9757	464.6995	424.6466	410.6112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.9778	1355.5168	1223.7242	1015.8833	778.7721	517.7254	335.5873	353.0628	559.0133	855.4308	1148.1975	1395.9287	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	719.5960	573.2194	492.1111	291.1018	131.1538	0.0000	0.0000	0.0000	0.0000	290.7040	520.9566	733.0762	(98)
Space heating												3751.9191	(98)
Space heating per m2											(98) / (4) =	46.7121	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8361	0.9046	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	731.0951	622.6930	617.2615	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.4235	841.0582	785.5237	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.5165	162.4637	125.1871	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.1673	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.8791	40.6159	31.2968	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												98.7918 (107)
Space cooling per m2												1.2300 (108)
Energy for space heating												46.7121 (99)
Energy for space cooling												1.2300 (108)
Total												47.9421 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3200	
Infiltration rate			0.3605	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3217	0.2988	0.3064	0.2911	0.2911	0.2834	0.2758	0.2681	0.2605	0.2834	0.2681	0.2834	(22b)
Effective ac	0.5518	0.5446	0.5469	0.5424	0.5424	0.5402	0.5380	0.5359	0.5339	0.5402	0.5359	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8047	37.3162	37.4750	37.1614	37.1614	37.0107	36.8639	36.7212	36.5825	37.0107	36.7212	37.0107	(38)
Heat transfer coeff	98.1316	97.6431	97.8019	97.4883	97.4883	97.3375	97.1907	97.0480	96.9093	97.3375	97.0480	97.3375	(39)
Average = Sum(39)m / 12 =												97.3968	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2218	1.2157	1.2177	1.2137	1.2137	1.2119	1.2100	1.2083	1.2065	1.2119	1.2083	1.2119	(40)
HLP (average)												1.2126	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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If cylinder contains dedicated solar storage
              0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss   11.8131   10.6602   11.7801   11.3748   11.7356   11.3359   11.7005   11.7233   11.3571   11.7617   11.4116   11.8059 (61)
Total heat required for water heating calculated for each month
             163.2543  143.1117  148.4581  130.5340  126.0717  109.9992  103.1266  116.6361  117.5229  135.4877  146.4682  158.4687 (62)
Solar input   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             163.2543  143.1117  148.4581  130.5340  126.0717  109.9992  103.1266  116.6361  117.5229  135.4877  146.4682  158.4687 (64)
                                                                                Total per year (kWh/year) = Sum(64)m =   1599.1392 (64)
RHI water heating demand                                                                                                    1599 (64)
Heat gains from water heating, kWh/month
              53.3075   46.7052   48.3905   42.4641   40.9507   35.6395   33.3243   37.8143   38.1394   44.0793   47.7592   51.7168 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          56.8398   57.1242   57.0314   57.2149   57.2149   57.3035   57.3900   57.4744   57.5567   57.3035   57.4744   57.3035
alpha         4.7893    4.8083    4.8021    4.8143    4.8143    4.8202    4.8260    4.8316    4.8371    4.8202    4.8316    4.8202
util living area
              0.9895    0.9835    0.9634    0.9041    0.7765    0.5626    0.4143    0.4370    0.7069    0.9177    0.9781    0.9914 (86)

MIT          19.9599   20.0787   20.3349   20.6477   20.8778   20.9795   20.9962   20.9952   20.9410   20.6794   20.2868   19.9431 (87)
Th 2         19.9026   19.9075   19.9059   19.9090   19.9090   19.9105   19.9120   19.9134   19.9148   19.9105   19.9134   19.9105 (88)
util rest of house
              0.9861    0.9781    0.9512    0.8726    0.7094    0.4634    0.3007    0.3178    0.6100    0.8825    0.9696    0.9885 (89)
MIT 2        18.5572   18.7318   19.0958   19.5248   19.8043   19.8998   19.9110   19.9121   19.8767   19.5778   19.0378   18.5390 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.2511 (91)
MIT          18.9095   19.0701   19.4070   19.8068   20.0739   20.1709   20.1835   20.1841   20.1440   19.8545   19.3514   18.8916 (92)
Temperature adjustment                                                                                                      0.0000
adjusted MIT 18.9095   19.0701   19.4070   19.8068   20.0739   20.1709   20.1835   20.1841   20.1440   19.8545   19.3514   18.8916 (93)
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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7205	0.4879	0.3294	0.3479	0.6320	0.8803	0.9638	0.9847	(94)
Useful gains	673.3941	727.5220	777.5704	784.6873	670.7642	465.8065	298.7279	298.0957	500.3022	630.3833	645.2602	639.0099	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1374.7701	1344.5516	1213.4257	1004.7907	738.3671	474.1241	299.6876	299.3081	527.5693	822.9373	1111.3403	1352.1741	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.8237	414.6439	324.2764	158.4745	50.2966	0.0000	0.0000	0.0000	0.0000	143.2602	335.5776	530.5942	(98)
Space heating												2478.9470	(98)
RHI space heating demand												2479	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3200	
Infiltration rate		0.3605	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3907	0.3830	0.3754	0.3371	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600	(22b)
Effective ac	0.5763	0.5734	0.5704	0.5568	0.5543	0.5424	0.5424	0.5402	0.5469	0.5543	0.5594	0.5648	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4874	39.2844	39.0853	38.1505	37.9756	37.1614	37.1614	37.0107	37.4750	37.9756	38.3294	38.6994	(38)
Heat transfer coeff	99.8142	99.6112	99.4122	98.4774	98.3025	97.4883	97.4883	97.3375	97.8019	98.3025	98.6563	99.0262	(39)
Average = Sum(39)m / 12 =												98.4765	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2402	1.2377	1.2261	1.2239	1.2137	1.2137	1.2119	1.2177	1.2239	1.2283	1.2329	(40)
HLP (average)												1.2261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8816	55.9955	56.1076	56.6402	56.7410	57.2149	57.2149	57.3035	57.0314	56.7410	56.5375	56.3263	
alpha	4.7254	4.7330	4.7405	4.7760	4.7827	4.8143	4.8143	4.8202	4.8021	4.7827	4.7692	4.7551	
util living area													
	0.9924	0.9862	0.9714	0.9285	0.8280	0.6557	0.4937	0.5437	0.7821	0.9460	0.9858	0.9939	(86)
MIT	19.8371	19.9912	20.2386	20.5563	20.8167	20.9559	20.9908	20.9857	20.8968	20.5685	20.1456	19.8043	(87)
Th 2	19.8860	19.8880	19.8900	19.8992	19.9009	19.9090	19.9090	19.9105	19.9059	19.9009	19.8974	19.8938	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9041	0.7723	0.5610	0.3761	0.4227	0.6977	0.9222	0.9804	0.9919	(89)
MIT 2	18.3673	18.5915	18.9478	19.3965	19.7292	19.8812	19.9059	19.9050	19.8289	19.4240	18.8239	18.3251	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7364	18.9430	19.2719	19.6878	20.0023	20.1511	20.1783	20.1764	20.0971	19.7114	19.1558	18.6966	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7364	18.9430	19.2719	19.6878	20.0023	20.1511	20.1783	20.1764	20.0971	19.7114	19.1558	18.6966	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8985	0.7781	0.5832	0.4058	0.4531	0.7141	0.9171	0.9754	0.9888	(94)
Useful gains	651.5224	719.7031	766.6515	780.6958	709.7790	520.9681	346.0401	362.8713	534.5640	628.5341	623.5454	622.3633	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1440.9542	1398.8381	1269.6854	1062.3509	816.1357	541.1668	348.8434	367.5835	586.5242	895.6732	1189.3818	1435.5410	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	587.3372	456.3787	374.2573	202.7917	79.1294	0.0000	0.0000	0.0000	0.0000	198.7515	407.4022	605.0042	(98)
Space heating												2911.0522	(98)
Space heating per m2											(98) / (4) =	36.2432	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3133.5330	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	587.3372	456.3787	374.2573	202.7917	79.1294	0.0000	0.0000	0.0000	0.0000	198.7515	407.4022	605.0042	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	632.2252	491.2581	402.8603	218.2903	85.1770	0.0000	0.0000	0.0000	0.0000	213.9413	438.5384	651.2424	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1841	89.1148	88.9674	88.6191	87.9066	86.7000	86.7000	86.7000	86.7000	88.5748	89.0310	89.2165	(217)
Fuel for water heating, kWh/month													
	183.0533	160.5925	166.8680	147.2978	143.4155	126.8734	118.9465	134.5283	135.5512	152.9641	164.5136	177.6226	(219)
Water heating fuel used												1812.2268	(219)
Annual totals kWh/year													
Space heating fuel - main system												3133.5330	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4745.9842	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3133.5330	3.4800	109.0469	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.2268	3.4800	63.0655	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			265.7620	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8907	(257)
SAP value		87.5750	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3133.5330	0.2160	676.8431	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.2268	0.2160	391.4410	(264)
Space and water heating			1068.2841	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			964.6006	(272)
CO2 emissions per m2			12.0100	(273)
EI value			89.6859	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3200	
Infiltration rate			0.3605	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3217	0.2988	0.3064	0.2911	0.2911	0.2834	0.2758	0.2681	0.2605	0.2834	0.2681	0.2834	(22b)
Effective ac	0.5518	0.5446	0.5469	0.5424	0.5424	0.5402	0.5380	0.5359	0.5339	0.5402	0.5359	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8047	37.3162	37.4750	37.1614	37.1614	37.0107	36.8639	36.7212	36.5825	37.0107	36.7212	37.0107	(38)
Heat transfer coeff	98.1316	97.6431	97.8019	97.4883	97.4883	97.3375	97.1907	97.0480	96.9093	97.3375	97.0480	97.3375	(39)
Average = Sum(39)m / 12 =												97.3968	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2218	1.2157	1.2177	1.2137	1.2137	1.2119	1.2100	1.2083	1.2065	1.2119	1.2083	1.2119	(40)
HLP (average)												1.2126	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103 (83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8398	57.1242	57.0314	57.2149	57.2149	57.3035	57.3900	57.4744	57.5567	57.3035	57.4744	57.3035	
alpha	4.7893	4.8083	4.8021	4.8143	4.8143	4.8202	4.8260	4.8316	4.8371	4.8202	4.8316	4.8202	
util living area													
	0.9895	0.9835	0.9634	0.9041	0.7765	0.5626	0.4143	0.4370	0.7069	0.9177	0.9781	0.9914	(86)
MIT	19.9599	20.0787	20.3349	20.6477	20.8778	20.9795	20.9962	20.9952	20.9410	20.6794	20.2868	19.9431	(87)
Th 2	19.9026	19.9075	19.9059	19.9090	19.9090	19.9105	19.9120	19.9134	19.9148	19.9105	19.9134	19.9105	(88)
util rest of house													
	0.9861	0.9781	0.9512	0.8726	0.7094	0.4634	0.3007	0.3178	0.6100	0.8825	0.9696	0.9885	(89)
MIT 2	18.5572	18.7318	19.0958	19.5248	19.8043	19.8998	19.9110	19.9121	19.8767	19.5778	19.0378	18.5390	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9095	19.0701	19.4070	19.8068	20.0739	20.1709	20.1835	20.1841	20.1440	19.8545	19.3514	18.8916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9095	19.0701	19.4070	19.8068	20.0739	20.1709	20.1835	20.1841	20.1440	19.8545	19.3514	18.8916	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7205	0.4879	0.3294	0.3479	0.6320	0.8803	0.9638	0.9847	(94)
Useful gains	673.3941	727.5220	777.5704	784.6873	670.7642	465.8065	298.7279	298.0957	500.3022	630.3833	645.2602	639.0099	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1374.7701	1344.5516	1213.4257	1004.7907	738.3671	474.1241	299.6876	299.3081	527.5693	822.9373	1111.3403	1352.1741	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.8237	414.6439	324.2764	158.4745	50.2966	0.0000	0.0000	0.0000	0.0000	143.2602	335.5776	530.5942	(98)
Space heating												2478.9470	(98)
Space heating per m2											(98) / (4) =	30.8634	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2668.4037	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	521.8237	414.6439	324.2764	158.4745	50.2966	0.0000	0.0000	0.0000	0.0000	143.2602	335.5776	530.5942	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	561.7047	446.3336	349.0596	170.5861	54.1406	0.0000	0.0000	0.0000	0.0000	154.2090	361.2246	571.1455	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1162	89.0566	88.8699	88.4259	87.5891	86.7000	86.7000	86.7000	86.7000	88.3156	88.9030	89.1433	(217)
Fuel for water heating, kWh/month													
	183.1927	160.6974	167.0510	147.6197	143.9354	126.8734	118.9465	134.5283	135.5512	153.4130	164.7506	177.7684	(219)
Water heating fuel used												1814.3276	(219)
Annual totals kWh/year													
Space heating fuel - main system												2668.4037	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4207.8378	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2668.4037	7.3800	196.9282	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.3276	7.3800	133.8974	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			359.0411	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2668.4037	0.2160	576.3752	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3276	0.2160	391.8948	(264)
Space and water heating			968.2700	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			825.6003	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2668.4037	1.2200	3255.4525	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3276	1.2200	2213.4796	(264)
Space and water heating			5468.9321	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4625.0093	(272)
Primary energy kWh/m2/year			57.5823	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£438	£366	£72
Space heating	£325	£325	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£359	£302	£58
Total cost of uses	£359	£301	£58
Delivered energy	52 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3200	
Infiltration rate			0.3605	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3907	0.3830	0.3754	0.3371	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600	(22b)
Effective ac	0.5763	0.5734	0.5704	0.5568	0.5543	0.5424	0.5424	0.5402	0.5469	0.5543	0.5594	0.5648	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4874	39.2844	39.0853	38.1505	37.9756	37.1614	37.1614	37.0107	37.4750	37.9756	38.3294	38.6994	(38)
Heat transfer coeff	99.8142	99.6112	99.4122	98.4774	98.3025	97.4883	97.4883	97.3375	97.8019	98.3025	98.6563	99.0262	(39)
Average = Sum(39)m / 12 =												98.4765	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2402	1.2377	1.2261	1.2239	1.2137	1.2137	1.2119	1.2177	1.2239	1.2283	1.2329	(40)
HLP (average)												1.2261	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8816	55.9955	56.1076	56.6402	56.7410	57.2149	57.2149	57.3035	57.0314	56.7410	56.5375	56.3263	
alpha	4.7254	4.7330	4.7405	4.7760	4.7827	4.8143	4.8143	4.8202	4.8021	4.7827	4.7692	4.7551	
util living area													
	0.9924	0.9862	0.9714	0.9285	0.8280	0.6557	0.4937	0.5437	0.7821	0.9460	0.9858	0.9939	(86)
MIT	19.8371	19.9912	20.2386	20.5563	20.8167	20.9559	20.9908	20.9857	20.8968	20.5685	20.1456	19.8043	(87)
Th 2	19.8860	19.8880	19.8900	19.8992	19.9009	19.9090	19.9090	19.9105	19.9059	19.9009	19.8974	19.8938	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9041	0.7723	0.5610	0.3761	0.4227	0.6977	0.9222	0.9804	0.9919	(89)
MIT 2	18.3673	18.5915	18.9478	19.3965	19.7292	19.8812	19.9059	19.9050	19.8289	19.4240	18.8239	18.3251	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7364	18.9430	19.2719	19.6878	20.0023	20.1511	20.1783	20.1764	20.0971	19.7114	19.1558	18.6966	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7364	18.9430	19.2719	19.6878	20.0023	20.1511	20.1783	20.1764	20.0971	19.7114	19.1558	18.6966	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8985	0.7781	0.5832	0.4058	0.4531	0.7141	0.9171	0.9754	0.9888	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	651.5224	719.7031	766.6515	780.6958	709.7790	520.9681	346.0401	362.8713	534.5640	628.5341	623.5454	622.3633	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1440.9542	1398.8381	1269.6854	1062.3509	816.1357	541.1668	348.8434	367.5835	586.5242	895.6732	1189.3818	1435.5410	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	587.3372	456.3787	374.2573	202.7917	79.1294	0.0000	0.0000	0.0000	0.0000	198.7515	407.4022	605.0042	(98)

Space heating 2911.0522 (98)
Space heating per m2 (98) / (4) = 36.2432 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3133.5330 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	587.3372	456.3787	374.2573	202.7917	79.1294	0.0000	0.0000	0.0000	0.0000	198.7515	407.4022	605.0042	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	632.2252	491.2581	402.8603	218.2903	85.1770	0.0000	0.0000	0.0000	0.0000	213.9413	438.5384	651.2424	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2703	89.2967	89.3261	89.3877	89.5015	86.7000	86.7000	86.7000	86.7000	88.9310	89.1637	89.2880	(217)
Fuel for water heating, kWh/month	155.4483	114.5092	88.2957	41.6989	12.1299	0.0000	0.0000	21.8859	47.3296	93.6179	131.6963	154.5323	(219)

Water heating fuel used 861.1440 (219)
Annual totals kWh/year
Space heating fuel - main system 3133.5330 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) = -630.4424 -630.4424 (233)
Total delivered energy for all uses 3844.9014 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3133.5330	3.4800	109.0469	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.1440	3.4800	29.9678	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			239.2594	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8019 (257)
SAP value 88.8141
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3133.5330	0.2160	676.8431	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.1440	0.2160	186.0071	(264)
Space and water heating			862.8502	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			785.1167 (272)
CO2 emissions per m2			9.7700 (273)
EI value			91.6050
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3200	
Infiltration rate			0.3605	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3064	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3217	0.2988	0.3064	0.2911	0.2911	0.2834	0.2758	0.2681	0.2605	0.2834	0.2681	0.2834	(22b)
Effective ac	0.5518	0.5446	0.5469	0.5424	0.5424	0.5402	0.5380	0.5359	0.5339	0.5402	0.5359	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8047	37.3162	37.4750	37.1614	37.1614	37.0107	36.8639	36.7212	36.5825	37.0107	36.7212	37.0107	(38)
Heat transfer coeff	98.1316	97.6431	97.8019	97.4883	97.4883	97.3375	97.1907	97.0480	96.9093	97.3375	97.0480	97.3375	(39)
Average = Sum(39)m / 12 =												97.3968	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2218	1.2157	1.2177	1.2137	1.2137	1.2119	1.2100	1.2083	1.2065	1.2119	1.2083	1.2119	(40)
HLP (average)												1.2126	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8398	57.1242	57.0314	57.2149	57.2149	57.3035	57.3900	57.4744	57.5567	57.3035	57.4744	57.3035	
alpha	4.7893	4.8083	4.8021	4.8143	4.8143	4.8202	4.8260	4.8316	4.8371	4.8202	4.8316	4.8202	
util living area													
	0.9895	0.9835	0.9634	0.9041	0.7765	0.5626	0.4143	0.4370	0.7069	0.9177	0.9781	0.9914	(86)
MIT	19.9599	20.0787	20.3349	20.6477	20.8778	20.9795	20.9962	20.9952	20.9410	20.6794	20.2868	19.9431	(87)
Th 2	19.9026	19.9075	19.9059	19.9090	19.9090	19.9105	19.9120	19.9134	19.9148	19.9105	19.9134	19.9105	(88)
util rest of house													
	0.9861	0.9781	0.9512	0.8726	0.7094	0.4634	0.3007	0.3178	0.6100	0.8825	0.9696	0.9885	(89)
MIT 2	18.5572	18.7318	19.0958	19.5248	19.8043	19.8998	19.9110	19.9121	19.8767	19.5778	19.0378	18.5390	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9095	19.0701	19.4070	19.8068	20.0739	20.1709	20.1835	20.1841	20.1440	19.8545	19.3514	18.8916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9095	19.0701	19.4070	19.8068	20.0739	20.1709	20.1835	20.1841	20.1440	19.8545	19.3514	18.8916	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9726	0.9441	0.8691	0.7205	0.4879	0.3294	0.3479	0.6320	0.8803	0.9638	0.9847	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	673.3941	727.5220	777.5704	784.6873	670.7642	465.8065	298.7279	298.0957	500.3022	630.3833	645.2602	639.0099 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1374.7701	1344.5516	1213.4257	1004.7907	738.3671	474.1241	299.6876	299.3081	527.5693	822.9373	1111.3403	1352.1741 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	521.8237	414.6439	324.2764	158.4745	50.2966	0.0000	0.0000	0.0000	0.0000	143.2602	335.5776	530.5942 (98)

Space heating 2478.9470 (98)
Space heating per m2 (98) / (4) = 30.8634 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2668.4037 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	521.8237	414.6439	324.2764	158.4745	50.2966	0.0000	0.0000	0.0000	0.0000	143.2602	335.5776	530.5942	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	561.7047	446.3336	349.0596	170.5861	54.1406	0.0000	0.0000	0.0000	0.0000	154.2090	361.2246	571.1455	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2245	89.2474	89.2575	89.2867	89.1322	86.7000	86.7000	86.7000	86.7000	88.7324	89.0738	89.2322	(217)
Fuel for water heating, kWh/month	150.9192	114.7910	88.0228	40.5824	17.1783	0.0000	0.0000	14.9624	41.9393	89.4548	126.4625	151.2383	(219)

Water heating fuel used 835.5511 (219)
Annual totals kWh/year
Space heating fuel - main system 2668.4037 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602 -705.5602 (233)
Total delivered energy for all uses 3279.0614 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2668.4037	7.3800	196.9282	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.5511	7.3800	61.6637	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			301.1374	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2668.4037	0.2160	576.3752	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5511	0.2160	180.4790	(264)
Space and water heating			756.8542	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			640.1345	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2668.4037	1.2200	3255.4525	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5511	1.2200	1019.3724	(264)
Space and water heating			4274.8249	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3584.4020	(272)
Primary energy kWh/m2/year			44.6265	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.9700	87.1704	0.7200	0.7000	0.7650	241.0805
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	3.6100	118.5567	0.7200	0.7000	0.7650	148.5141
total:						496.5388

	Jun	Jul	Aug	
Solar gains	535	497	436	(P3)
Internal gains	429	411	419	
Total summer gains	964	908	855	(P5)
Summer gain/loss ratio	1.58	1.49	1.41	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.96	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 369 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.96	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.58		
CO_2 Emissions (t/year)	0.79	**DFEE**	49.64	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.96		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.96	$kgCO_2/m^2$	Pass
	-5.05 (-26.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.64	$kWh/m^2/yr$	
	-5.5 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.32 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.97 m², No overhang 2.46 m², No overhang 3.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.32 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 370 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	9 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.97	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.52		
CO_2 Emissions (t/year)	0.80	**DFEE**	49.71	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.7 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.39 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.97 m², No overhang
Windows facing South: 3.61 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	480.3544	558.9358	632.7224	710.0836	765.2170	755.3745	718.7678	664.5325	604.5084	529.9443	472.0724	453.1310	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9980	0.9956	0.9886	0.9641	0.8918	0.7409	0.5760	0.6376	0.8700	0.9788	0.9959	0.9985	(86)
MIT	19.6329	19.7937	20.0595	20.4144	20.7319	20.9253	20.9824	20.9719	20.8275	20.4181	19.9600	19.6034	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9973	0.9940	0.9844	0.9498	0.8481	0.6461	0.4437	0.5040	0.8009	0.9677	0.9942	0.9980	(89)
MIT 2	18.0697	18.3056	18.6934	19.2069	19.6337	19.8580	19.9020	19.8983	19.7633	19.2209	18.5560	18.0321	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4622	18.6793	19.0364	19.5101	19.9095	20.1261	20.1733	20.1679	20.0305	19.5215	18.9086	18.4267	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4622	18.6793	19.0364	19.5101	19.9095	20.1261	20.1733	20.1679	20.0305	19.5215	18.9086	18.4267	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9915	0.9798	0.9433	0.8485	0.6667	0.4771	0.5376	0.8103	0.9624	0.9920	0.9969	(94)
Useful gains	478.4182	554.1959	619.9494	669.8471	649.2872	503.6172	342.9596	357.2554	489.8355	510.0353	468.2750	451.7321	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1415.0378	1373.9259	1247.4548	1045.6623	807.6072	539.0380	348.5591	366.9619	580.3875	877.6548	1165.9280	1410.0517	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	696.8450	550.8586	466.8640	270.5869	117.7901	0.0000	0.0000	0.0000	0.0000	273.5089	502.3102	712.9898	(98)
Space heating												3591.7534	(98)
Space heating per m2											(98) / (4) =	44.7180	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3866.2577	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	696.8450	550.8586	466.8640	270.5869	117.7901	0.0000	0.0000	0.0000	0.0000	273.5089	502.3102	712.9898	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	750.1022	592.9586	502.5447	291.2668	126.7923	0.0000	0.0000	0.0000	0.0000	294.4122	540.6998	767.4810	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2746	89.2209	89.1065	88.8330	88.2167	86.7000	86.7000	86.7000	86.7000	88.8141	89.1571	89.3006	(217)
Fuel for water heating, kWh/month													
	182.8676	160.4015	166.6075	146.9431	142.9114	126.8734	118.9465	134.5283	135.5512	152.5520	164.2810	177.4552	(219)
Water heating fuel used												1809.9188	(219)
Annual totals kWh/year													
Space heating fuel - main system												3866.2577	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5476.4009	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3866.2577	0.2160	835.1117	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.9188	0.2160	390.9425	(264)
Space and water heating			1226.0541	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1122.3706	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9700	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.4283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4283	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	480.3303	548.5553	610.7956	675.1283	719.9672	708.0563	674.2973	628.2200	577.7358	515.8772	469.0317	455.1010	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9958	0.9897	0.9680	0.9016	0.7538	0.5863	0.6448	0.8748	0.9797	0.9960	0.9985	(86)
MIT	19.6999	19.8481	20.0967	20.4337	20.7378	20.9280	20.9837	20.9743	20.8378	20.4499	20.0162	19.6754	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9974	0.9944	0.9859	0.9552	0.8611	0.6624	0.4573	0.5153	0.8087	0.9692	0.9943	0.9980	(89)
MIT 2	18.1959	18.4138	18.7770	19.2676	19.6796	19.9041	19.9475	19.9445	19.8147	19.2984	18.6681	18.1667	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7740	19.1084	19.5604	19.9453	20.1612	20.2077	20.2031	20.0716	19.5875	19.0066	18.5455	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9921	0.9818	0.9493	0.8612	0.6822	0.4899	0.5478	0.8178	0.9643	0.9922	0.9970	(94)
Useful gains	478.4399	544.2395	599.7028	640.8760	620.0445	483.0671	330.3568	344.1585	472.4752	497.4728	465.3646	453.7157	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1367.5006	1325.8481	1201.9011	1004.2723	775.0289	517.3141	335.5929	353.0854	557.7293	844.7947	1124.2214	1360.8599	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating												3419.3913	(98)
Space heating per m2											(98) / (4) =	42.5721	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3661.0185	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.4612	525.2410	448.0355	261.6454	115.3084	0.0000	0.0000	0.0000	0.0000	258.4075	474.3769	674.9153	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	708.2026	562.3565	479.6954	280.1342	123.4565	0.0000	0.0000	0.0000	0.0000	276.6676	507.8982	722.6074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8122	87.6137	87.1957	86.2211	84.2601	80.3000	80.3000	80.3000	80.3000	86.0739	87.3350	87.8960	(217)
Fuel for water heating, kWh/month													
	230.4920	202.8741	212.0892	190.2387	188.4713	174.1812	166.8789	186.0308	188.0853	199.8058	210.2089	224.8356	(219)
Water heating fuel used												2374.1918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3661.0185	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6465.8770	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3661.0185	0.2160	790.7800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2374.1918	0.2160	512.8254	(264)
Space and water heating			1303.6054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1527.1215	(272)
Emissions per m2 for space and water heating			16.2301	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2301 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			19.0100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	448.9589	528.3179	603.7192	683.2741	739.8322	731.9945	697.0900	640.6719	579.8706	503.0363	442.6007	422.5087	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9985	0.9965	0.9906	0.9688	0.9019	0.7562	0.5913	0.6564	0.8841	0.9826	0.9969	0.9989	(86)
MIT	19.5971	19.7592	20.0279	20.3883	20.7144	20.9182	20.9804	20.9682	20.8122	20.3900	19.9267	19.5684	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9980	0.9953	0.9870	0.9561	0.8607	0.6622	0.4568	0.5212	0.8190	0.9734	0.9956	0.9985	(89)
MIT 2	18.6099	18.7731	19.0417	19.4019	19.7042	19.8702	19.9035	19.9008	19.7976	19.4096	18.9482	18.5875	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8578	19.0207	19.2893	19.6496	19.9579	20.1334	20.1739	20.1689	20.0524	19.6558	19.1939	18.8338	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8578	19.0207	19.2893	19.6496	19.9579	20.1334	20.1739	20.1689	20.0524	19.6558	19.1939	18.8338	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9939	0.9844	0.9525	0.8633	0.6835	0.4910	0.5555	0.8295	0.9706	0.9944	0.9980	(94)
Useful gains	447.7514	525.1049	594.3126	650.7853	638.6719	500.3218	342.2936	355.9100	480.9817	488.2369	440.1348	421.6549	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1454.5643	1407.9662	1272.6193	1059.4048	812.3699	539.7559	348.6158	367.0541	582.5299	890.8671	1194.1038	1450.4022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	749.0688	593.2828	504.6601	294.2060	129.2313	0.0000	0.0000	0.0000	0.0000	299.5569	542.8577	765.3880	(98)
Space heating												3878.2516	(98)
Space heating per m2											(98) / (4) =	48.2850	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.9221	721.8323	740.1730	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8414	0.9068	0.8763	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	771.4838	654.5866	648.6497	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	947.8524	905.1638	840.8282	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	126.9854	186.4294	142.9808	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												456.3956 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	31.7463	46.6073	35.7452	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												114.0989 (107)
Space cooling per m2												1.4206 (108)
Energy for space heating												48.2850 (99)
Energy for space cooling												1.4206 (108)
Total												49.7056 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.6300	0.7000	0.7700	25.9001	(74)
South	3.6100	46.7521	0.6300	0.7000	0.7700	51.5798	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	92.2457	162.8558	239.2813	326.0912	393.7447	403.8237	383.9209	331.2127	268.8550	184.3070	111.5019	78.3039	(83)
Total gains	435.7810	505.0528	569.5362	636.6897	683.5830	674.3054	642.2442	593.3557	541.4628	476.7068	426.6718	411.3224	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9987	0.9971	0.9923	0.9745	0.9162	0.7774	0.6112	0.6746	0.8963	0.9852	0.9974	0.9991	(86)
MIT	19.6486	19.7985	20.0510	20.3951	20.7112	20.9170	20.9804	20.9687	20.8143	20.4083	19.9678	19.6248	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9983	0.9961	0.9894	0.9638	0.8797	0.6878	0.4789	0.5428	0.8365	0.9773	0.9963	0.9987	(89)
MIT 2	18.6936	18.8450	19.0981	19.4451	19.7417	19.9137	19.9485	19.9461	19.8409	19.4634	19.0234	18.6773	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9334	19.0845	19.3374	19.6837	19.9851	20.1657	20.2076	20.2029	20.0854	19.7007	19.2605	18.9152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9873	0.9606	0.8814	0.7079	0.5126	0.5763	0.8458	0.9748	0.9953	0.9983	(94)
Useful gains	434.7788	502.5118	562.2844	611.5752	602.4901	477.3505	329.2056	341.9343	457.9757	464.6995	424.6466	410.6112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.9778	1355.5168	1223.7242	1015.8833	778.7721	517.7254	335.5873	353.0628	559.0133	855.4308	1148.1975	1395.9287	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	719.5960	573.2194	492.1111	291.1018	131.1538	0.0000	0.0000	0.0000	0.0000	290.7040	520.9566	733.0762	(98)
Space heating												3751.9191	(98)
Space heating per m2											(98) / (4) =	46.7121	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8361	0.9046	0.8748	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	731.0951	622.6930	617.2615	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.4235	841.0582	785.5237	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.5165	162.4637	125.1871	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.1673	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.8791	40.6159	31.2968	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												98.7918 (107)
Space cooling per m2												1.2300 (108)
Energy for space heating												46.7121 (99)
Energy for space cooling												1.2300 (108)
Total												47.9421 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103 (83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9895	0.9835	0.9634	0.9042	0.7767	0.5628	0.4145	0.4372	0.7071	0.9178	0.9781	0.9914	(86)
MIT	19.9587	20.0777	20.3340	20.6471	20.8775	20.9794	20.9962	20.9952	20.9409	20.6789	20.2861	19.9423	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9861	0.9782	0.9512	0.8727	0.7096	0.4636	0.3008	0.3179	0.6102	0.8826	0.9696	0.9885	(89)
MIT 2	18.5551	18.7301	19.0941	19.5236	19.8035	19.8992	19.9105	19.9117	19.8761	19.5768	19.0365	18.5374	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9727	0.9442	0.8692	0.7206	0.4881	0.3295	0.3481	0.6322	0.8804	0.9638	0.9847	(94)
Useful gains	673.3984	727.5312	777.6025	784.7785	670.9445	465.9931	298.8430	298.2035	500.4372	630.4439	645.2708	639.0120	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1375.5568	1345.2187	1214.0570	1005.2691	738.7270	474.3420	299.8069	299.4207	527.7731	823.3020	1111.7831	1352.7800	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	522.4058	415.0860	324.7222	158.7532	50.4302	0.0000	0.0000	0.0000	0.0000	143.4865	335.8889	531.0434	(98)
Space heating												2481.8162	(98)
RHI space heating demand												2482	(98)

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902 (83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9924	0.9862	0.9714	0.9286	0.8282	0.6560	0.4939	0.5439	0.7823	0.9460	0.9858	0.9939	(86)
MIT	19.8354	19.9896	20.2372	20.5554	20.8161	20.9557	20.9908	20.9856	20.8965	20.5677	20.1445	19.8028	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9042	0.7726	0.5612	0.3762	0.4228	0.6979	0.9223	0.9804	0.9919	(89)
MIT 2	18.3641	18.5885	18.9451	19.3948	19.7280	19.8806	19.9053	19.9045	19.8280	19.4224	18.8217	18.3224	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7336	18.9404	19.2696	19.6862	20.0012	20.1506	20.1779	20.1760	20.0964	19.7100	19.1539	18.6942	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7336	18.9404	19.2696	19.6862	20.0012	20.1506	20.1779	20.1760	20.0964	19.7100	19.1539	18.6942	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8986	0.7783	0.5834	0.4060	0.4533	0.7143	0.9171	0.9754	0.9888	(94)
Useful gains	651.5248	719.7132	766.6841	780.7818	709.9685	521.1620	346.1876	363.0141	534.7203	628.5834	623.5533	622.3642	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1442.1480	1399.9533	1270.6573	1063.0165	816.6351	541.4298	349.0030	367.7446	586.8315	896.2003	1190.1518	1436.5608	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	588.2236	457.1213	374.9561	203.2090	79.3600	0.0000	0.0000	0.0000	0.0000	199.1070	407.9509	605.7622	(98)
Space heating												2915.6902	(98)
Space heating per m2											(98) / (4) =	36.3009	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3138.5255	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.2236	457.1213	374.9561	203.2090	79.3600	0.0000	0.0000	0.0000	0.0000	199.1070	407.9509	605.7622	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	633.1794	492.0574	403.6126	218.7395	85.4252	0.0000	0.0000	0.0000	0.0000	214.3240	439.1291	652.0584	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1849	89.1158	88.9686	88.6207	87.9088	86.7000	86.7000	86.7000	86.7000	88.5762	89.0319	89.2172	(217)
Fuel for water heating, kWh/month													
	183.0515	160.5907	166.8657	147.2952	143.4119	126.8734	118.9465	134.5283	135.5512	152.9618	164.5120	177.6212	(219)
Water heating fuel used												1812.2096	(219)
Annual totals kWh/year													
Space heating fuel - main system												3138.5255	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4750.9594	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3138.5255	3.4800	109.2207	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.2096	3.4800	63.0649	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			265.9352	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8913	(257)
SAP value		87.5669	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3138.5255	0.2160	677.9215	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.2096	0.2160	391.4373	(264)
Space and water heating			1069.3588	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			965.6752	(272)
CO2 emissions per m2			12.0200	(273)
EI value			89.6744	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9895	0.9835	0.9634	0.9042	0.7767	0.5628	0.4145	0.4372	0.7071	0.9178	0.9781	0.9914	(86)
MIT	19.9587	20.0777	20.3340	20.6471	20.8775	20.9794	20.9962	20.9952	20.9409	20.6789	20.2861	19.9423	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9861	0.9782	0.9512	0.8727	0.7096	0.4636	0.3008	0.3179	0.6102	0.8826	0.9696	0.9885	(89)
MIT 2	18.5551	18.7301	19.0941	19.5236	19.8035	19.8992	19.9105	19.9117	19.8761	19.5768	19.0365	18.5374	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9727	0.9442	0.8692	0.7206	0.4881	0.3295	0.3481	0.6322	0.8804	0.9638	0.9847	(94)
Useful gains	673.3984	727.5312	777.6025	784.7785	670.9445	465.9931	298.8430	298.2035	500.4372	630.4439	645.2708	639.0120	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1375.5568	1345.2187	1214.0570	1005.2691	738.7270	474.3420	299.8069	299.4207	527.7731	823.3020	1111.7831	1352.7800	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	522.4058	415.0860	324.7222	158.7532	50.4302	0.0000	0.0000	0.0000	0.0000	143.4865	335.8889	531.0434	(98)
Space heating												2481.8162	(98)
Space heating per m2											(98) / (4) =	30.8991	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2671.4921	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	522.4058	415.0860	324.7222	158.7532	50.4302	0.0000	0.0000	0.0000	0.0000	143.4865	335.8889	531.0434	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	562.3313	446.8094	349.5395	170.8862	54.2844	0.0000	0.0000	0.0000	0.0000	154.4526	361.5596	571.6291	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1168	89.0573	88.8709	88.4273	87.5908	86.7000	86.7000	86.7000	86.7000	88.3169	88.9036	89.1438	(217)
Fuel for water heating, kWh/month													
	183.1913	160.6962	167.0492	147.6173	143.9326	126.8734	118.9465	134.5283	135.5512	153.4108	164.7494	177.7674	(219)
Water heating fuel used												1814.3137	(219)
Annual totals kWh/year													
Space heating fuel - main system												2671.4921	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4210.9124	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2671.4921	7.3800	197.1561	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.3137	7.3800	133.8964	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			359.2680	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2671.4921	0.2160	577.0423	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3137	0.2160	391.8918	(264)
Space and water heating			968.9341	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			826.2644	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2671.4921	1.2200	3259.2204	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.3137	1.2200	2213.4627	(264)
Space and water heating			5472.6832	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4628.7603	(272)
Primary energy kWh/m2/year			57.6290	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£438	£366	£72
Space heating	£326	£326	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£359	£302	£58
Total cost of uses	£360	£302	£58
Delivered energy	52 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	10.6334	0.7200	0.7000	0.7700	29.6001	(74)
South	3.6100	46.7521	0.7200	0.7000	0.7700	58.9484	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	105.4236	186.1209	273.4644	372.6757	449.9940	461.5128	438.7668	378.5288	307.2629	210.6366	127.4308	89.4902	(83)
Total gains	660.6016	736.9305	802.8715	868.8965	912.2406	893.3146	852.7641	800.7815	748.6028	685.3749	639.2924	629.4345	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9924	0.9862	0.9714	0.9286	0.8282	0.6560	0.4939	0.5439	0.7823	0.9460	0.9858	0.9939	(86)
MIT	19.8354	19.9896	20.2372	20.5554	20.8161	20.9557	20.9908	20.9856	20.8965	20.5677	20.1445	19.8028	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9899	0.9818	0.9618	0.9042	0.7726	0.5612	0.3762	0.4228	0.6979	0.9223	0.9804	0.9919	(89)
MIT 2	18.3641	18.5885	18.9451	19.3948	19.7280	19.8806	19.9053	19.9045	19.8280	19.4224	18.8217	18.3224	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7336	18.9404	19.2696	19.6862	20.0012	20.1506	20.1779	20.1760	20.0964	19.7100	19.1539	18.6942	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7336	18.9404	19.2696	19.6862	20.0012	20.1506	20.1779	20.1760	20.0964	19.7100	19.1539	18.6942	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9766	0.9549	0.8986	0.7783	0.5834	0.4060	0.4533	0.7143	0.9171	0.9754	0.9888	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	651.5248	719.7132	766.6841	780.7818	709.9685	521.1620	346.1876	363.0141	534.7203	628.5834	623.5533	622.3642	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1442.1480	1399.9533	1270.6573	1063.0165	816.6351	541.4298	349.0030	367.7446	586.8315	896.2003	1190.1518	1436.5608	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	588.2236	457.1213	374.9561	203.2090	79.3600	0.0000	0.0000	0.0000	0.0000	199.1070	407.9509	605.7622	(98)
Space heating												2915.6902	(98)
Space heating per m2											(98) / (4) =	36.3009	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3138.5255	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.2236	457.1213	374.9561	203.2090	79.3600	0.0000	0.0000	0.0000	0.0000	199.1070	407.9509	605.7622	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	633.1794	492.0574	403.6126	218.7395	85.4252	0.0000	0.0000	0.0000	0.0000	214.3240	439.1291	652.0584	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2711	89.2975	89.3270	89.3886	89.5025	86.7000	86.7000	86.7000	86.7000	88.9322	89.1644	89.2886	(217)
Fuel for water heating, kWh/month	155.4470	114.5082	88.2948	41.6985	12.1298	0.0000	0.0000	21.8859	47.3296	93.6166	131.6951	154.5312	(219)
Water heating fuel used												861.1368	(219)
Annual totals kWh/year													
Space heating fuel - main system												3138.5255	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3849.8866	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3138.5255	3.4800	109.2207	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.1368	3.4800	29.9676	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			239.4328	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8024	(257)
SAP value		88.8060	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3138.5255	0.2160	677.9215	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.1368	0.2160	186.0055	(264)
Space and water heating			863.9270	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			786.1935 (272)
CO2 emissions per m2			9.7900 (273)
EI value			91.5935
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
								Total per year (kWh/year) = Sum(64)m =				743.5253	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.9700	13.4839	0.7200	0.7000	0.7700	37.5351	(74)
South	3.6100	56.7559	0.7200	0.7000	0.7700	71.5619	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	130.7426	197.1787	294.1664	406.6437	468.7828	522.9062	493.0047	434.5002	350.2866	241.3522	157.6675	109.0103	(83)
Total gains	685.9207	747.9883	823.5735	902.8645	931.0294	954.7079	907.0020	856.7528	791.6265	716.0905	669.5291	648.9546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9895	0.9835	0.9634	0.9042	0.7767	0.5628	0.4145	0.4372	0.7071	0.9178	0.9781	0.9914	(86)
MIT	19.9587	20.0777	20.3340	20.6471	20.8775	20.9794	20.9962	20.9952	20.9409	20.6789	20.2861	19.9423	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9861	0.9782	0.9512	0.8727	0.7096	0.4636	0.3008	0.3179	0.6102	0.8826	0.9696	0.9885	(89)
MIT 2	18.5551	18.7301	19.0941	19.5236	19.8035	19.8992	19.9105	19.9117	19.8761	19.5768	19.0365	18.5374	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9076	19.0685	19.4055	19.8057	20.0732	20.1705	20.1831	20.1838	20.1435	19.8536	19.3503	18.8902	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9727	0.9442	0.8692	0.7206	0.4881	0.3295	0.3481	0.6322	0.8804	0.9638	0.9847	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	673.3984	727.5312	777.6025	784.7785	670.9445	465.9931	298.8430	298.2035	500.4372	630.4439	645.2708	639.0120 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1375.5568	1345.2187	1214.0570	1005.2691	738.7270	474.3420	299.8069	299.4207	527.7731	823.3020	1111.7831	1352.7800 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	522.4058	415.0860	324.7222	158.7532	50.4302	0.0000	0.0000	0.0000	0.0000	143.4865	335.8889	531.0434 (98)

Space heating 2481.8162 (98)
Space heating per m2 (98) / (4) = 30.8991 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2671.4921 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	522.4058	415.0860	324.7222	158.7532	50.4302	0.0000	0.0000	0.0000	0.0000	143.4865	335.8889	531.0434	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	562.3313	446.8094	349.5395	170.8862	54.2844	0.0000	0.0000	0.0000	0.0000	154.4526	361.5596	571.6291	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2251	89.2479	89.2582	89.2876	89.1338	86.7000	86.7000	86.7000	86.7000	88.7335	89.0743	89.2326	(217)
Fuel for water heating, kWh/month													
	150.9182	114.7903	88.0221	40.5820	17.1780	0.0000	0.0000	14.9624	41.9393	89.4537	126.4617	151.2376	(219)
Water heating fuel used												835.5453	(219)

Annual totals kWh/year
Space heating fuel - main system 2671.4921 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602 -705.5602 (233)
Total delivered energy for all uses 3282.1440 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2671.4921	7.3800	197.1561	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.5453	7.3800	61.6632	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			301.3649	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2671.4921	0.2160	577.0423	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5453	0.2160	180.4778	(264)
Space and water heating			757.5201	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			640.8004	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2671.4921	1.2200	3259.2204	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5453	1.2200	1019.3652	(264)
Space and water heating			4278.5856	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3588.1628	(272)
Primary energy kWh/m2/year			44.6733	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.9700	87.1704	0.7200	0.7000	0.7650	241.0805
South	3.6100	118.5567	0.7200	0.7000	0.7650	148.5141
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						496.5388

	Jun	Jul	Aug	
Solar gains	535	497	436	(P3)
Internal gains	429	411	419	
Total summer gains	964	908	855	(P5)
Summer gain/loss ratio	1.58	1.49	1.41	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.96	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 370 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	9 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.97	**TER**	19.01
Environmental	90 B	**% DER<TER**	26.52		
CO_2 Emissions (t/year)	0.80	**DFEE**	49.71	**TFEE**	55.13
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.97	$kgCO_2/m^2$	Pass
	-5.04 (-26.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.13	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.71	$kWh/m^2/yr$	
	-5.4 (-9.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.97 m², No overhang 3.61 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 371 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	11 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.35	**TER**	18.73
Environmental	89 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.81	**DFEE**	48.72	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.93 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.47 m², No overhang
Windows facing East: 0.50 m², No overhang
Windows facing South: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.4910	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5322	0.5217	0.5113	0.4591	0.4487	0.3965	0.3965	0.3861	0.4174	0.4487	0.4695	0.4904	(22b)
Effective ac	0.6416	0.6361	0.6307	0.6054	0.6007	0.5786	0.5786	0.5745	0.5871	0.6007	0.6102	0.6203	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2924	42.9214	42.5577	40.8496	40.5300	39.0424	39.0424	38.7669	39.6154	40.5300	41.1765	41.8524	(38)
Heat transfer coeff	100.6280	100.2570	99.8934	98.1853	97.8657	96.3780	96.3780	96.1025	96.9511	97.8657	98.5122	99.1881	(39)
Average = Sum(39)m / 12 =												98.1837	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2722	1.2675	1.2629	1.2413	1.2372	1.2184	1.2184	1.2149	1.2257	1.2372	1.2454	1.2540	(40)
HLP (average)												1.2413	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	477.0559	549.5166	607.2180	658.9169	691.7088	675.7266	644.8450	608.1294	570.6205	516.5107	467.9015	450.7550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5877	54.7897	54.9892	55.9458	56.1285	56.9949	56.9949	57.1583	56.6580	56.1285	55.7602	55.3802	
alpha	4.6392	4.6526	4.6659	4.7297	4.7419	4.7997	4.7997	4.8106	4.7772	4.7419	4.7173	4.6920	
util living area													
	0.9979	0.9956	0.9899	0.9716	0.9176	0.7878	0.6246	0.6762	0.8855	0.9798	0.9958	0.9984	(86)
MIT	19.6011	19.7596	20.0142	20.3602	20.6781	20.9009	20.9750	20.9638	20.8083	20.4020	19.9457	19.5827	(87)
Th 2	19.8627	19.8664	19.8700	19.8871	19.8903	19.9053	19.9053	19.9081	19.8995	19.8903	19.8838	19.8771	(88)
util rest of house													
	0.9972	0.9941	0.9861	0.9598	0.8807	0.6964	0.4854	0.5394	0.8208	0.9692	0.9941	0.9979	(89)
MIT 2	18.0079	18.2418	18.6145	19.1236	19.5610	19.8353	19.8957	19.8924	19.7384	19.1909	18.5263	17.9909	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3165	18.5357	18.8856	19.3631	19.7774	20.0417	20.1048	20.0999	19.9456	19.4255	18.8012	18.2992	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3165	18.5357	18.8856	19.3631	19.7774	20.0417	20.1048	20.0999	19.9456	19.4255	18.8012	18.2992	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9913	0.9813	0.9524	0.8761	0.7093	0.5124	0.5655	0.8241	0.9630	0.9915	0.9967	(94)
Useful gains	474.9849	544.7561	595.8488	627.5335	605.9760	479.2824	330.3888	343.8842	470.2321	497.3781	463.9263	449.2466	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1410.4507	1367.0791	1237.2385	1027.3257	790.4984	524.4628	337.7834	355.5726	566.7387	863.7104	1152.7115	1398.4717	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	695.9865	552.6011	477.1939	287.8504	137.2847	0.0000	0.0000	0.0000	0.0000	272.5512	495.9254	706.2235	(98)
Space heating												3625.6167	(98)
Space heating per m2											(98) / (4) =	45.8359	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3902.7090 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	695.9865	552.6011	477.1939	287.8504	137.2847	0.0000	0.0000	0.0000	0.0000	272.5512	495.9254	706.2235	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	749.1782	594.8343	513.6641	309.8497	147.7768	0.0000	0.0000	0.0000	0.0000	293.3813	533.8271	760.1975	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2768	89.2256	89.1228	88.8804	88.3435	86.7000	86.7000	86.7000	86.7000	88.8155	89.1529	89.2987	(217)
Fuel for water heating, kWh/month													
	181.8487	159.5041	165.6587	146.0621	141.9314	126.1921	118.3152	133.8039	134.8180	151.7153	163.3814	176.4769	(219)
Water heating fuel used												1799.7078	(219)
Annual totals kWh/year													
Space heating fuel - main system												3902.7090	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	363.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) = -623.7532	-623.7532 (233)
Total delivered energy for all uses	5516.6743 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3902.7090	0.2160	842.9852	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.7078	0.2160	388.7369	(264)
Space and water heating			1231.7220	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1135.3217	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.3500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.8942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.8942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	477.0823	539.8439	588.0165	629.9116	655.2236	637.9662	609.2357	578.4890	547.7005	503.7223	464.9574	452.6774	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9980	0.9958	0.9904	0.9727	0.9185	0.7849	0.6161	0.6656	0.8808	0.9795	0.9958	0.9984	(86)
MIT	19.7512	19.8932	20.1233	20.4334	20.7224	20.9193	20.9816	20.9730	20.8415	20.4758	20.0595	19.7277	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9973	0.9944	0.9868	0.9616	0.8831	0.6976	0.4863	0.5374	0.8174	0.9690	0.9941	0.9979	(89)
MIT 2	18.2906	18.4996	18.8360	19.2897	19.6863	19.9248	19.9751	19.9723	19.8448	19.3562	18.7512	18.2631	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9920	0.9826	0.9551	0.8795	0.7105	0.5115	0.5620	0.8218	0.9634	0.9917	0.9968	(94)
Useful gains	475.1132	535.4991	577.8028	601.6289	576.2885	453.2945	311.5936	325.0865	450.1118	485.2746	461.1168	451.2291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1307.1888	1266.8329	1146.5504	954.8726	735.0127	489.9841	317.0471	333.7823	529.5448	805.5876	1073.8016	1300.4123	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating												3217.3333	(98)
Space heating per m2											(98) / (4) =	40.6743	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3444.6823	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	662.8097	526.1845	453.0495	272.3078	126.4355	0.0000	0.0000	0.0000	0.0000	255.1529	472.3052	676.4372	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6916	87.4900	87.0827	86.1663	84.3321	80.3000	80.3000	80.3000	80.3000	85.8876	87.1908	87.7783	(217)
Fuel for water heating, kWh/month													
	229.7778	201.9477	211.0961	189.2230	187.1858	173.1411	165.8823	184.9199	186.9622	199.0435	209.2991	224.1395	(219)
Water heating fuel used												2362.6182	(219)
Annual totals kWh/year													
Space heating fuel - main system												3444.6823	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6245.3112	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3444.6823	0.2160	744.0514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2362.6182	0.2160	510.3255	(264)
Space and water heating			1254.3769	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1481.7044	(272)
Emissions per m2 for space and water heating			15.8581	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8581 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.3932	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3342	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4262	0.4178	0.4094	0.3677	0.3593	0.3175	0.3175	0.3092	0.3342	0.3593	0.3760	0.3927	(22b)
Effective ac	0.5908	0.5873	0.5838	0.5676	0.5645	0.5504	0.5504	0.5478	0.5559	0.5645	0.5707	0.5771	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.8651	39.6272	39.3940	38.2986	38.0937	37.1397	37.1397	36.9630	37.5071	38.0937	38.5083	38.9417	(38)
Heat transfer coeff	97.2008	96.9628	96.7296	95.6343	95.4293	94.4753	94.4753	94.2986	94.8428	95.4293	95.8439	96.2774	(39)
Average = Sum(39)m / 12 =												95.6333	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2288	1.2258	1.2229	1.2090	1.2064	1.1944	1.1944	1.1921	1.1990	1.2064	1.2117	1.2172	(40)
HLP (average)												1.2090	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225 (71)

Water heating gains (Table 5)

	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394 (72)

Total internal gains

	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747 (83)
Total gains	445.8067	519.0408	578.3472	632.2267	666.4348	652.4453	623.2557	584.3703	546.0890	489.7225	438.5650	420.2744 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5125	56.6511	56.7877	57.4381	57.5615	58.1428	58.1428	58.2517	57.9175	57.5615	57.3125	57.0545	
alpha	4.7675	4.7767	4.7858	4.8292	4.8374	4.8762	4.8762	4.8834	4.8612	4.8374	4.8208	4.8036	
util living area	0.9985	0.9965	0.9915	0.9748	0.9233	0.7968	0.6330	0.6883	0.8949	0.9831	0.9968	0.9989	(86)
MIT	19.6210	19.7775	20.0284	20.3646	20.6801	20.9001	20.9751	20.9628	20.8050	20.3994	19.9491	19.5952	(87)
Th 2	19.8970	19.8994	19.9017	19.9128	19.9149	19.9245	19.9245	19.9263	19.9208	19.9149	19.9107	19.9063	(88)
util rest of house	0.9979	0.9953	0.9883	0.9642	0.8884	0.7076	0.4949	0.5528	0.8339	0.9741	0.9955	0.9985	(89)
MIT 2	18.6432	18.8011	19.0525	19.3917	19.6894	19.8758	19.9179	19.9151	19.8070	19.4308	18.9817	18.6248	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8326	18.9902	19.2415	19.5801	19.8813	20.0742	20.1226	20.1180	20.0003	19.6184	19.1690	18.8127	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8326	18.9902	19.2415	19.5801	19.8813	20.0742	20.1226	20.1180	20.0003	19.6184	19.1690	18.8127	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9856	0.9600	0.8871	0.7216	0.5220	0.5791	0.8394	0.9707	0.9942	0.9979	(94)
Useful gains	444.5561	515.8675	570.0301	606.9243	591.2078	470.7992	325.3390	338.4313	458.3644	475.3888	436.0180	419.3847	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1412.5790	1366.2288	1232.4795	1021.3846	780.7326	517.1725	332.8027	350.6066	559.5994	860.6207	1156.7438	1406.8763	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	720.2091	571.4428	492.8624	298.4114	141.0065	0.0000	0.0000	0.0000	0.0000	286.6125	518.9225	734.6937	(98)
Space heating												3764.1610	(98)
Space heating per m2											(98) / (4) =	47.5874	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	888.0679	699.1173	716.6696	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8133	0.8880	0.8605	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	722.2673	620.7883	616.7256	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	854.2159	818.2561	774.4877	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	95.0030	146.9160	117.3750	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  359.2941 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   23.7508   36.7290   29.3438    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                   89.8235 (107)
Space cooling per m2                                                                                             1.1356 (108)
Energy for space heating                                                                                        47.5874 (99)
Energy for space cooling                                                                                         1.1356 (108)
Total                                                                                                           48.7229 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                          48.7 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	432.6789	496.5833	546.9855	591.6846	619.0388	604.3989	577.3560	543.8150	511.6262	464.7679	422.8326	409.0400	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9987	0.9971	0.9930	0.9787	0.9325	0.8099	0.6442	0.6981	0.9029	0.9853	0.9973	0.9990	(86)
MIT	19.6990	19.8429	20.0767	20.3934	20.6932	20.9059	20.9776	20.9665	20.8171	20.4336	20.0103	19.6762	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9982	0.9961	0.9903	0.9698	0.9014	0.7256	0.5113	0.5681	0.8463	0.9774	0.9962	0.9987	(89)
MIT 2	18.7663	18.9118	19.1464	19.4676	19.7525	19.9353	19.9762	19.9738	19.8696	19.5114	19.0885	18.7512	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9949	0.9881	0.9661	0.9000	0.7388	0.5374	0.5934	0.8513	0.9745	0.9951	0.9982	(94)
Useful gains	431.6527	494.0705	540.4765	571.6393	557.1247	446.5595	310.2499	322.6928	435.5491	452.9156	420.7420	408.3093	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.3886	1296.2964	1168.5284	967.0818	739.2948	490.5081	317.0519	333.7766	530.9097	816.0872	1097.4693	1335.1805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	676.8435	539.0958	467.2707	284.7186	135.5346	0.0000	0.0000	0.0000	0.0000	270.1996	487.2436	689.5922	(98)
Space heating												3550.4987	(98)
Space heating per m2											(98) / (4) =	44.8862	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8173	0.8930	0.8672	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.2788	586.8368	584.0899	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	798.0578	764.6071	727.0854	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.3609	132.2611	106.3886	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												322.0106	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    20.8402    33.0653    26.5972     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          80.5027 (107)
Space cooling per m2                                                                                                                    1.0177 (108)
Energy for space heating                                                                                                               44.8862 (99)
Energy for space cooling                                                                                                                1.0177 (108)
Total                                                                                                                                  45.9039 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                    52.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.4910	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4382	0.4069	0.4174	0.3965	0.3965	0.3861	0.3756	0.3652	0.3548	0.3861	0.3652	0.3861	(22b)
Effective ac	0.5960	0.5828	0.5871	0.5786	0.5786	0.5745	0.5706	0.5667	0.5629	0.5745	0.5667	0.5745	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2178	39.3252	39.6154	39.0424	39.0424	38.7669	38.4987	38.2379	37.9845	38.7669	38.2379	38.7669	(38)
Heat transfer coeff	97.5535	96.6609	96.9511	96.3780	96.3780	96.1025	95.8344	95.5736	95.3201	96.1025	95.5736	96.1025	(39)
Average = Sum(39)m / 12 =												96.2109	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2333	1.2220	1.2257	1.2184	1.2184	1.2149	1.2116	1.2083	1.2051	1.2149	1.2083	1.2149	(40)
HLP (average)												1.2163	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3081	56.8281	56.6580	56.9949	56.9949	57.1583	57.3182	57.4746	57.6275	57.1583	57.4746	57.1583	
alpha	4.7539	4.7885	4.7772	4.7997	4.7997	4.8106	4.8212	4.8316	4.8418	4.8106	4.8316	4.8106	
util living area													
	0.9893	0.9837	0.9667	0.9192	0.8116	0.6077	0.4498	0.4661	0.7266	0.9208	0.9777	0.9911	(86)
MIT	19.9503	20.0690	20.3072	20.6086	20.8490	20.9714	20.9946	20.9937	20.9337	20.6712	20.2902	19.9456	(87)
Th 2	19.8935	19.9024	19.8995	19.9053	19.9053	19.9081	19.9108	19.9134	19.9160	19.9081	19.9134	19.9081	(88)
util rest of house													
	0.9858	0.9784	0.9554	0.8910	0.7479	0.5038	0.3272	0.3399	0.6301	0.8865	0.9690	0.9881	(89)
MIT 2	18.5368	18.7142	19.0525	19.4724	19.7722	19.8927	19.9093	19.9117	19.8724	19.5656	19.0427	18.5408	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9724	0.9474	0.8844	0.7528	0.5231	0.3511	0.3645	0.6458	0.8815	0.9623	0.9838	(94)
Useful gains	667.4095	714.7771	750.4629	745.2511	640.4270	450.5115	288.1390	287.3195	483.6563	614.9572	637.6663	634.4139	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1357.0271	1321.9925	1192.0585	982.3272	720.9819	461.4454	289.3721	288.7535	512.6266	805.3174	1088.0373	1327.4531	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.0755	408.0487	328.5471	170.6948	59.9329	0.0000	0.0000	0.0000	0.0000	141.6280	324.2671	515.6212	(98)
Space heating												2461.8152	(98)
RHI space heating demand												2462	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.4910	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5322	0.5217	0.5113	0.4591	0.4487	0.3965	0.3965	0.3861	0.4174	0.4487	0.4695	0.4904	(22b)
Effective ac	0.6416	0.6361	0.6307	0.6054	0.6007	0.5786	0.5786	0.5745	0.5871	0.6007	0.6102	0.6203	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2924	42.9214	42.5577	40.8496	40.5300	39.0424	39.0424	38.7669	39.6154	40.5300	41.1765	41.8524	(38)
Heat transfer coeff	100.6280	100.2570	99.8934	98.1853	97.8657	96.3780	96.3780	96.1025	96.9511	97.8657	98.5122	99.1881	(39)
Average = Sum(39)m / 12 =												98.1837	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2722	1.2675	1.2629	1.2413	1.2372	1.2184	1.2184	1.2149	1.2257	1.2372	1.2454	1.2540	(40)
HLP (average)												1.2413	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5877	54.7897	54.9892	55.9458	56.1285	56.9949	56.9949	57.1583	56.6580	56.1285	55.7602	55.3802	
alpha	4.6392	4.6526	4.6659	4.7297	4.7419	4.7997	4.7997	4.8106	4.7772	4.7419	4.7173	4.6920	
util living area													
	0.9922	0.9864	0.9740	0.9399	0.8583	0.6980	0.5313	0.5738	0.7990	0.9480	0.9856	0.9937	(86)
MIT	19.8046	19.9567	20.1945	20.5089	20.7765	20.9418	20.9873	20.9819	20.8845	20.5540	20.1316	19.7833	(87)
Th 2	19.8627	19.8664	19.8700	19.8871	19.8903	19.9053	19.9053	19.9081	19.8995	19.8903	19.8838	19.8771	(88)
util rest of house													
	0.9896	0.9820	0.9651	0.9183	0.8072	0.6021	0.4062	0.4479	0.7162	0.9248	0.9801	0.9916	(89)
MIT 2	18.3037	18.5265	18.8709	19.3246	19.6756	19.8675	19.9008	19.9009	19.8120	19.3964	18.7939	18.2830	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5944	18.8035	19.1272	19.5539	19.8888	20.0755	20.1112	20.1103	20.0197	19.6206	19.0529	18.5736	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5944	18.8035	19.1272	19.5539	19.8888	20.0755	20.1112	20.1103	20.0197	19.6206	19.0529	18.5736	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9763	0.9573	0.9103	0.8071	0.6182	0.4305	0.4722	0.7264	0.9176	0.9743	0.9881	(94)
Useful gains	646.9012	709.3020	743.1827	743.3626	676.0476	502.3452	334.8579	351.0796	518.5580	615.8193	618.0365	618.7489	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1438.4151	1393.9206	1261.3754	1046.0609	801.4047	527.7224	338.4065	356.5680	573.9241	882.8076	1177.5113	1425.6871	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	588.8863	460.0637	385.5354	217.9428	93.2656	0.0000	0.0000	0.0000	0.0000	198.6393	402.8219	600.3620	(98)
Space heating												2947.5170	(98)
Space heating per m2											(98) / (4) =	37.2632	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3172.7847	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	588.8863	460.0637	385.5354	217.9428	93.2656	0.0000	0.0000	0.0000	0.0000	198.6393	402.8219	600.3620	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	633.8927	495.2247	415.0004	234.5994	100.3936	0.0000	0.0000	0.0000	0.0000	213.8205	433.6080	646.2454	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1886	89.1228	88.9905	88.6782	88.0367	86.7000	86.7000	86.7000	86.7000	88.5786	89.0274	89.2154	(217)
Fuel for water heating, kWh/month													
	182.0284	159.6879	165.9049	146.3951	142.4261	126.1921	118.3152	133.8039	134.8180	152.1211	163.6118	176.6417	(219)
Water heating fuel used												1801.9464	(219)
Annual totals kWh/year													
Space heating fuel - main system												3172.7847	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4788.9886	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3172.7847	3.4800	110.4129	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1801.9464	3.4800	62.7077	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			268.6212	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9091	(257)
SAP value		87.3179	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3172.7847	0.2160	685.3215	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.9464	0.2160	389.2204	(264)
Space and water heating			1074.5419	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			978.1416	(272)
CO2 emissions per m2			12.3700	(273)
EI value			89.4383	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8814 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8814 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.4910	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4382	0.4069	0.4174	0.3965	0.3965	0.3861	0.3756	0.3652	0.3548	0.3861	0.3652	0.3861	(22b)
Effective ac	0.5960	0.5828	0.5871	0.5786	0.5786	0.5745	0.5706	0.5667	0.5629	0.5745	0.5667	0.5745	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2178	39.3252	39.6154	39.0424	39.0424	38.7669	38.4987	38.2379	37.9845	38.7669	38.2379	38.7669	(38)
Heat transfer coeff	97.5535	96.6609	96.9511	96.3780	96.3780	96.1025	95.8344	95.5736	95.3201	96.1025	95.5736	96.1025	(39)
Average = Sum(39)m / 12 =												96.2109	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2333	1.2220	1.2257	1.2184	1.2184	1.2149	1.2116	1.2083	1.2051	1.2149	1.2083	1.2149	(40)
HLP (average)												1.2163	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3081	56.8281	56.6580	56.9949	56.9949	57.1583	57.3182	57.4746	57.6275	57.1583	57.4746	57.1583	
alpha	4.7539	4.7885	4.7772	4.7997	4.7997	4.8106	4.8212	4.8316	4.8418	4.8106	4.8316	4.8106	
util living area													
	0.9893	0.9837	0.9667	0.9192	0.8116	0.6077	0.4498	0.4661	0.7266	0.9208	0.9777	0.9911	(86)
MIT	19.9503	20.0690	20.3072	20.6086	20.8490	20.9714	20.9946	20.9937	20.9337	20.6712	20.2902	19.9456	(87)
Th 2	19.8935	19.9024	19.8995	19.9053	19.9053	19.9081	19.9108	19.9134	19.9160	19.9081	19.9134	19.9081	(88)
util rest of house													
	0.9858	0.9784	0.9554	0.8910	0.7479	0.5038	0.3272	0.3399	0.6301	0.8865	0.9690	0.9881	(89)
MIT 2	18.5368	18.7142	19.0525	19.4724	19.7722	19.8927	19.9093	19.9117	19.8724	19.5656	19.0427	18.5408	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9724	0.9474	0.8844	0.7528	0.5231	0.3511	0.3645	0.6458	0.8815	0.9623	0.9838	(94)
Useful gains	667.4095	714.7771	750.4629	745.2511	640.4270	450.5115	288.1390	287.3195	483.6563	614.9572	637.6663	634.4139	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1357.0271	1321.9925	1192.0585	982.3272	720.9819	461.4454	289.3721	288.7535	512.6266	805.3174	1088.0373	1327.4531	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.0755	408.0487	328.5471	170.6948	59.9329	0.0000	0.0000	0.0000	0.0000	141.6280	324.2671	515.6212	(98)
Space heating												2461.8152	(98)
Space heating per m2											(98) / (4) =	31.1228	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2649.9626	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.0755	408.0487	328.5471	170.6948	59.9329	0.0000	0.0000	0.0000	0.0000	141.6280	324.2671	515.6212	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	552.2879	439.2344	353.6568	183.7403	64.5133	0.0000	0.0000	0.0000	0.0000	152.4521	349.0496	555.0282	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1095	89.0501	88.8829	88.4891	87.7097	86.7000	86.7000	86.7000	86.7000	88.3109	88.8831	89.1299	(217)
Fuel for water heating, kWh/month													
	182.1901	159.8184	166.1058	146.7079	142.9571	126.1921	118.3152	133.8039	134.8180	152.5823	163.8773	176.8110	(219)
Water heating fuel used												1804.1792	(219)
Annual totals kWh/year													
Space heating fuel - main system												2649.9626	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4199.2142	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2649.9626	7.3800	195.5672	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.1792	7.3800	133.1484	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			362.6534	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2649.9626	0.2160	572.3919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.1792	0.2160	389.7027	(264)
Space and water heating			962.0946	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			829.7872	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2649.9626	1.2200	3232.9543	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.1792	1.2200	2201.0986	(264)
Space and water heating			5434.0530	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4651.4253	(272)
Primary energy kWh/m2/year			58.8044	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.33 kg/m²	B 89	B 91
Total Savings	£58	2.33 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£436	£364	£72
Space heating	£324	£324	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£363	£305	£58
Total cost of uses	£362	£305	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	46 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.9300	
Infiltration rate			0.4910	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5322	0.5217	0.5113	0.4591	0.4487	0.3965	0.3965	0.3861	0.4174	0.4487	0.4695	0.4904	(22b)
Effective ac	0.6416	0.6361	0.6307	0.6054	0.6007	0.5786	0.5786	0.5745	0.5871	0.6007	0.6102	0.6203	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2924	42.9214	42.5577	40.8496	40.5300	39.0424	39.0424	38.7669	39.6154	40.5300	41.1765	41.8524	(38)
Heat transfer coeff	100.6280	100.2570	99.8934	98.1853	97.8657	96.3780	96.3780	96.1025	96.9511	97.8657	98.5122	99.1881	(39)
Average = Sum(39)m / 12 =												98.1837	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2722	1.2675	1.2629	1.2413	1.2372	1.2184	1.2184	1.2149	1.2257	1.2372	1.2454	1.2540	(40)
HLP (average)												1.2413	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747 (83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5877	54.7897	54.9892	55.9458	56.1285	56.9949	56.9949	57.1583	56.6580	56.1285	55.7602	55.3802	
alpha	4.6392	4.6526	4.6659	4.7297	4.7419	4.7997	4.7997	4.8106	4.7772	4.7419	4.7173	4.6920	
util living area													
	0.9922	0.9864	0.9740	0.9399	0.8583	0.6980	0.5313	0.5738	0.7990	0.9480	0.9856	0.9937	(86)
MIT	19.8046	19.9567	20.1945	20.5089	20.7765	20.9418	20.9873	20.9819	20.8845	20.5540	20.1316	19.7833	(87)
Th 2	19.8627	19.8664	19.8700	19.8871	19.8903	19.9053	19.9053	19.9081	19.8995	19.8903	19.8838	19.8771	(88)
util rest of house													
	0.9896	0.9820	0.9651	0.9183	0.8072	0.6021	0.4062	0.4479	0.7162	0.9248	0.9801	0.9916	(89)
MIT 2	18.3037	18.5265	18.8709	19.3246	19.6756	19.8675	19.9008	19.9009	19.8120	19.3964	18.7939	18.2830	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5944	18.8035	19.1272	19.5539	19.8888	20.0755	20.1112	20.1103	20.0197	19.6206	19.0529	18.5736	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5944	18.8035	19.1272	19.5539	19.8888	20.0755	20.1112	20.1103	20.0197	19.6206	19.0529	18.5736	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9763	0.9573	0.9103	0.8071	0.6182	0.4305	0.4722	0.7264	0.9176	0.9743	0.9881	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	646.9012	709.3020	743.1827	743.3626	676.0476	502.3452	334.8579	351.0796	518.5580	615.8193	618.0365	618.7489	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1438.4151	1393.9206	1261.3754	1046.0609	801.4047	527.7224	338.4065	356.5680	573.9241	882.8076	1177.5113	1425.6871	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	588.8863	460.0637	385.5354	217.9428	93.2656	0.0000	0.0000	0.0000	0.0000	198.6393	402.8219	600.3620	(98)
Space heating												2947.5170	(98)
Space heating per m2											(98) / (4) =	37.2632	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3172.7847	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	588.8863	460.0637	385.5354	217.9428	93.2656	0.0000	0.0000	0.0000	0.0000	198.6393	402.8219	600.3620	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	633.8927	495.2247	415.0004	234.5994	100.3936	0.0000	0.0000	0.0000	0.0000	213.8205	433.6080	646.2454	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2747	89.3039	89.3437	89.4231	89.5661	86.7000	86.7000	86.7000	86.7000	88.9355	89.1608	89.2871	(217)
Fuel for water heating, kWh/month	154.4988	113.7329	87.5685	41.1608	11.6977	0.0000	0.0000	21.4599	46.8301	92.9356	130.8796	153.6122	(219)
Water heating fuel used												854.3761	(219)
Annual totals kWh/year													
Space heating fuel - main system												3172.7847	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3891.4183	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3172.7847	3.4800	110.4129	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3761	3.4800	29.7323	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			242.2408	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8198	(257)
SAP value		88.5633	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3172.7847	0.2160	685.3215	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3761	0.2160	184.5452	(264)
Space and water heating			869.8667	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			799.4164 (272)
CO2 emissions per m2			10.1100 (273)
EI value			91.3681
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9300	
Infiltration rate		0.4910	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4174	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4382	0.4069	0.4174	0.3965	0.3965	0.3861	0.3756	0.3652	0.3548	0.3861	0.3652	0.3861	(22b)
Effective ac	0.5960	0.5828	0.5871	0.5786	0.5786	0.5745	0.5706	0.5667	0.5629	0.5745	0.5667	0.5745	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2178	39.3252	39.6154	39.0424	39.0424	38.7669	38.4987	38.2379	37.9845	38.7669	38.2379	38.7669	(38)
Heat transfer coeff	97.5535	96.6609	96.9511	96.3780	96.3780	96.1025	95.8344	95.5736	95.3201	96.1025	95.5736	96.1025	(39)
Average = Sum(39)m / 12 =												96.2109	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2333	1.2220	1.2257	1.2184	1.2184	1.2149	1.2116	1.2083	1.2051	1.2149	1.2083	1.2149	(40)
HLP (average)												1.2163	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168 (83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3081	56.8281	56.6580	56.9949	56.9949	57.1583	57.3182	57.4746	57.6275	57.1583	57.4746	57.1583	
alpha	4.7539	4.7885	4.7772	4.7997	4.7997	4.8106	4.8212	4.8316	4.8418	4.8106	4.8316	4.8106	
util living area													
	0.9893	0.9837	0.9667	0.9192	0.8116	0.6077	0.4498	0.4661	0.7266	0.9208	0.9777	0.9911	(86)
MIT	19.9503	20.0690	20.3072	20.6086	20.8490	20.9714	20.9946	20.9937	20.9337	20.6712	20.2902	19.9456	(87)
Th 2	19.8935	19.9024	19.8995	19.9053	19.9053	19.9081	19.9108	19.9134	19.9160	19.9081	19.9134	19.9081	(88)
util rest of house													
	0.9858	0.9784	0.9554	0.8910	0.7479	0.5038	0.3272	0.3399	0.6301	0.8865	0.9690	0.9881	(89)
MIT 2	18.5368	18.7142	19.0525	19.4724	19.7722	19.8927	19.9093	19.9117	19.8724	19.5656	19.0427	18.5408	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8106	18.9766	19.2955	19.6924	19.9808	20.1016	20.1195	20.1213	20.0779	19.7798	19.2843	18.8129	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9724	0.9474	0.8844	0.7528	0.5231	0.3511	0.3645	0.6458	0.8815	0.9623	0.9838	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.4095	714.7771	750.4629	745.2511	640.4270	450.5115	288.1390	287.3195	483.6563	614.9572	637.6663	634.4139	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1357.0271	1321.9925	1192.0585	982.3272	720.9819	461.4454	289.3721	288.7535	512.6266	805.3174	1088.0373	1327.4531	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	513.0755	408.0487	328.5471	170.6948	59.9329	0.0000	0.0000	0.0000	0.0000	141.6280	324.2671	515.6212	(98)
Space heating												2461.8152	(98)
Space heating per m2											(98) / (4) =	31.1228	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2649.9626	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	513.0755	408.0487	328.5471	170.6948	59.9329	0.0000	0.0000	0.0000	0.0000	141.6280	324.2671	515.6212	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	552.2879	439.2344	353.6568	183.7403	64.5133	0.0000	0.0000	0.0000	0.0000	152.4521	349.0496	555.0282	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2188	89.2425	89.2682	89.3285	89.2427	86.7000	86.7000	86.7000	86.7000	88.7293	89.0565	89.2202	(217)
Fuel for water heating, kWh/month	150.0048	114.0379	87.3178	40.0645	16.7426	0.0000	0.0000	14.5776	41.4721	88.8025	125.6866	150.3505	(219)
Water heating fuel used												829.0569	(219)
Annual totals kWh/year													
Space heating fuel - main system												2649.9626	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3274.0919	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2649.9626	7.3800	195.5672	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0569	7.3800	61.1844	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			305.0194	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2649.9626	0.2160	572.3919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0569	0.2160	179.0763	(264)
Space and water heating			751.4682	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			645.1108	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2649.9626	1.2200	3232.9543	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0569	1.2200	1011.4495	(264)
Space and water heating			4244.4038	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3615.2761	(272)
Primary energy kWh/m2/year			45.7051	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4700	87.1704	0.7200	0.7000	0.7650	195.7077
East	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
South	4.7500	118.5567	0.7200	0.7000	0.7650	195.4133
total:						412.8577

	Jun	Jul	Aug	
Solar gains	443	413	370	(P3)
Internal gains	425	408	416	
Total summer gains	869	821	786	(P5)
Summer gain/loss ratio	1.45	1.37	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 371 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	11 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.35	**TER**	18.73
Environmental	89 B	**% DER<TER**	23.39		
CO_2 Emissions (t/year)	0.81	**DFEE**	48.72	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.35	$kgCO_2/m^2$	Pass
	-4.38 (-23.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.79	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.72	$kWh/m^2/yr$	
	-4.1 (-7.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.93 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.47 m², No overhang
Windows facing East	0.50 m², No overhang
Windows facing South	4.75 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.93 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 372 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	15 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.25	**TER**	18.73
Environmental	90 B	**% DER<TER**	23.93		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.35	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.25 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.53 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.47 m², No overhang
Windows facing South: 4.75 m², No overhang
Windows facing West: 0.50 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.5300	
Infiltration rate		0.4710	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4004	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5105	0.5005	0.4905	0.4404	0.4304	0.3804	0.3804	0.3703	0.4004	0.4304	0.4504	0.4704	(22b)
Effective ac	0.6303	0.6252	0.6203	0.5970	0.5926	0.5723	0.5723	0.5686	0.5802	0.5926	0.6014	0.6107	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5299	42.1885	41.8539	40.2821	39.9880	38.6191	38.6191	38.3656	39.1464	39.9880	40.5829	41.2049	(38)
Heat transfer coeff	99.8656	99.5242	99.1895	97.6178	97.3237	95.9547	95.9547	95.7012	96.4820	97.3237	97.9186	98.5405	(39)
Average = Sum(39)m / 12 =												97.6164	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2625	1.2582	1.2540	1.2341	1.2304	1.2131	1.2131	1.2099	1.2197	1.2304	1.2379	1.2458	(40)
HLP (average)												1.2341	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	477.0559	549.5166	607.2180	658.9169	691.7088	675.7266	644.8450	608.1294	570.6205	516.5107	467.9015	450.7550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0045	55.1932	55.3794	56.2711	56.4411	57.2463	57.2463	57.3980	56.9335	56.4411	56.0982	55.7441	
alpha	4.6670	4.6795	4.6920	4.7514	4.7627	4.8164	4.8164	4.8265	4.7956	4.7627	4.7399	4.7163	
util living area													
	0.9979	0.9956	0.9898	0.9714	0.9168	0.7862	0.6226	0.6743	0.8845	0.9797	0.9958	0.9984	(86)
MIT	19.6135	19.7713	20.0244	20.3672	20.6830	20.9028	20.9757	20.9646	20.8112	20.4077	19.9540	19.5933	(87)
Th 2	19.8703	19.8737	19.8771	19.8928	19.8958	19.9095	19.9095	19.9121	19.9042	19.8958	19.8898	19.8836	(88)
util rest of house													
	0.9972	0.9941	0.9860	0.9595	0.8797	0.6949	0.4841	0.5381	0.8196	0.9690	0.9941	0.9979	(89)
MIT 2	18.0313	18.2638	18.6343	19.1377	19.5716	19.8410	19.9003	19.8968	19.7457	19.2031	18.5424	18.0109	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3377	18.5558	18.9036	19.3759	19.7868	20.0466	20.1085	20.1036	19.9521	19.4364	18.8158	18.3174	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3377	18.5558	18.9036	19.3759	19.7868	20.0466	20.1085	20.1036	19.9521	19.4364	18.8158	18.3174	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9913	0.9812	0.9521	0.8752	0.7079	0.5109	0.5641	0.8231	0.9628	0.9915	0.9967	(94)
Useful gains	474.9949	544.7607	595.8187	627.3659	605.3932	478.3353	329.4655	343.0306	469.6498	497.2980	463.9295	449.2543	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.8837	1359.0835	1230.3051	1022.6309	787.0420	522.6298	336.6613	354.4431	564.6194	859.9886	1147.1936	1391.1323	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	689.6053	547.2249	472.0579	284.5908	135.1467	0.0000	0.0000	0.0000	0.0000	269.8418	491.9501	700.7572	(98)
Space heating												3591.1747	(98)
Space heating per m2											(98) / (4) =	45.4004	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3865.6348 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	689.6053	547.2249	472.0579	284.5908	135.1467	0.0000	0.0000	0.0000	0.0000	269.8418	491.9501	700.7572	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	742.3092	589.0473	508.1355	306.3410	145.4754	0.0000	0.0000	0.0000	0.0000	290.4648	529.5481	754.3134	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2721	89.2203	89.1164	88.8724	88.3310	86.7000	86.7000	86.7000	86.7000	88.8083	89.1483	89.2949	(217)
Fuel for water heating, kWh/month													
	181.8582	159.5134	165.6706	146.0751	141.9515	126.1921	118.3152	133.8039	134.8180	151.7276	163.3898	176.4844	(219)
Water heating fuel used												1799.7999	(219)
Annual totals kWh/year													
Space heating fuel - main system												3865.6348	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	363.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =	-623.7532 -623.7532 (233)
Total delivered energy for all uses	5479.6922 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3865.6348	0.2160	834.9771	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.7999	0.2160	388.7568	(264)
Space and water heating			1223.7339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1127.3335	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.7942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.7942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	477.0823	539.8439	588.0165	629.9116	655.2236	637.9662	609.2357	578.4890	547.7005	503.7223	464.9574	452.6774	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9980	0.9958	0.9904	0.9727	0.9185	0.7849	0.6161	0.6656	0.8808	0.9795	0.9958	0.9984	(86)
MIT	19.7512	19.8932	20.1233	20.4334	20.7224	20.9193	20.9816	20.9730	20.8415	20.4758	20.0595	19.7277	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9973	0.9944	0.9868	0.9616	0.8831	0.6976	0.4863	0.5374	0.8174	0.9690	0.9941	0.9979	(89)
MIT 2	18.2906	18.4996	18.8360	19.2897	19.6863	19.9248	19.9751	19.9723	19.8448	19.3562	18.7512	18.2631	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9920	0.9826	0.9551	0.8795	0.7105	0.5115	0.5620	0.8218	0.9634	0.9917	0.9968	(94)
Useful gains	475.1132	535.4991	577.8028	601.6289	576.2885	453.2945	311.5936	325.0865	450.1118	485.2746	461.1168	451.2291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1307.1888	1266.8329	1146.5504	954.8726	735.0127	489.9841	317.0471	333.7823	529.5448	805.5876	1073.8016	1300.4123	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating												3217.3333	(98)
Space heating per m2											(98) / (4) =	40.6743	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3444.6823	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	662.8097	526.1845	453.0495	272.3078	126.4355	0.0000	0.0000	0.0000	0.0000	255.1529	472.3052	676.4372	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6916	87.4900	87.0827	86.1663	84.3321	80.3000	80.3000	80.3000	80.3000	85.8876	87.1908	87.7783	(217)
Fuel for water heating, kWh/month													
	229.7778	201.9477	211.0961	189.2230	187.1858	173.1411	165.8823	184.9199	186.9622	199.0435	209.2991	224.1395	(219)
Water heating fuel used												2362.6182	(219)
Annual totals kWh/year													
Space heating fuel - main system												3444.6823	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6245.3112	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3444.6823	0.2160	744.0514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2362.6182	0.2160	510.3255	(264)
Space and water heating			1254.3769	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1481.7044	(272)
Emissions per m2 for space and water heating			15.8581	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8581 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.5300	
Infiltration rate		0.3732	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3172	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4045	0.3965	0.3886	0.3490	0.3410	0.3014	0.3014	0.2934	0.3172	0.3410	0.3569	0.3728	(22b)
Effective ac	0.5818	0.5786	0.5755	0.5609	0.5582	0.5454	0.5454	0.5431	0.5503	0.5582	0.5637	0.5695	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2577	39.0434	38.8333	37.8465	37.6619	36.8024	36.8024	36.6433	37.1335	37.6619	38.0354	38.4258	(38)
Heat transfer coeff	96.5933	96.3790	96.1689	95.1822	94.9975	94.1381	94.1381	93.9789	94.4691	94.9975	95.3710	95.7615	(39)
Average = Sum(39)m / 12 =												95.1813	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2212	1.2184	1.2158	1.2033	1.2010	1.1901	1.1901	1.1881	1.1943	1.2010	1.2057	1.2106	(40)
HLP (average)												1.2033	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Average daily hot water use (litres/day)												92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	445.8067	519.0408	578.3472	632.2267	666.4348	652.4453	623.2557	584.3703	546.0890	489.7225	438.5650	420.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8678	56.9943	57.1188	57.7110	57.8231	58.3510	58.3510	58.4499	58.1466	57.8231	57.5967	57.3618	
alpha	4.7912	4.7996	4.8079	4.8474	4.8549	4.8901	4.8901	4.8967	4.8764	4.8549	4.8398	4.8241	
util living area													
	0.9985	0.9965	0.9914	0.9746	0.9226	0.7955	0.6314	0.6868	0.8942	0.9830	0.9968	0.9989	(86)
MIT	19.6310	19.7869	20.0367	20.3703	20.6840	20.9017	20.9756	20.9635	20.8074	20.4041	19.9557	19.6037	(87)
Th 2	19.9031	19.9053	19.9074	19.9173	19.9192	19.9279	19.9279	19.9295	19.9246	19.9192	19.9154	19.9115	(88)
util rest of house													
	0.9979	0.9953	0.9882	0.9640	0.8877	0.7064	0.4939	0.5517	0.8330	0.9740	0.9955	0.9985	(89)
MIT 2	18.6580	18.8152	19.0652	19.4009	19.6966	19.8799	19.9214	19.9186	19.8122	19.4389	18.9920	18.6374	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8465	19.0034	19.2533	19.5886	19.8878	20.0778	20.1256	20.1210	20.0050	19.6258	19.1787	18.8246	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8465	19.0034	19.2533	19.5886	19.8878	20.0778	20.1256	20.1210	20.0050	19.6258	19.1787	18.8246	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9856	0.9598	0.8864	0.7204	0.5208	0.5780	0.8385	0.9706	0.9942	0.9979	(94)
Useful gains	444.5614	515.8698	570.0085	606.8004	590.7492	470.0434	324.5955	337.7502	457.9162	475.3351	436.0201	419.3889	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1405.0910	1359.2677	1226.4751	1017.3671	777.8253	515.6722	331.8945	349.6916	557.8375	857.4293	1151.9546	1400.4714	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.6340	566.7634	488.4112	295.6080	139.1847	0.0000	0.0000	0.0000	0.0000	284.2780	515.4728	729.9254	(98)
Space heating												3734.2774	(98)
Space heating per m2											(98) / (4) =	47.2096	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	884.8980	696.6218	714.2399	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8152	0.8895	0.8622	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	721.4102	619.6526	615.8094	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	854.2159	818.2561	774.4877	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	95.6201	147.7610	118.0567	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												361.4378 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	23.9050	36.9402	29.5142	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												90.3594 (107)
Space cooling per m2												1.1423 (108)
Energy for space heating												47.2096 (99)
Energy for space cooling												1.1423 (108)
Total												48.3519 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	432.6789	496.5833	546.9855	591.6846	619.0388	604.3989	577.3560	543.8150	511.6262	464.7679	422.8326	409.0400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9987	0.9971	0.9930	0.9787	0.9325	0.8099	0.6442	0.6981	0.9029	0.9853	0.9973	0.9990	(86)
MIT	19.6990	19.8429	20.0767	20.3934	20.6932	20.9059	20.9776	20.9665	20.8171	20.4336	20.0103	19.6762	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9982	0.9961	0.9903	0.9698	0.9014	0.7256	0.5113	0.5681	0.8463	0.9774	0.9962	0.9987	(89)
MIT 2	18.7663	18.9118	19.1464	19.4676	19.7525	19.9353	19.9762	19.9738	19.8696	19.5114	19.0885	18.7512	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9949	0.9881	0.9661	0.9000	0.7388	0.5374	0.5934	0.8513	0.9745	0.9951	0.9982	(94)
Useful gains	431.6527	494.0705	540.4765	571.6393	557.1247	446.5595	310.2499	322.6928	435.5491	452.9156	420.7420	408.3093	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.3886	1296.2964	1168.5284	967.0818	739.2948	490.5081	317.0519	333.7766	530.9097	816.0872	1097.4693	1335.1805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	676.8435	539.0958	467.2707	284.7186	135.5346	0.0000	0.0000	0.0000	0.0000	270.1996	487.2436	689.5922	(98)
Space heating												3550.4987	(98)
Space heating per m2											(98) / (4) =	44.8862	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8173	0.8930	0.8672	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.2788	586.8368	584.0899	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	798.0578	764.6071	727.0854	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.3609	132.2611	106.3886	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												322.0106	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    20.8402    33.0653    26.5972     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          80.5027 (107)
Space cooling per m2                                                                                                                    1.0177 (108)
Energy for space heating                                                                                                               44.8862 (99)
Energy for space cooling                                                                                                                1.0177 (108)
Total                                                                                                                                  45.9039 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                    52.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.5300	
Infiltration rate		0.4710	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4004	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4204	0.3904	0.4004	0.3804	0.3804	0.3703	0.3603	0.3503	0.3403	0.3703	0.3503	0.3703	(22b)
Effective ac	0.5884	0.5762	0.5802	0.5723	0.5723	0.5686	0.5649	0.5614	0.5579	0.5686	0.5614	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7007	38.8793	39.1464	38.6191	38.6191	38.3656	38.1188	37.8788	37.6456	38.3656	37.8788	38.3656	(38)
Heat transfer coeff	97.0364	96.2150	96.4820	95.9547	95.9547	95.7012	95.4545	95.2145	94.9812	95.7012	95.2145	95.7012	(39)
Average = Sum(39)m / 12 =												95.8009	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2268	1.2164	1.2197	1.2131	1.2131	1.2099	1.2068	1.2037	1.2008	1.2099	1.2037	1.2099	(40)
HLP (average)												1.2111	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6082	57.0915	56.9335	57.2463	57.2463	57.3980	57.5463	57.6914	57.8331	57.3980	57.6914	57.3980	
alpha	4.7739	4.8061	4.7956	4.8164	4.8164	4.8265	4.8364	4.8461	4.8555	4.8265	4.8461	4.8265	
util living area													
	0.9892	0.9836	0.9665	0.9185	0.8102	0.6058	0.4481	0.4646	0.7251	0.9202	0.9776	0.9910	(86)
MIT	19.9588	20.0762	20.3139	20.6133	20.8516	20.9721	20.9947	20.9939	20.9349	20.6749	20.2951	19.9522	(87)
Th 2	19.8987	19.9069	19.9042	19.9095	19.9095	19.9121	19.9146	19.9170	19.9194	19.9121	19.9170	19.9121	(88)
util rest of house													
	0.9857	0.9783	0.9551	0.8902	0.7465	0.5023	0.3264	0.3391	0.6288	0.8858	0.9689	0.9880	(89)
MIT 2	18.5528	18.7278	19.0655	19.4820	19.7789	19.8971	19.9132	19.9154	19.8766	19.5737	19.0522	18.5532	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9723	0.9472	0.8837	0.7515	0.5216	0.3501	0.3636	0.6446	0.8809	0.9622	0.9838	(94)
Useful gains	667.3773	714.7101	750.2551	744.6996	639.2990	449.2294	287.3316	286.5612	482.7106	614.5227	637.5836	634.3966	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1351.2425	1317.0834	1187.4302	978.8451	718.3835	459.8750	288.5266	287.9539	511.1487	802.6471	1084.7748	1322.9870	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	508.7957	404.7949	325.2583	168.5848	58.8389	0.0000	0.0000	0.0000	0.0000	139.9646	321.9777	512.3113	(98)
Space heating												2440.5260	(98)
RHI space heating demand												2441	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.5300
Infiltration rate		0.4710 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4004 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5105	0.5005	0.4905	0.4404	0.4304	0.3804	0.3804	0.3703	0.4004	0.4304	0.4504	0.4704	(22b)
Effective ac	0.6303	0.6252	0.6203	0.5970	0.5926	0.5723	0.5723	0.5686	0.5802	0.5926	0.6014	0.6107	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss (33) + (36) =	57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5299	42.1885	41.8539	40.2821	39.9880	38.6191	38.6191	38.3656	39.1464	39.9880	40.5829	41.2049	(38)
Heat transfer coeff	99.8656	99.5242	99.1895	97.6178	97.3237	95.9547	95.9547	95.7012	96.4820	97.3237	97.9186	98.5405	(39)
Average = Sum(39)m / 12 =												97.6164	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2625	1.2582	1.2540	1.2341	1.2304	1.2131	1.2131	1.2099	1.2197	1.2304	1.2379	1.2458	(40)
HLP (average)												1.2341	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0045	55.1932	55.3794	56.2711	56.4411	57.2463	57.2463	57.3980	56.9335	56.4411	56.0982	55.7441	
alpha	4.6670	4.6795	4.6920	4.7514	4.7627	4.8164	4.8164	4.8265	4.7956	4.7627	4.7399	4.7163	
util living area													
	0.9921	0.9864	0.9737	0.9393	0.8569	0.6961	0.5293	0.5719	0.7973	0.9475	0.9855	0.9936	(86)
MIT	19.8173	19.9687	20.2049	20.5157	20.7807	20.9432	20.9877	20.9824	20.8868	20.5597	20.1400	19.7942	(87)
Th 2	19.8703	19.8737	19.8771	19.8928	19.8958	19.9095	19.9095	19.9121	19.9042	19.8958	19.8898	19.8836	(88)
util rest of house													
	0.9896	0.9819	0.9648	0.9176	0.8057	0.6005	0.4050	0.4467	0.7146	0.9242	0.9800	0.9916	(89)
MIT 2	18.3275	18.5489	18.8908	19.3383	19.6853	19.8726	19.9052	19.9052	19.8185	19.4083	18.8102	18.3034	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6160	18.8239	19.1453	19.5663	19.8975	20.0800	20.1149	20.1138	20.0255	19.6313	19.0678	18.5921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6160	18.8239	19.1453	19.5663	19.8975	20.0800	20.1149	20.1138	20.0255	19.6313	19.0678	18.5921	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9762	0.9571	0.9097	0.8058	0.6166	0.4292	0.4709	0.7249	0.9170	0.9742	0.9881	(94)
Useful gains	646.8856	709.2342	742.9805	742.8569	674.9172	501.0525	333.8282	350.0787	517.4864	615.4710	617.9776	618.7429	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1429.6790	1385.7605	1254.2803	1041.2220	797.8073	525.8280	337.2678	355.4153	571.6997	878.9561	1171.8666	1418.2068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	582.3983	454.6257	380.4071	214.8229	91.4302	0.0000	0.0000	0.0000	0.0000	196.0329	398.8001	594.8012	(98)
Space heating												2913.3183	(98)
Space heating per m2											(98) / (4) =	36.8308	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3135.9723	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	582.3983	454.6257	380.4071	214.8229	91.4302	0.0000	0.0000	0.0000	0.0000	196.0329	398.8001	594.8012	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	626.9089	489.3710	409.4802	231.2410	98.4179	0.0000	0.0000	0.0000	0.0000	211.0150	429.2788	640.2596	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1825	89.1158	88.9817	88.6673	88.0212	86.7000	86.7000	86.7000	86.7000	88.5684	89.0210	89.2103	(217)
Fuel for water heating, kWh/month													
	182.0410	159.7005	165.9212	146.4131	142.4511	126.1921	118.3152	133.8039	134.8180	152.1387	163.6235	176.6517	(219)
Water heating fuel used												1802.0701	(219)
Annual totals kWh/year													
Space heating fuel - main system												3135.9723	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4752.2999	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3135.9723	3.4800	109.1318	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.0701	3.4800	62.7120	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			267.3444	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9048	(257)
SAP value		87.3782	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3135.9723	0.2160	677.3700	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.0701	0.2160	389.2471	(264)
Space and water heating			1066.6172	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			970.2168	(272)
CO2 emissions per m2			12.2700	(273)
EI value			89.5238	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8813 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8813 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.5300	
Infiltration rate		0.4710	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4004	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4204	0.3904	0.4004	0.3804	0.3804	0.3703	0.3603	0.3503	0.3403	0.3703	0.3503	0.3703	(22b)
Effective ac	0.5884	0.5762	0.5802	0.5723	0.5723	0.5686	0.5649	0.5614	0.5579	0.5686	0.5614	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7007	38.8793	39.1464	38.6191	38.6191	38.3656	38.1188	37.8788	37.6456	38.3656	37.8788	38.3656	(38)
Heat transfer coeff	97.0364	96.2150	96.4820	95.9547	95.9547	95.7012	95.4545	95.2145	94.9812	95.7012	95.2145	95.7012	(39)
Average = Sum(39)m / 12 =												95.8009	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2268	1.2164	1.2197	1.2131	1.2131	1.2099	1.2068	1.2037	1.2008	1.2099	1.2037	1.2099	(40)
HLP (average)												1.2111	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6082	57.0915	56.9335	57.2463	57.2463	57.3980	57.5463	57.6914	57.8331	57.3980	57.6914	57.3980	
alpha	4.7739	4.8061	4.7956	4.8164	4.8164	4.8265	4.8364	4.8461	4.8555	4.8265	4.8461	4.8265	
util living area													
	0.9892	0.9836	0.9665	0.9185	0.8102	0.6058	0.4481	0.4646	0.7251	0.9202	0.9776	0.9910	(86)
MIT	19.9588	20.0762	20.3139	20.6133	20.8516	20.9721	20.9947	20.9939	20.9349	20.6749	20.2951	19.9522	(87)
Th 2	19.8987	19.9069	19.9042	19.9095	19.9095	19.9121	19.9146	19.9170	19.9194	19.9121	19.9170	19.9121	(88)
util rest of house													
	0.9857	0.9783	0.9551	0.8902	0.7465	0.5023	0.3264	0.3391	0.6288	0.8858	0.9689	0.9880	(89)
MIT 2	18.5528	18.7278	19.0655	19.4820	19.7789	19.8971	19.9132	19.9154	19.8766	19.5737	19.0522	18.5532	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9723	0.9472	0.8837	0.7515	0.5216	0.3501	0.3636	0.6446	0.8809	0.9622	0.9838	(94)
Useful gains	667.3773	714.7101	750.2551	744.6996	639.2990	449.2294	287.3316	286.5612	482.7106	614.5227	637.5836	634.3966	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1351.2425	1317.0834	1187.4302	978.8451	718.3835	459.8750	288.5266	287.9539	511.1487	802.6471	1084.7748	1322.9870	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	508.7957	404.7949	325.2583	168.5848	58.8389	0.0000	0.0000	0.0000	0.0000	139.9646	321.9777	512.3113	(98)
Space heating												2440.5260	(98)
Space heating per m2											(98) / (4) =	30.8537	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2627.0463	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	508.7957	404.7949	325.2583	168.5848	58.8389	0.0000	0.0000	0.0000	0.0000	139.9646	321.9777	512.3113	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	547.6810	435.7318	350.1166	181.4691	63.3358	0.0000	0.0000	0.0000	0.0000	150.6616	346.5852	551.4653	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1045	89.0451	88.8759	88.4793	87.6970	86.7000	86.7000	86.7000	86.7000	88.3014	88.8782	89.1261	(217)
Fuel for water heating, kWh/month													
	182.2003	159.8274	166.1189	146.7242	142.9777	126.1921	118.3152	133.8039	134.8180	152.5987	163.8864	176.8185	(219)
Water heating fuel used												1804.2813	(219)
Annual totals kWh/year													
Space heating fuel - main system												2627.0463	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4176.4001	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2627.0463	7.3800	193.8760	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.2813	7.3800	133.1560	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			360.9697	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2627.0463	0.2160	567.4420	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.2813	0.2160	389.7248	(264)
Space and water heating			957.1668	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			824.8594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2627.0463	1.2200	3204.9965	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.2813	1.2200	2201.2232	(264)
Space and water heating			5406.2197	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4623.5921	(272)
Primary energy kWh/m2/year			58.4525	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.33 kg/m²	B 89	B 91
Total Savings	£58	2.33 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£434	£362	£72
Space heating	£322	£322	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£361	£303	£58
Total cost of uses	£360	£303	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.5300	
Infiltration rate			0.4710	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4004	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5105	0.5005	0.4905	0.4404	0.4304	0.3804	0.3804	0.3703	0.4004	0.4304	0.4504	0.4704	(22b)
Effective ac	0.6303	0.6252	0.6203	0.5970	0.5926	0.5723	0.5723	0.5686	0.5802	0.5926	0.6014	0.6107	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5299	42.1885	41.8539	40.2821	39.9880	38.6191	38.6191	38.3656	39.1464	39.9880	40.5829	41.2049	(38)
Heat transfer coeff	99.8656	99.5242	99.1895	97.6178	97.3237	95.9547	95.9547	95.7012	96.4820	97.3237	97.9186	98.5405	(39)
Average = Sum(39)m / 12 =												97.6164	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2625	1.2582	1.2540	1.2341	1.2304	1.2131	1.2131	1.2099	1.2197	1.2304	1.2379	1.2458	(40)
HLP (average)												1.2341	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747 (83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0045	55.1932	55.3794	56.2711	56.4411	57.2463	57.2463	57.3980	56.9335	56.4411	56.0982	55.7441	
alpha	4.6670	4.6795	4.6920	4.7514	4.7627	4.8164	4.8164	4.8265	4.7956	4.7627	4.7399	4.7163	
util living area													
	0.9921	0.9864	0.9737	0.9393	0.8569	0.6961	0.5293	0.5719	0.7973	0.9475	0.9855	0.9936	(86)
MIT	19.8173	19.9687	20.2049	20.5157	20.7807	20.9432	20.9877	20.9824	20.8868	20.5597	20.1400	19.7942	(87)
Th 2	19.8703	19.8737	19.8771	19.8928	19.8958	19.9095	19.9095	19.9121	19.9042	19.8958	19.8898	19.8836	(88)
util rest of house													
	0.9896	0.9819	0.9648	0.9176	0.8057	0.6005	0.4050	0.4467	0.7146	0.9242	0.9800	0.9916	(89)
MIT 2	18.3275	18.5489	18.8908	19.3383	19.6853	19.8726	19.9052	19.9052	19.8185	19.4083	18.8102	18.3034	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6160	18.8239	19.1453	19.5663	19.8975	20.0800	20.1149	20.1138	20.0255	19.6313	19.0678	18.5921	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6160	18.8239	19.1453	19.5663	19.8975	20.0800	20.1149	20.1138	20.0255	19.6313	19.0678	18.5921	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9762	0.9571	0.9097	0.8058	0.6166	0.4292	0.4709	0.7249	0.9170	0.9742	0.9881	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	646.8856	709.2342	742.9805	742.8569	674.9172	501.0525	333.8282	350.0787	517.4864	615.4710	617.9776	618.7429	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1429.6790	1385.7605	1254.2803	1041.2220	797.8073	525.8280	337.2678	355.4153	571.6997	878.9561	1171.8666	1418.2068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	582.3983	454.6257	380.4071	214.8229	91.4302	0.0000	0.0000	0.0000	0.0000	196.0329	398.8001	594.8012	(98)

Space heating 2913.3183 (98)
Space heating per m2 (98) / (4) = 36.8308 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3135.9723 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	582.3983	454.6257	380.4071	214.8229	91.4302	0.0000	0.0000	0.0000	0.0000	196.0329	398.8001	594.8012	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	626.9089	489.3710	409.4802	231.2410	98.4179	0.0000	0.0000	0.0000	0.0000	211.0150	429.2788	640.2596	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2691	89.2981	89.3375	89.4172	89.5602	86.7000	86.7000	86.7000	86.7000	88.9266	89.1551	89.2825	(217)
Fuel for water heating, kWh/month	154.5085	113.7403	87.5746	41.1635	11.6984	0.0000	0.0000	21.4599	46.8301	92.9449	130.8880	153.6202	(219)

Water heating fuel used 854.4283 (219)
Annual totals kWh/year
Space heating fuel - main system 3135.9723 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) = -623.7532 -623.7532 (233)
Total delivered energy for all uses 3854.6582 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3135.9723	3.4800	109.1318	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.4283	3.4800	29.7341	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			240.9615	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8155 (257)
SAP value 88.6237
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3135.9723	0.2160	677.3700	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.4283	0.2160	184.5565	(264)
Space and water heating			861.9265	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			791.4762 (272)
CO2 emissions per m2			10.0100 (273)
EI value			91.4538
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.5300	
Infiltration rate		0.4710	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4004	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4204	0.3904	0.4004	0.3804	0.3804	0.3703	0.3603	0.3503	0.3403	0.3703	0.3503	0.3703	(22b)
Effective ac	0.5884	0.5762	0.5802	0.5723	0.5723	0.5686	0.5649	0.5614	0.5579	0.5686	0.5614	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7007	38.8793	39.1464	38.6191	38.6191	38.3656	38.1188	37.8788	37.6456	38.3656	37.8788	38.3656	(38)
Heat transfer coeff	97.0364	96.2150	96.4820	95.9547	95.9547	95.7012	95.4545	95.2145	94.9812	95.7012	95.2145	95.7012	(39)
Average = Sum(39)m / 12 =												95.8009	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2268	1.2164	1.2197	1.2131	1.2131	1.2099	1.2068	1.2037	1.2008	1.2099	1.2037	1.2099	(40)
HLP (average)												1.2111	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168 (83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6082	57.0915	56.9335	57.2463	57.2463	57.3980	57.5463	57.6914	57.8331	57.3980	57.6914	57.3980	
alpha	4.7739	4.8061	4.7956	4.8164	4.8164	4.8265	4.8364	4.8461	4.8555	4.8265	4.8461	4.8265	
util living area													
	0.9892	0.9836	0.9665	0.9185	0.8102	0.6058	0.4481	0.4646	0.7251	0.9202	0.9776	0.9910	(86)
MIT	19.9588	20.0762	20.3139	20.6133	20.8516	20.9721	20.9947	20.9939	20.9349	20.6749	20.2951	19.9522	(87)
Th 2	19.8987	19.9069	19.9042	19.9095	19.9095	19.9121	19.9146	19.9170	19.9194	19.9121	19.9170	19.9121	(88)
util rest of house													
	0.9857	0.9783	0.9551	0.8902	0.7465	0.5023	0.3264	0.3391	0.6288	0.8858	0.9689	0.9880	(89)
MIT 2	18.5528	18.7278	19.0655	19.4820	19.7789	19.8971	19.9132	19.9154	19.8766	19.5737	19.0522	18.5532	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8251	18.9890	19.3073	19.7011	19.9867	20.1053	20.1227	20.1243	20.0816	19.7870	19.2930	18.8241	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9723	0.9472	0.8837	0.7515	0.5216	0.3501	0.3636	0.6446	0.8809	0.9622	0.9838	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.3773	714.7101	750.2551	744.6996	639.2990	449.2294	287.3316	286.5612	482.7106	614.5227	637.5836	634.3966 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1351.2425	1317.0834	1187.4302	978.8451	718.3835	459.8750	288.5266	287.9539	511.1487	802.6471	1084.7748	1322.9870 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	508.7957	404.7949	325.2583	168.5848	58.8389	0.0000	0.0000	0.0000	0.0000	139.9646	321.9777	512.3113 (98)
Space heating												2440.5260 (98)
Space heating per m2											(98) / (4) =	30.8537 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2627.0463 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	508.7957	404.7949	325.2583	168.5848	58.8389	0.0000	0.0000	0.0000	0.0000	139.9646	321.9777	512.3113	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	547.6810	435.7318	350.1166	181.4691	63.3358	0.0000	0.0000	0.0000	0.0000	150.6616	346.5852	551.4653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2142	89.2383	89.2631	89.3227	89.2330	86.7000	86.7000	86.7000	86.7000	88.7205	89.0521	89.2167	(217)
Fuel for water heating, kWh/month	150.0124	114.0432	87.3228	40.0672	16.7444	0.0000	0.0000	14.5776	41.4721	88.8113	125.6929	150.3563	(219)
Water heating fuel used												829.1002	(219)
Annual totals kWh/year													
Space heating fuel - main system												2627.0463	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3251.2189	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2627.0463	7.3800	193.8760	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.1002	7.3800	61.1876	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			303.3314	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2627.0463	0.2160	567.4420	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1002	0.2160	179.0856	(264)
Space and water heating			746.5276	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			640.1702	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2627.0463	1.2200	3204.9965	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1002	1.2200	1011.5022	(264)
Space and water heating			4216.4987	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3587.3710	(272)
Primary energy kWh/m2/year			45.3524	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4700	87.1704	0.7200	0.7000	0.7650	195.7077
South	4.7500	118.5567	0.7200	0.7000	0.7650	195.4133
West	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
total:						412.8577

	Jun	Jul	Aug	
Solar gains	443	413	370	(P3)
Internal gains	425	408	416	
Total summer gains	869	821	786	(P5)
Summer gain/loss ratio	1.45	1.37	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 372 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	15 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.25	**TER**	18.73
Environmental	90 B	**% DER<TER**	23.93		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.35	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.41		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.25	$kgCO_2/m^2$	Pass
	-4.48 (-23.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.79	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.35	$kWh/m^2/yr$	
	-4.4 (-8.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.53 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	6.47 m², No overhang 4.75 m², No overhang 0.50 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.53 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 373 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	17 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.51	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.08		
CO_2 Emissions (t/year)	1.12	**DFEE**	53.73	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 117 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.51 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.7 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.34 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.90 (measured in this dwelling)
Maximum                                 10.0                                    OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing North:                   8.79 m², No overhang
Windows facing South:                   7.03 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.020 W/m²K
Photovoltaic array                      1.10 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098	(22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.7652	59.3820	59.0064	57.2422	56.9122	55.3757	55.3757	55.0911	55.9675	56.9122	57.5799	58.2780	(38)
Heat transfer coeff	149.2216	148.8384	148.4628	146.6987	146.3686	144.8321	144.8321	144.5475	145.4239	146.3686	147.0363	147.7344	(39)
Average = Sum(39)m / 12 =												146.6971	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2706	1.2674	1.2642	1.2491	1.2463	1.2332	1.2332	1.2308	1.2383	1.2463	1.2520	1.2580	(40)
HLP (average)												1.2491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	456.1245	453.6518	436.8767	409.7601	381.8770	355.4447	338.5930	345.3364	359.5722	386.9219	418.2604	442.0964	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	603.5642	704.0425	782.3709	850.7092	893.3141	872.4449	833.0682	784.7848	737.2004	663.9652	594.6032	568.5042	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6540	54.7947	54.9333	55.5939	55.7193	56.3104	56.3104	56.4213	56.0813	55.7193	55.4663	55.2042	
alpha	4.6436	4.6530	4.6622	4.7063	4.7146	4.7540	4.7540	4.7614	4.7388	4.7146	4.6978	4.6803	
util living area													
	0.9990	0.9976	0.9943	0.9834	0.9481	0.8502	0.7010	0.7517	0.9258	0.9886	0.9979	0.9992	(86)
MIT	19.5218	19.6737	19.9230	20.2628	20.5959	20.8542	20.9580	20.9409	20.7474	20.3195	19.8612	19.4990	(87)
Th 2	19.8639	19.8665	19.8690	19.8809	19.8831	19.8935	19.8935	19.8954	19.8895	19.8831	19.8786	19.8739	(88)
util rest of house													
	0.9986	0.9968	0.9921	0.9760	0.9215	0.7689	0.5546	0.6132	0.8757	0.9822	0.9969	0.9989	(89)
MIT 2	17.8929	18.1168	18.4822	18.9828	19.4520	19.7829	19.8762	19.8677	19.6632	19.0698	18.3997	17.8664	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.1564	18.3687	18.7153	19.1899	19.6371	19.9562	20.0512	20.0413	19.8386	19.2720	18.6361	18.1305	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1564	18.3687	18.7153	19.1899	19.6371	19.9562	20.0512	20.0413	19.8386	19.2720	18.6361	18.1305	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9886	0.9695	0.9139	0.7744	0.5777	0.6340	0.8727	0.9770	0.9953	0.9982	(94)
Useful gains	602.1581	700.5239	773.4640	824.7457	816.3595	675.6375	481.2321	497.5928	643.3756	648.6674	591.7900	567.5049	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2067.6806	2004.6524	1813.5183	1509.5152	1161.7373	775.7539	499.8462	526.3460	834.5276	1269.3041	1696.2299	2058.0178	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1090.3487	876.3744	773.8004	493.0340	256.9611	0.0000	0.0000	0.0000	0.0000	461.7537	795.1967	1108.9416	(98)
Space heating												5856.4106	(98)
Space heating per m2											(98) / (4) =	49.8673	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6303.9942	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1090.3487	876.3744	773.8004	493.0340	256.9611	0.0000	0.0000	0.0000	0.0000	461.7537	795.1967	1108.9416	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1173.6800	943.3524	832.9391	530.7147	276.5997	0.0000	0.0000	0.0000	0.0000	497.0438	855.9706	1193.6939	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4364	89.4010	89.3295	89.1630	88.7590	86.7000	86.7000	86.7000	86.7000	89.1031	89.3483	89.4547	(217)
Fuel for water heating, kWh/month													
	199.1940	174.6562	181.2552	159.5638	154.7260	138.0806	129.3317	146.4468	147.6134	165.7279	178.8027	193.2780	(219)
Water heating fuel used												1968.6763	(219)
Annual totals kWh/year													
Space heating fuel - main system												6303.9942	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												7887.8540	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6303.9942	0.2160	1361.6627	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.6763	0.2160	425.2341	(264)
Space and water heating			1786.8968	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total CO2, kg/year			1587.1771	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5100	ZC1
Total Floor Area	TFA	117.4400	
Assumed number of occupants	N	2.8529	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2212	ZC2
CO2 emissions from cooking, equation (L16)		1.5963	ZC3
Total CO2 emissions		29.3275	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.3275	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3823	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2738	48.8380	45.2514	46.7598	48.8380	49.2738	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
								Total per year (kWh/year) = Sum(64)m =				2191.5671	(64)
Heat gains from water heating, kWh/month													
	68.0400	59.8728	62.6490	55.8306	53.9604	47.3407	45.0751	50.5194	51.0859	57.9195	61.6460	66.2950	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	91.4516	89.0964	84.2057	77.5425	72.5275	65.7510	60.5848	67.9025	70.9527	77.8488	85.6194	89.1062	(72)
Total internal gains													
	469.2708	466.8008	450.0312	422.9078	394.3338	367.2120	350.3657	357.7982	372.7274	400.0836	431.4133	455.2454	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	598.2806	685.8927	752.3387	808.7383	841.8413	819.5873	783.0315	742.3156	703.1520	642.4964	585.7133	565.8522	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9991	0.9979	0.9950	0.9849	0.9507	0.8501	0.6941	0.7436	0.9249	0.9892	0.9980	0.9993	(86)
MIT	19.6598	19.7980	20.0262	20.3380	20.6438	20.8784	20.9682	20.9546	20.7853	20.3938	19.9720	19.6378	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9987	0.9972	0.9930	0.9783	0.9260	0.7727	0.5571	0.6131	0.8765	0.9832	0.9972	0.9991	(89)
MIT 2	18.1554	18.3590	18.6937	19.1531	19.5843	19.8842	19.9642	19.9577	19.7800	19.2380	18.6215	18.1294	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9957	0.9901	0.9727	0.9194	0.7787	0.5788	0.6330	0.8746	0.9786	0.9958	0.9985	(94)
Useful gains	597.0587	682.9412	744.9099	786.6699	773.9910	638.2325	453.2416	469.9028	614.9759	628.7219	583.2258	564.9797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1922.2555	1862.2151	1683.7369	1401.1974	1078.3872	721.6497	467.3891	491.9640	777.3351	1181.3694	1578.3831	1914.1382	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating												5277.2932	(98)
Space heating per m2											(98) / (4) =	44.9361	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5650.2069	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1055.6171	848.4712	747.8451	473.7256	242.4741	0.0000	0.0000	0.0000	0.0000	440.2245	767.1448	1074.7044	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3924	88.2401	87.9281	87.2257	85.7099	80.3000	80.3000	80.3000	80.3000	86.9818	88.0068	88.4596	(217)
Fuel for water heating, kWh/month													
	245.8079	217.0089	228.6666	206.5187	203.4827	191.2901	183.2705	204.3037	206.5600	214.8010	224.5707	239.6884	(219)
Water heating fuel used												2565.9692	(219)
Annual totals kWh/year													
Space heating fuel - main system												5650.2069	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Total delivered energy for all uses												8771.2617	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5650.2069	0.2160	1220.4447	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.9692	0.2160	554.2493	(264)
Space and water heating			1774.6940	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Total CO2, kg/m2/year			2062.7834	(272)
Emissions per m2 for space and water heating			15.1115	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1216	(272b)
Emissions per m2 for pumps and fans			0.3314	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1115 * 1.00) + 2.1216 + 0.3314, rounded to 2 d.p.			17.5600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.3773	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3207	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4089	0.4009	0.3928	0.3527	0.3447	0.3046	0.3046	0.2966	0.3207	0.3447	0.3608	0.3768	(22b)
Effective ac	0.5836	0.5803	0.5772	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5651	0.5710	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.2388	57.9149	57.5974	56.1061	55.8271	54.5283	54.5283	54.2877	55.0286	55.8271	56.3916	56.9817	(38)
Heat transfer coeff	147.6952	147.3713	147.0538	145.5626	145.2835	143.9847	143.9847	143.7442	144.4850	145.2835	145.8480	146.4381	(39)
Average = Sum(39)m / 12 =												145.5612	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2576	1.2549	1.2522	1.2395	1.2371	1.2260	1.2260	1.2240	1.2303	1.2371	1.2419	1.2469	(40)
HLP (average)												1.2395	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	569.7620	671.0930	751.1920	821.9374	866.1077	847.4409	809.9340	759.2525	710.8143	635.0876	562.9124	535.5510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2188	55.3402	55.4597	56.0278	56.1354	56.6418	56.6418	56.7366	56.4457	56.1354	55.9182	55.6929	
alpha	4.6813	4.6893	4.6973	4.7352	4.7424	4.7761	4.7761	4.7824	4.7630	4.7424	4.7279	4.7129	
util living area													
	0.9992	0.9981	0.9952	0.9854	0.9528	0.8596	0.7127	0.7654	0.9332	0.9904	0.9983	0.9994	(86)
MIT	19.5120	19.6637	19.9129	20.2514	20.5860	20.8477	20.9556	20.9368	20.7371	20.3057	19.8475	19.4874	(87)
Th 2	19.8742	19.8764	19.8785	19.8886	19.8904	19.8992	19.8992	19.9009	19.8958	19.8904	19.8866	19.8826	(88)
util rest of house													
	0.9989	0.9974	0.9933	0.9788	0.9281	0.7808	0.5666	0.6283	0.8867	0.9850	0.9976	0.9992	(89)
MIT 2	18.5164	18.6697	18.9197	19.2630	19.5865	19.8193	19.8865	19.8802	19.7326	19.3203	18.8615	18.4985	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6775	18.8305	19.0804	19.4229	19.7482	19.9857	20.0595	20.0512	19.8951	19.4798	19.0210	18.6585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6775	18.8305	19.0804	19.4229	19.7482	19.9857	20.0595	20.0512	19.8951	19.4798	19.0210	18.6585	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9964	0.9913	0.9750	0.9240	0.7883	0.5903	0.6499	0.8866	0.9821	0.9967	0.9989	(94)
Useful gains	568.8798	668.7025	744.6840	801.3758	800.2556	667.9969	478.0934	493.4039	630.2399	623.7031	561.0689	534.9361	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2123.4898	2052.9564	1849.9964	1531.7360	1169.2673	775.4599	498.1135	524.8331	837.3036	1290.0839	1738.6565	2117.2709	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1156.6299	930.2186	822.3525	525.8593	274.5448	0.0000	0.0000	0.0000	0.0000	495.7873	847.8630	1177.2571	(98)
Space heating												6230.5124	(98)
Space heating per m2											(98) / (4) =	53.0527	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1353.4561	1065.4867	1092.4557	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7340	0.8242	0.7894	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	993.4307	878.2002	862.4124	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0102	1058.7086	1001.8556	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	80.3373	134.2983	103.7457	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												318.3813	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   20.0843   33.5746   25.9364    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              79.5953 (107)
Space cooling per m2                                                                                                        0.6778 (108)
Energy for space heating                                                                                                   53.0527 (99)
Energy for space cooling                                                                                                    0.6778 (108)
Total                                                                                                                      53.7305 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                      53.7 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3823 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	551.3321	639.7941	708.0052	766.8188	802.1780	782.8159	748.1246	704.3214	663.6108	600.4572	540.8695	519.7501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9994	0.9985	0.9962	0.9879	0.9587	0.8677	0.7178	0.7697	0.9382	0.9919	0.9986	0.9995	(86)
MIT	19.6225	19.7616	19.9917	20.3068	20.6187	20.8644	20.9629	20.9467	20.7630	20.3618	19.9365	19.6010	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9991	0.9979	0.9946	0.9825	0.9371	0.7946	0.5801	0.6405	0.8958	0.9873	0.9980	0.9994	(89)
MIT 2	18.6879	18.8286	19.0599	19.3809	19.6839	19.9048	19.9666	19.9614	19.8240	19.4386	19.0121	18.6735	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9931	0.9794	0.9335	0.8016	0.6024	0.6609	0.8959	0.9849	0.9974	0.9991	(94)
Useful gains	550.6590	638.0132	703.1465	751.0311	748.8526	627.4996	450.6595	465.4570	594.5591	591.4016	539.4500	519.2829	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1982.2899	1914.9463	1724.6217	1426.1308	1089.0156	723.6310	467.5504	492.2031	781.7717	1203.1824	1621.6299	1974.9303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1065.1334	858.0990	759.9775	486.0717	253.0813	0.0000	0.0000	0.0000	0.0000	455.1649	779.1695	1083.0017	(98)
Space heating												5739.6992	(98)
Space heating per m2											(98) / (4) =	48.8735	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8038	980.7392	1005.3689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7475	0.8386	0.8058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.2544	822.4029	810.1758	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1029.4744	986.4639	937.6505	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.7185	122.0614	94.8411	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												287.6210	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   17.6796   30.5153   23.7103    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              71.9052 (107)
Space cooling per m2                                                                                                        0.6123 (108)
Energy for space heating                                                                                                   48.8735 (99)
Energy for space cooling                                                                                                    0.6123 (108)
Total                                                                                                                      49.4857 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        56.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3662	0.3401	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2965	0.3226	0.3052	0.3226	(22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.5897	55.6678	55.9675	55.3757	55.3757	55.0911	54.8142	54.5448	54.2830	55.0911	54.5448	55.0911	(38)
Heat transfer coeff	146.0461	145.1242	145.4239	144.8321	144.8321	144.5475	144.2706	144.0012	143.7394	144.5475	144.0012	144.5475	(39)
Average = Sum(39)m / 12 =												144.6595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2436	1.2357	1.2383	1.2332	1.2332	1.2308	1.2285	1.2262	1.2239	1.2308	1.2262	1.2308	(40)
HLP (average)												1.2318	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
RHI water heating demand												1743	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8423	56.1971	56.0813	56.3104	56.3104	56.4213	56.5296	56.6353	56.7385	56.4213	56.6353	56.4213	
alpha	4.7228	4.7465	4.7388	4.7540	4.7540	4.7614	4.7686	4.7757	4.7826	4.7614	4.7757	4.7614	
util living area													
	0.9944	0.9912	0.9811	0.9508	0.8718	0.6870	0.5205	0.5393	0.8008	0.9525	0.9881	0.9955	(86)
MIT	19.8257	19.9381	20.1817	20.4986	20.7802	20.9503	20.9894	20.9878	20.8938	20.5771	20.1690	19.8169	(87)
Th 2	19.8853	19.8915	19.8895	19.8935	19.8935	19.8954	19.8973	19.8991	19.9009	19.8954	19.8991	19.8954	(88)
util rest of house													
	0.9925	0.9882	0.9741	0.9311	0.8180	0.5776	0.3800	0.3951	0.7091	0.9286	0.9831	0.9939	(89)
MIT 2	18.3510	18.5185	18.8690	19.3195	19.6887	19.8670	19.8943	19.8957	19.8260	19.4358	18.8603	18.3454	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9672	0.9224	0.8164	0.5933	0.4030	0.4186	0.7185	0.9208	0.9777	0.9910	(94)
Useful gains	853.3696	922.7688	982.0762	998.3999	891.5249	657.0836	425.2115	423.9504	691.7328	822.8014	824.1145	807.9504	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1999.3058	1951.6488	1756.9187	1449.8077	1066.7268	685.4840	428.7011	428.0221	761.6345	1188.2401	1608.7824	1963.4597	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	852.5765	691.4074	576.4828	325.0136	130.3503	0.0000	0.0000	0.0000	0.0000	271.8865	564.9609	859.6989	(98)
Space heating												4272.3768	(98)
RHI space heating demand												4272	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098	(22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.7652	59.3820	59.0064	57.2422	56.9122	55.3757	55.3757	55.0911	55.9675	56.9122	57.5799	58.2780	(38)
Heat transfer coeff	149.2216	148.8384	148.4628	146.6987	146.3686	144.8321	144.8321	144.5475	145.4239	146.3686	147.0363	147.7344	(39)
Average = Sum(39)m / 12 =												146.6971	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2706	1.2674	1.2642	1.2491	1.2463	1.2332	1.2332	1.2308	1.2383	1.2463	1.2520	1.2580	(40)
HLP (average)												1.2491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6540	54.7947	54.9333	55.5939	55.7193	56.3104	56.3104	56.4213	56.0813	55.7193	55.4663	55.2042	
alpha	4.6436	4.6530	4.6622	4.7063	4.7146	4.7540	4.7540	4.7614	4.7388	4.7146	4.6978	4.6803	
util living area													
	0.9960	0.9926	0.9851	0.9639	0.9066	0.7743	0.6088	0.6541	0.8611	0.9697	0.9924	0.9968	(86)
MIT	19.6964	19.8440	20.0812	20.3993	20.6964	20.9058	20.9768	20.9674	20.8311	20.4573	20.0216	19.6706	(87)
Th 2	19.8639	19.8665	19.8690	19.8809	19.8831	19.8935	19.8935	19.8954	19.8895	19.8831	19.8786	19.8739	(88)
util rest of house													
	0.9946	0.9901	0.9797	0.9494	0.8663	0.6809	0.4702	0.5176	0.7892	0.9546	0.9893	0.9957	(89)
MIT 2	18.1476	18.3642	18.7098	19.1725	19.5768	19.8281	19.8848	19.8817	19.7523	19.2615	18.6323	18.1169	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3982	18.6036	18.9316	19.3710	19.7579	20.0024	20.0615	20.0574	19.9268	19.4549	18.8571	18.3682	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3982	18.6036	18.9316	19.3710	19.7579	20.0024	20.0615	20.0574	19.9268	19.4549	18.8571	18.3682	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9734	0.9407	0.8608	0.6912	0.4925	0.5392	0.7921	0.9467	0.9852	0.9935	(94)
Useful gains	822.6904	913.7248	968.1937	986.0259	925.6955	720.7599	491.7067	513.9482	725.5753	811.9186	791.7520	784.1990	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2103.7485	2039.6227	1845.6353	1536.0746	1179.4263	782.4465	501.3298	528.6636	847.3615	1296.0846	1728.7180	2093.1349	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	953.1072	756.6034	652.8165	396.0351	188.7758	0.0000	0.0000	0.0000	0.0000	360.2195	674.6155	973.8483	(98)
Space heating												4956.0214	(98)
Space heating per m2											(98) / (4) =	42.2005	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5334.7916	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	953.1072	756.6034	652.8165	396.0351	188.7758	0.0000	0.0000	0.0000	0.0000	360.2195	674.6155	973.8483	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1025.9497	814.4278	702.7089	426.3026	203.2032	0.0000	0.0000	0.0000	0.0000	387.7497	726.1739	1048.2759	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3805	89.3359	89.2454	89.0315	88.5240	86.7000	86.7000	86.7000	86.7000	88.9455	89.2691	89.4025	(217)
Fuel for water heating, kWh/month													
	199.3186	174.7834	181.4260	159.7995	155.1366	138.0806	129.3317	146.4468	147.6134	166.0216	178.9613	193.3908	(219)
Water heating fuel used												1970.3103	(219)
Annual totals kWh/year													
Space heating fuel - main system												5334.7916	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												6920.2854	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5334.7916	3.4800	185.6507	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.3103	3.4800	68.5668	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			323.4603	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8363	(257)
SAP value		88.3332	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5334.7916	0.2160	1152.3150	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.3103	0.2160	425.5870	(264)
Space and water heating			1577.9020	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total kg/year			1378.1822	(272)
CO2 emissions per m2			11.7400	(273)
EI value			88.6311	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8833 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8833 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3662	0.3401	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2965	0.3226	0.3052	0.3226	(22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.5897	55.6678	55.9675	55.3757	55.3757	55.0911	54.8142	54.5448	54.2830	55.0911	54.5448	55.0911	(38)
Heat transfer coeff	146.0461	145.1242	145.4239	144.8321	144.8321	144.5475	144.2706	144.0012	143.7394	144.5475	144.0012	144.5475	(39)
Average = Sum(39)m / 12 =												144.6595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2436	1.2357	1.2383	1.2332	1.2332	1.2308	1.2285	1.2262	1.2239	1.2308	1.2262	1.2308	(40)
HLP (average)												1.2318	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8423	56.1971	56.0813	56.3104	56.3104	56.4213	56.5296	56.6353	56.7385	56.4213	56.6353	56.4213	
alpha	4.7228	4.7465	4.7388	4.7540	4.7540	4.7614	4.7686	4.7757	4.7826	4.7614	4.7757	4.7614	
util living area													
	0.9944	0.9912	0.9811	0.9508	0.8718	0.6870	0.5205	0.5393	0.8008	0.9525	0.9881	0.9955	(86)
MIT	19.8257	19.9381	20.1817	20.4986	20.7802	20.9503	20.9894	20.9878	20.8938	20.5771	20.1690	19.8169	(87)
Th 2	19.8853	19.8915	19.8895	19.8935	19.8935	19.8954	19.8973	19.8991	19.9009	19.8954	19.8991	19.8954	(88)
util rest of house													
	0.9925	0.9882	0.9741	0.9311	0.8180	0.5776	0.3800	0.3951	0.7091	0.9286	0.9831	0.9939	(89)
MIT 2	18.3510	18.5185	18.8690	19.3195	19.6887	19.8670	19.8943	19.8957	19.8260	19.4358	18.8603	18.3454	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9672	0.9224	0.8164	0.5933	0.4030	0.4186	0.7185	0.9208	0.9777	0.9910	(94)
Useful gains	853.3696	922.7688	982.0762	998.3999	891.5249	657.0836	425.2115	423.9504	691.7328	822.8014	824.1145	807.9504	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1999.3058	1951.6488	1756.9187	1449.8077	1066.7268	685.4840	428.7011	428.0221	761.6345	1188.2401	1608.7824	1963.4597	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	852.5765	691.4074	576.4828	325.0136	130.3503	0.0000	0.0000	0.0000	0.0000	271.8865	564.9609	859.6989	(98)
Space heating												4272.3768	(98)
Space heating per m2											(98) / (4) =	36.3792	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4598.8986	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	852.5765	691.4074	576.4828	325.0136	130.3503	0.0000	0.0000	0.0000	0.0000	271.8865	564.9609	859.6989	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	917.7357	744.2490	620.5413	349.8531	140.3124	0.0000	0.0000	0.0000	0.0000	292.6657	608.1388	925.4024	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3301	89.2928	89.1783	88.9010	88.2293	86.7000	86.7000	86.7000	86.7000	88.7471	89.1745	89.3478	(217)
Fuel for water heating, kWh/month													
	199.4309	174.8678	181.5625	160.0342	155.6549	138.0806	129.3317	146.4468	147.6134	166.3927	179.1513	193.5091	(219)
Water heating fuel used												1972.0759	(219)
Annual totals kWh/year													
Space heating fuel - main system												4598.8986	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												6081.9065	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4598.8986	7.3800	339.3987	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1972.0759	7.3800	145.5392	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			451.7710	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4598.8986	0.2160	993.3621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.0759	0.2160	425.9684	(264)
Space and water heating			1419.3305	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			1165.5042	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4598.8986	1.2200	5610.6563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.0759	1.2200	2405.9326	(264)
Space and water heating			8016.5888	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			6515.1502	(272)
Primary energy kWh/m2/year			55.4764	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (16.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.67 kg/m²	B 89	B 90
Total Savings	£62	1.67 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£173	-£14
Mains gas	£592	£516	£76
Space heating	£468	£468	£0
Water heating	£146	£84	£62
Lighting	£138	£138	£0
Generated (PV)	-£299	-£299	£0
Total cost of fuels	£452	£390	£62
Total cost of uses	£453	£391	£62
Delivered energy	52 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200	(1b)	x 2.5300	(2b) =	148.5616	(1b) - (3b)
First floor	58.7200	(1c)	x 2.6200	(2c) =	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4447	0.4360	0.4273	0.3837	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098	(22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	59.7652	59.3820	59.0064	57.2422	56.9122	55.3757	55.3757	55.0911	55.9675	56.9122	57.5799	58.2780	(38)
Heat transfer coeff	149.2216	148.8384	148.4628	146.6987	146.3686	144.8321	144.8321	144.5475	145.4239	146.3686	147.0363	147.7344	(39)
Average = Sum(39)m / 12 =												146.6971	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2706	1.2674	1.2642	1.2491	1.2463	1.2332	1.2332	1.2308	1.2383	1.2463	1.2520	1.2580	(40)
HLP (average)												1.2491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1306	(H8)
Utilisation factor												0.5871	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-878.7246	(H17)
Solar input	-25.4813	-42.5209	-72.4180	-97.0543	-119.9025	-117.8832	-116.3253	-101.6340	-79.5998	-54.3573	-30.2244	-21.3235	(63)
								Solar input (sum of months) = Sum(63)m =				-878.7246	(63)
Output from w/h													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
								Total per year (kWh/year) = Sum(64)m =				868.4047	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6540	54.7947	54.9333	55.5939	55.7193	56.3104	56.3104	56.4213	56.0813	55.7193	55.4663	55.2042	
alpha	4.6436	4.6530	4.6622	4.7063	4.7146	4.7540	4.7540	4.7614	4.7388	4.7146	4.6978	4.6803	
util living area													
	0.9960	0.9926	0.9851	0.9639	0.9066	0.7743	0.6088	0.6541	0.8611	0.9697	0.9924	0.9968	(86)
MIT	19.6964	19.8440	20.0812	20.3993	20.6964	20.9058	20.9768	20.9674	20.8311	20.4573	20.0216	19.6706	(87)
Th 2	19.8639	19.8665	19.8690	19.8809	19.8831	19.8935	19.8935	19.8954	19.8895	19.8831	19.8786	19.8739	(88)
util rest of house													
	0.9946	0.9901	0.9797	0.9494	0.8663	0.6809	0.4702	0.5176	0.7892	0.9546	0.9893	0.9957	(89)
MIT 2	18.1476	18.3642	18.7098	19.1725	19.5768	19.8281	19.8848	19.8817	19.7523	19.2615	18.6323	18.1169	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3982	18.6036	18.9316	19.3710	19.7579	20.0024	20.0615	20.0574	19.9268	19.4549	18.8571	18.3682	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3982	18.6036	18.9316	19.3710	19.7579	20.0024	20.0615	20.0574	19.9268	19.4549	18.8571	18.3682	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9734	0.9407	0.8608	0.6912	0.4925	0.5392	0.7921	0.9467	0.9852	0.9935	(94)
Useful gains	822.6904	913.7248	968.1937	986.0259	925.6955	720.7599	491.7067	513.9482	725.5753	811.9186	791.7520	784.1990	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	2103.7485	2039.6227	1845.6353	1536.0746	1179.4263	782.4465	501.3298	528.6636	847.3615	1296.0846	1728.7180	2093.1349 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	953.1072	756.6034	652.8165	396.0351	188.7758	0.0000	0.0000	0.0000	0.0000	360.2195	674.6155	973.8483 (98)

Space heating 4956.0214 (98)
Space heating per m2 (98) / (4) = 42.2005 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 5334.7916 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	953.1072	756.6034	652.8165	396.0351	188.7758	0.0000	0.0000	0.0000	0.0000	360.2195	674.6155	973.8483	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1025.9497	814.4278	702.7089	426.3026	203.2032	0.0000	0.0000	0.0000	0.0000	387.7497	726.1739	1048.2759	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4442	89.4688	89.5017	89.5613	89.6204	86.7000	86.7000	86.7000	86.7000	89.2225	89.3687	89.4553	(217)
Fuel for water heating, kWh/month													
	170.6881	126.9978	99.9940	50.4879	19.4495	2.1138	0.0000	29.2219	55.8028	104.5829	144.9420	169.4396	(219)
Water heating fuel used												973.7203	(219)
Annual totals kWh/year													
Space heating fuel - main system												5334.7916	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												5973.6953	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5334.7916	3.4800	185.6507	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.7203	3.4800	33.8855	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			295.3739	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7637 (257)
SAP value 89.3462
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5334.7916	0.2160	1152.3150	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.7203	0.2160	210.3236	(264)
Space and water heating			1362.6386	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-939.9020	0.5190	-487.8092 (269)
Total kg/year			1188.8688 (272)
CO2 emissions per m2			10.1200 (273)
EI value			90.1928
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.9000	
Infiltration rate		0.4103	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3488	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3662	0.3401	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2965	0.3226	0.3052	0.3226	(22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.5897	55.6678	55.9675	55.3757	55.3757	55.0911	54.8142	54.5448	54.2830	55.0911	54.5448	55.0911	(38)
Heat transfer coeff	146.0461	145.1242	145.4239	144.8321	144.8321	144.5475	144.2706	144.0012	143.7394	144.5475	144.0012	144.5475	(39)
Average = Sum(39)m / 12 =												144.6595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2436	1.2357	1.2383	1.2332	1.2332	1.2308	1.2285	1.2262	1.2239	1.2308	1.2262	1.2308	(40)
HLP (average)												1.2318	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2653	(H8)
Utilisation factor												0.5463	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-915.1250	(H17)
Solar input	-29.8536	-42.4499	-72.9612	-98.4415	-115.6255	-123.5063	-120.9089	-108.2172	-84.7266	-58.5770	-35.3089	-24.5483	(63)
								Solar input (sum of months) = Sum(63)m =				-915.1250	(63)
Output from w/h													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
								Total per year (kWh/year) = Sum(64)m =				840.3783	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8423	56.1971	56.0813	56.3104	56.3104	56.4213	56.5296	56.6353	56.7385	56.4213	56.6353	56.4213	
alpha	4.7228	4.7465	4.7388	4.7540	4.7540	4.7614	4.7686	4.7757	4.7826	4.7614	4.7757	4.7614	
util living area													
	0.9944	0.9912	0.9811	0.9508	0.8718	0.6870	0.5205	0.5393	0.8008	0.9525	0.9881	0.9955	(86)
MIT	19.8257	19.9381	20.1817	20.4986	20.7802	20.9503	20.9894	20.9878	20.8938	20.5771	20.1690	19.8169	(87)
Th 2	19.8853	19.8915	19.8895	19.8935	19.8935	19.8954	19.8973	19.8991	19.9009	19.8954	19.8991	19.8954	(88)
util rest of house													
	0.9925	0.9882	0.9741	0.9311	0.8180	0.5776	0.3800	0.3951	0.7091	0.9286	0.9831	0.9939	(89)
MIT 2	18.3510	18.5185	18.8690	19.3195	19.6887	19.8670	19.8943	19.8957	19.8260	19.4358	18.8603	18.3454	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5896	18.7481	19.0814	19.5103	19.8653	20.0423	20.0715	20.0724	19.9987	19.6204	19.0720	18.5835	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9672	0.9224	0.8164	0.5933	0.4030	0.4186	0.7185	0.9208	0.9777	0.9910	(94)
Useful gains	853.3696	922.7688	982.0762	998.3999	891.5249	657.0836	425.2115	423.9504	691.7328	822.8014	824.1145	807.9504	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1999.3058	1951.6488	1756.9187	1449.8077	1066.7268	685.4840	428.7011	428.0221	761.6345	1188.2401	1608.7824	1963.4597 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	852.5765	691.4074	576.4828	325.0136	130.3503	0.0000	0.0000	0.0000	0.0000	271.8865	564.9609	859.6989 (98)

Space heating 4272.3768 (98)

Space heating per m2 (98) / (4) = 36.3792 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.9000 (206)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

Space heating requirement 4598.8986 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	852.5765	691.4074	576.4828	325.0136	130.3503	0.0000	0.0000	0.0000	0.0000	271.8865	564.9609	859.6989	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	917.7357	744.2490	620.5413	349.8531	140.3124	0.0000	0.0000	0.0000	0.0000	292.6657	608.1388	925.4024	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4110	89.4339	89.4586	89.5074	89.4288	86.7000	86.7000	86.7000	86.7000	89.0885	89.3050	89.4143	(217)
Fuel for water heating, kWh/month													
	165.8613	127.1269	99.4349	48.9685	24.2737	0.0000	0.0000	21.6289	49.8896	100.0036	139.3520	165.9106	(219)
Water heating fuel used												942.4499	(219)
Annual totals kWh/year													
Space heating fuel - main system												4598.8986	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												5102.2805	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4598.8986	7.3800	339.3987	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.4499	7.3800	69.5528	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			390.1146	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4598.8986	0.2160	993.3621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4499	0.2160	203.5692	(264)
Space and water heating			1196.9313	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			969.0550	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	4598.8986	1.2200	5610.6563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4499	1.2200	1149.7889	(264)
Space and water heating			6760.4452	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			5412.5065	(272)
Primary energy kWh/m2/year			46.0874	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	798.36 (P1)
Transmission heat loss coefficient	89.46 (37)
Summer heat loss coefficient	887.81 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.7900	87.1704	0.7200	0.7000	0.7650	265.8842
South	7.0300	118.5567	0.7200	0.7000	0.7650	289.2117
total:						555.0959

	Jun	Jul	Aug	
Solar gains	595	555	501	(P3)
Internal gains	523	501	511	
Total summer gains	1118	1056	1011	(P5)
Summer gain/loss ratio	1.26	1.19	1.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	16.91	18.74	18.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 373 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	17 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.51	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.08		
CO_2 Emissions (t/year)	1.12	**DFEE**	53.73	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.56	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.51	$kgCO_2/m^2$	Pass
	-4.05 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.73	$kWh/m^2/yr$	
	-3.2 (-5.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.90 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.79 m², No overhang
Windows facing South	7.03 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.90 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.020	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 374 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	19 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.42	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.60		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.34	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 117 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.42 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.79 m², No overhang
Windows facing South: 7.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4126	0.4044	0.3631	0.3548	0.3136	0.3136	0.3053	0.3301	0.3548	0.3713	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.7354	58.3922	58.0558	56.4758	56.1801	54.8040	54.8040	54.5491	55.3341	56.1801	56.7782	57.4034	(38)
Heat transfer coeff	148.1918	147.8486	147.5122	145.9322	145.6366	144.2604	144.2604	144.0055	144.7905	145.6366	146.2346	146.8598	(39)
Average = Sum(39)m / 12 =												145.9308	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2619	1.2589	1.2561	1.2426	1.2401	1.2284	1.2284	1.2262	1.2329	1.2401	1.2452	1.2505	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	456.1245	453.6518	436.8767	409.7601	381.8770	355.4447	338.5930	345.3364	359.5722	386.9219	418.2604	442.0964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	603.5642	704.0425	782.3709	850.7092	893.3141	872.4449	833.0682	784.7848	737.2004	663.9652	594.6032	568.5042	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0338	55.1615	55.2873	55.8859	55.9994	56.5336	56.5336	56.6336	56.3266	55.9994	55.7704	55.5329	
alpha	4.6689	4.6774	4.6858	4.7257	4.7333	4.7689	4.7689	4.7756	4.7551	4.7333	4.7180	4.7022	
util living area													
	0.9990	0.9976	0.9943	0.9833	0.9477	0.8492	0.6993	0.7503	0.9252	0.9886	0.9979	0.9992	(86)
MIT	19.5330	19.6842	19.9322	20.2692	20.6005	20.8562	20.9588	20.9419	20.7503	20.3247	19.8686	19.5085	(87)
Th 2	19.8708	19.8731	19.8754	19.8861	19.8881	19.8974	19.8974	19.8991	19.8938	19.8881	19.8840	19.8798	(88)
util rest of house													
	0.9986	0.9968	0.9920	0.9759	0.9210	0.7678	0.5534	0.6120	0.8750	0.9822	0.9969	0.9990	(89)
MIT 2	17.9140	18.1367	18.5001	18.9956	19.4620	19.7884	19.8804	19.8719	19.6701	19.0808	18.4142	17.8844	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.1759	18.3870	18.7318	19.2017	19.6462	19.9612	20.0549	20.0450	19.8449	19.2820	18.6495	18.1472	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1759	18.3870	18.7318	19.2017	19.6462	19.9612	20.0549	20.0450	19.8449	19.2820	18.6495	18.1472	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9886	0.9694	0.9134	0.7734	0.5764	0.6329	0.8721	0.9769	0.9953	0.9983	(94)
Useful gains	602.1689	700.5366	773.4627	824.6583	815.9406	674.7569	480.1818	496.6683	642.9193	648.6344	591.7991	567.5126	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2056.2956	1994.0400	1804.3399	1503.3474	1157.2526	773.4039	498.4038	524.8989	831.8049	1264.4194	1688.9314	2048.2764	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1081.8702	869.2343	766.9726	488.6561	253.9361	0.0000	0.0000	0.0000	0.0000	458.1441	789.9352	1101.6883	(98)
Space heating												5810.4370	(98)
Space heating per m2											(98) / (4) =	49.4758	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6254.5070	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1081.8702	869.2343	766.9726	488.6561	253.9361	0.0000	0.0000	0.0000	0.0000	458.1441	789.9352	1101.6883	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1164.5535	935.6666	825.5895	526.0023	273.3435	0.0000	0.0000	0.0000	0.0000	493.1583	850.3070	1185.8862	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4333	89.3975	89.3253	89.1580	88.7503	86.7000	86.7000	86.7000	86.7000	89.0984	89.3453	89.4521	(217)
Fuel for water heating, kWh/month													
	199.2009	174.6629	181.2636	159.5729	154.7412	138.0806	129.3317	146.4468	147.6134	165.7366	178.8088	193.2834	(219)
Water heating fuel used												1968.7429	(219)
Annual totals kWh/year													
Space heating fuel - main system												6254.5070	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												7838.4335	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6254.5070	0.2160	1350.9735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.7429	0.2160	425.2485	(264)
Space and water heating			1776.2220	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total CO2, kg/year			1576.5022	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.4200	ZC1
Total Floor Area	TFA	117.4400	
Assumed number of occupants	N	2.8529	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2212	ZC2
CO2 emissions from cooking, equation (L16)		1.5963	ZC3
Total CO2 emissions		29.2375	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.2375	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3823	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2738	48.8380	45.2514	46.7598	48.8380	49.2738	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
								Total per year (kWh/year) = Sum(64)m =				2191.5671	(64)
Heat gains from water heating, kWh/month													
	68.0400	59.8728	62.6490	55.8306	53.9604	47.3407	45.0751	50.5194	51.0859	57.9195	61.6460	66.2950	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	91.4516	89.0964	84.2057	77.5425	72.5275	65.7510	60.5848	67.9025	70.9527	77.8488	85.6194	89.1062	(72)
Total internal gains													
	469.2708	466.8008	450.0312	422.9078	394.3338	367.2120	350.3657	357.7982	372.7274	400.0836	431.4133	455.2454	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	598.2806	685.8927	752.3387	808.7383	841.8413	819.5873	783.0315	742.3156	703.1520	642.4964	585.7133	565.8522	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9991	0.9979	0.9950	0.9849	0.9507	0.8501	0.6941	0.7436	0.9249	0.9892	0.9980	0.9993	(86)
MIT	19.6598	19.7980	20.0262	20.3380	20.6438	20.8784	20.9682	20.9546	20.7853	20.3938	19.9720	19.6378	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9987	0.9972	0.9930	0.9783	0.9260	0.7727	0.5571	0.6131	0.8765	0.9832	0.9972	0.9991	(89)
MIT 2	18.1554	18.3590	18.6937	19.1531	19.5843	19.8842	19.9642	19.9577	19.7800	19.2380	18.6215	18.1294	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9957	0.9901	0.9727	0.9194	0.7787	0.5788	0.6330	0.8746	0.9786	0.9958	0.9985	(94)
Useful gains	597.0587	682.9412	744.9099	786.6699	773.9910	638.2325	453.2416	469.9028	614.9759	628.7219	583.2258	564.9797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1922.2555	1862.2151	1683.7369	1401.1974	1078.3872	721.6497	467.3891	491.9640	777.3351	1181.3694	1578.3831	1914.1382	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating												5277.2932	(98)
Space heating per m2											(98) / (4) =	44.9361	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5650.2069	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1055.6171	848.4712	747.8451	473.7256	242.4741	0.0000	0.0000	0.0000	0.0000	440.2245	767.1448	1074.7044	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3924	88.2401	87.9281	87.2257	85.7099	80.3000	80.3000	80.3000	80.3000	86.9818	88.0068	88.4596	(217)
Fuel for water heating, kWh/month													
	245.8079	217.0089	228.6666	206.5187	203.4827	191.2901	183.2705	204.3037	206.5600	214.8010	224.5707	239.6884	(219)
Water heating fuel used												2565.9692	(219)
Annual totals kWh/year													
Space heating fuel - main system												5650.2069	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Total delivered energy for all uses												8771.2617	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5650.2069	0.2160	1220.4447	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.9692	0.2160	554.2493	(264)
Space and water heating			1774.6940	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Total CO2, kg/m2/year			2062.7834	(272)
Emissions per m2 for space and water heating			15.1115	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1216	(272b)
Emissions per m2 for pumps and fans			0.3314	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1115 * 1.00) + 2.1216 + 0.3314, rounded to 2 d.p.			17.5600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323 (8)
Pressure test		Yes
Measured/design AP50		4.4600
Infiltration rate		0.3553 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3020 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3850	0.3775	0.3699	0.3322	0.3246	0.2869	0.2869	0.2793	0.3020	0.3246	0.3397	0.3548	(22b)
Effective ac	0.5741	0.5712	0.5684	0.5552	0.5527	0.5412	0.5412	0.5390	0.5456	0.5527	0.5577	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5838 (36)
Total fabric heat loss	(33) + (36) =	89.4564 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.2943	57.0071	56.7256	55.4031	55.1557	54.0039	54.0039	53.7906	54.4476	55.1557	55.6562	56.1795	(38)
Heat transfer coeff	146.7508	146.4635	146.1820	144.8596	144.6121	143.4603	143.4603	143.2471	143.9040	144.6121	145.1127	145.6359	(39)
Average = Sum(39)m / 12 =												144.8584	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2496	1.2471	1.2447	1.2335	1.2314	1.2216	1.2216	1.2197	1.2253	1.2314	1.2356	1.2401	(40)
HLP (average)												1.2335	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8529 (42)
Average daily hot water use (litres/day)		101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	569.7620	671.0930	751.1920	821.9374	866.1077	847.4409	809.9340	759.2525	710.8143	635.0876	562.9124	535.5510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5742	55.6832	55.7904	56.2997	56.3961	56.8488	56.8488	56.9335	56.6736	56.3961	56.2015	55.9996	
alpha	4.7049	4.7122	4.7194	4.7533	4.7597	4.7899	4.7899	4.7956	4.7782	4.7597	4.7468	4.7333	
util living area	0.9992	0.9981	0.9952	0.9853	0.9524	0.8587	0.7111	0.7641	0.9327	0.9904	0.9983	0.9994	(86)
MIT	19.5222	19.6734	19.9214	20.2572	20.5902	20.8496	20.9564	20.9378	20.7397	20.3105	19.8542	19.4961	(87)
Th 2	19.8805	19.8825	19.8844	19.8933	19.8950	19.9028	19.9028	19.9042	19.8998	19.8950	19.8916	19.8881	(88)
util rest of house	0.9989	0.9974	0.9932	0.9787	0.9276	0.7798	0.5655	0.6273	0.8861	0.9849	0.9976	0.9992	(89)
MIT 2	18.5317	18.6841	18.9328	19.2725	19.5942	19.8239	19.8903	19.8839	19.7382	19.3287	18.8722	18.5115	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6919	18.8442	19.0928	19.4318	19.7553	19.9899	20.0628	20.0544	19.9003	19.4875	19.0310	18.6708	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6919	18.8442	19.0928	19.4318	19.7553	19.9899	20.0628	20.0544	19.9003	19.4875	19.0310	18.6708	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9913	0.9749	0.9236	0.7873	0.5891	0.6488	0.8861	0.9820	0.9967	0.9989	(94)
Useful gains	568.8865	668.7111	744.6827	801.3062	799.8982	667.2135	477.1393	492.5747	629.8540	623.6794	561.0751	534.9408	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2112.0276	2042.3104	1840.8332	1525.6364	1164.9001	773.2351	496.7743	523.4855	834.6810	1285.2434	1731.3455	2107.4664	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1148.0970	923.0587	815.5360	521.5177	271.5614	0.0000	0.0000	0.0000	0.0000	492.2036	842.5947	1169.9591	(98)
Space heating												6184.5283	(98)
Space heating per m2											(98) / (4) =	52.6612	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1348.5273	1061.6066	1088.6776	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7361	0.8262	0.7914	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	992.6888	877.0500	861.5425	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0102	1058.7086	1001.8556	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	80.8714	135.1540	104.3929	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												320.4183	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   20.2179   33.7885   26.0982    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              80.1046 (107)
Space cooling per m2                                                                                                        0.6821 (108)
Energy for space heating                                                                                                   52.6612 (99)
Energy for space cooling                                                                                                    0.6821 (108)
Total                                                                                                                      53.3433 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                      53.3 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3823 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	551.3321	639.7941	708.0052	766.8188	802.1780	782.8159	748.1246	704.3214	663.6108	600.4572	540.8695	519.7501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9994	0.9985	0.9962	0.9879	0.9587	0.8677	0.7178	0.7697	0.9382	0.9919	0.9986	0.9995	(86)
MIT	19.6225	19.7616	19.9917	20.3068	20.6187	20.8644	20.9629	20.9467	20.7630	20.3618	19.9365	19.6010	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9991	0.9979	0.9946	0.9825	0.9371	0.7946	0.5801	0.6405	0.8958	0.9873	0.9980	0.9994	(89)
MIT 2	18.6879	18.8286	19.0599	19.3809	19.6839	19.9048	19.9666	19.9614	19.8240	19.4386	19.0121	18.6735	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9931	0.9794	0.9335	0.8016	0.6024	0.6609	0.8959	0.9849	0.9974	0.9991	(94)
Useful gains	550.6590	638.0132	703.1465	751.0311	748.8526	627.4996	450.6595	465.4570	594.5591	591.4016	539.4500	519.2829	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1982.2899	1914.9463	1724.6217	1426.1308	1089.0156	723.6310	467.5504	492.2031	781.7717	1203.1824	1621.6299	1974.9303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1065.1334	858.0990	759.9775	486.0717	253.0813	0.0000	0.0000	0.0000	0.0000	455.1649	779.1695	1083.0017	(98)
Space heating												5739.6992	(98)
Space heating per m2											(98) / (4) =	48.8735	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8038	980.7392	1005.3689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7475	0.8386	0.8058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.2544	822.4029	810.1758	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1029.4744	986.4639	937.6505	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.7185	122.0614	94.8411	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												287.6210	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   17.6796   30.5153   23.7103    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              71.9052 (107)
Space cooling per m2                                                                                                        0.6123 (108)
Energy for space heating                                                                                                   48.8735 (99)
Energy for space cooling                                                                                                    0.6123 (108)
Total                                                                                                                      49.4857 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        56.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.8913	55.0656	55.3341	54.8040	54.8040	54.5491	54.3011	54.0598	53.8254	54.5491	54.0598	54.5491	(38)
Heat transfer coeff	145.3477	144.5220	144.7905	144.2604	144.2604	144.0055	143.7575	143.5162	143.2818	144.0055	143.5162	144.0055	(39)
Average = Sum(39)m / 12 =												144.1058	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2376	1.2306	1.2329	1.2284	1.2284	1.2262	1.2241	1.2220	1.2200	1.2262	1.2220	1.2262	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
RHI water heating demand												1743	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1106	56.4312	56.3266	56.5336	56.5336	56.6336	56.7313	56.8267	56.9197	56.6336	56.8267	56.6336	
alpha	4.7407	4.7621	4.7551	4.7689	4.7689	4.7756	4.7821	4.7884	4.7946	4.7756	4.7884	4.7756	
util living area													
	0.9944	0.9912	0.9810	0.9504	0.8708	0.6854	0.5189	0.5378	0.7997	0.9522	0.9880	0.9955	(86)
MIT	19.8333	19.9445	20.1878	20.5031	20.7830	20.9513	20.9897	20.9881	20.8952	20.5806	20.1734	19.8228	(87)
Th 2	19.8900	19.8956	19.8938	19.8974	19.8974	19.8991	19.9008	19.9024	19.9040	19.8991	19.9024	19.8991	(88)
util rest of house													
	0.9925	0.9882	0.9740	0.9307	0.8170	0.5763	0.3792	0.3943	0.7081	0.9283	0.9831	0.9939	(89)
MIT 2	18.3653	18.5307	18.8808	19.3286	19.6953	19.8713	19.8979	19.8990	19.8301	19.4434	18.8689	18.3565	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9671	0.9221	0.8155	0.5920	0.4020	0.4177	0.7175	0.9205	0.9777	0.9910	(94)
Useful gains	853.3673	922.7474	981.9685	998.0265	890.5490	655.6315	424.2073	423.0140	690.7962	822.5122	824.0819	807.9520	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1991.6713	1945.1841	1750.8479	1445.2881	1063.3869	683.4488	427.6099	426.9917	759.7378	1184.7857	1604.5064	1957.5733	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	846.8982	687.0775	572.0463	322.0284	128.5914	0.0000	0.0000	0.0000	0.0000	269.5315	561.9057	855.3182	(98)
Space heating												4243.3972	(98)
RHI space heating demand												4243	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4126	0.4044	0.3631	0.3548	0.3136	0.3136	0.3053	0.3301	0.3548	0.3713	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.7354	58.3922	58.0558	56.4758	56.1801	54.8040	54.8040	54.5491	55.3341	56.1801	56.7782	57.4034	(38)
Heat transfer coeff	148.1918	147.8486	147.5122	145.9322	145.6366	144.2604	144.2604	144.0055	144.7905	145.6366	146.2346	146.8598	(39)
Average = Sum(39)m / 12 =												145.9308	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2619	1.2589	1.2561	1.2426	1.2401	1.2284	1.2284	1.2262	1.2329	1.2401	1.2452	1.2505	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North		8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South		7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)
Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0338	55.1615	55.2873	55.8859	55.9994	56.5336	56.5336	56.6336	56.3266	55.9994	55.7704	55.5329	
alpha	4.6689	4.6774	4.6858	4.7257	4.7333	4.7689	4.7689	4.7756	4.7551	4.7333	4.7180	4.7022	
util living area													
	0.9960	0.9926	0.9850	0.9636	0.9058	0.7729	0.6070	0.6525	0.8601	0.9694	0.9924	0.9968	(86)
MIT	19.7078	19.8548	20.0906	20.4056	20.7007	20.9074	20.9773	20.9681	20.8336	20.4625	20.0291	19.6803	(87)
Th 2	19.8708	19.8731	19.8754	19.8861	19.8881	19.8974	19.8974	19.8991	19.8938	19.8881	19.8840	19.8798	(88)
util rest of house													
	0.9946	0.9900	0.9796	0.9491	0.8654	0.6795	0.4691	0.5165	0.7880	0.9543	0.9893	0.9957	(89)
MIT 2	18.1690	18.3844	18.7279	19.1852	19.5862	19.8331	19.8889	19.8857	19.7587	19.2724	18.6471	18.1352	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4180	18.6223	18.9483	19.3827	19.7665	20.0069	20.0650	20.0608	19.9326	19.4650	18.8707	18.3852	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4180	18.6223	18.9483	19.3827	19.7665	20.0069	20.0650	20.0608	19.9326	19.4650	18.8707	18.3852	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9733	0.9404	0.8600	0.6899	0.4913	0.5380	0.7911	0.9464	0.9851	0.9935	(94)
Useful gains	822.6995	913.7088	968.0955	985.7020	924.7833	719.4300	490.4691	512.7796	724.6118	811.7099	791.7380	784.2090	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2092.1694	2028.8245	1836.2806	1529.7571	1174.7841	780.0056	499.8567	527.1752	844.5082	1291.0648	1721.2775	2083.2317	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	944.4856	749.3578	645.9297	391.7197	186.0006	0.0000	0.0000	0.0000	0.0000	356.6400	669.2685	966.4729	(98)
Space heating												4909.8746	(98)
Space heating per m2											(98) / (4) =	41.8075	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5285.1180	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	944.4856	749.3578	645.9297	391.7197	186.0006	0.0000	0.0000	0.0000	0.0000	356.6400	669.2685	966.4729	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1016.6691	806.6284	695.2957	421.6573	200.2159	0.0000	0.0000	0.0000	0.0000	383.8967	720.4181	1040.3368	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3765	89.3314	89.2398	89.0246	88.5124	86.7000	86.7000	86.7000	86.7000	88.9388	89.2651	89.3993	(217)
Fuel for water heating, kWh/month													
	199.3274	174.7922	181.4372	159.8120	155.1570	138.0806	129.3317	146.4468	147.6134	166.0341	178.9694	193.3977	(219)
Water heating fuel used												1970.3996	(219)
Annual totals kWh/year													
Space heating fuel - main system												5285.1180	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												6870.7011	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5285.1180	3.4800	183.9221	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.3996	3.4800	68.5699	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			321.7347	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8319	(257)
SAP value		88.3954	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5285.1180	0.2160	1141.5855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.3996	0.2160	425.6063	(264)
Space and water heating			1567.1918	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total kg/year			1367.4720	(272)
CO2 emissions per m2			11.6400	(273)
EI value			88.7195	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.8913	55.0656	55.3341	54.8040	54.8040	54.5491	54.3011	54.0598	53.8254	54.5491	54.0598	54.5491	(38)
Heat transfer coeff	145.3477	144.5220	144.7905	144.2604	144.2604	144.0055	143.7575	143.5162	143.2818	144.0055	143.5162	144.0055	(39)
Average = Sum(39)m / 12 =												144.1058	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2376	1.2306	1.2329	1.2284	1.2284	1.2262	1.2241	1.2220	1.2200	1.2262	1.2220	1.2262	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1106	56.4312	56.3266	56.5336	56.5336	56.6336	56.7313	56.8267	56.9197	56.6336	56.8267	56.6336	
alpha	4.7407	4.7621	4.7551	4.7689	4.7689	4.7756	4.7821	4.7884	4.7946	4.7756	4.7884	4.7756	
util living area													
	0.9944	0.9912	0.9810	0.9504	0.8708	0.6854	0.5189	0.5378	0.7997	0.9522	0.9880	0.9955	(86)
MIT	19.8333	19.9445	20.1878	20.5031	20.7830	20.9513	20.9897	20.9881	20.8952	20.5806	20.1734	19.8228	(87)
Th 2	19.8900	19.8956	19.8938	19.8974	19.8974	19.8991	19.9008	19.9024	19.9040	19.8991	19.9024	19.8991	(88)
util rest of house													
	0.9925	0.9882	0.9740	0.9307	0.8170	0.5763	0.3792	0.3943	0.7081	0.9283	0.9831	0.9939	(89)
MIT 2	18.3653	18.5307	18.8808	19.3286	19.6953	19.8713	19.8979	19.8990	19.8301	19.4434	18.8689	18.3565	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9671	0.9221	0.8155	0.5920	0.4020	0.4177	0.7175	0.9205	0.9777	0.9910	(94)
Useful gains	853.3673	922.7474	981.9685	998.0265	890.5490	655.6315	424.2073	423.0140	690.7962	822.5122	824.0819	807.9520	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1991.6713	1945.1841	1750.8479	1445.2881	1063.3869	683.4488	427.6099	426.9917	759.7378	1184.7857	1604.5064	1957.5733	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	846.8982	687.0775	572.0463	322.0284	128.5914	0.0000	0.0000	0.0000	0.0000	269.5315	561.9057	855.3182	(98)
Space heating												4243.3972	(98)
Space heating per m2											(98) / (4) =	36.1325	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4567.7042	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	846.8982	687.0775	572.0463	322.0284	128.5914	0.0000	0.0000	0.0000	0.0000	269.5315	561.9057	855.3182	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	911.6234	739.5882	615.7657	346.6398	138.4192	0.0000	0.0000	0.0000	0.0000	290.1308	604.8500	920.6870	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3270	89.2897	89.1739	88.8946	88.2185	86.7000	86.7000	86.7000	86.7000	88.7407	89.1714	89.3455	(217)
Fuel for water heating, kWh/month													
	199.4379	174.8738	181.5713	160.0456	155.6740	138.0806	129.3317	146.4468	147.6134	166.4047	179.1574	193.5142	(219)
Water heating fuel used												1972.1516	(219)
Annual totals kWh/year													
Space heating fuel - main system												4567.7042	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												6050.7878	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4567.7042	7.3800	337.0966	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1972.1516	7.3800	145.5448	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			449.4745	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4567.7042	0.2160	986.6241	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.1516	0.2160	425.9847	(264)
Space and water heating			1412.6088	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			1158.7826	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4567.7042	1.2200	5572.5991	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.1516	1.2200	2406.0249	(264)
Space and water heating			7978.6240	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			6477.1854	(272)
Primary energy kWh/m2/year			55.1531	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (17.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.67 kg/m²	B 89	B 90
Total Savings	£62	1.67 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£173	-£14
Mains gas	£590	£514	£76
Space heating	£466	£466	£0
Water heating	£146	£84	£62
Lighting	£138	£138	£0
Generated (PV)	-£299	-£299	£0
Total cost of fuels	£450	£388	£62
Total cost of uses	£451	£389	£62
Delivered energy	52 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200	(1b)	x 2.5300	(2b) =	148.5616	(1b) - (3b)
First floor	58.7200	(1c)	x 2.6200	(2c) =	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4126	0.4044	0.3631	0.3548	0.3136	0.3136	0.3053	0.3301	0.3548	0.3713	0.3879	(22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.7354	58.3922	58.0558	56.4758	56.1801	54.8040	54.8040	54.5491	55.3341	56.1801	56.7782	57.4034	(38)
Heat transfer coeff	148.1918	147.8486	147.5122	145.9322	145.6366	144.2604	144.2604	144.0055	144.7905	145.6366	146.2346	146.8598	(39)
Average = Sum(39)m / 12 =												145.9308	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2619	1.2589	1.2561	1.2426	1.2401	1.2284	1.2284	1.2262	1.2329	1.2401	1.2452	1.2505	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1306	(H8)
Utilisation factor												0.5871	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-878.7246	(H17)
Solar input	-25.4813	-42.5209	-72.4180	-97.0543	-119.9025	-117.8832	-116.3253	-101.6340	-79.5998	-54.3573	-30.2244	-21.3235	(63)
								Solar input (sum of months) = Sum(63)m =				-878.7246	(63)
Output from w/h													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
								Total per year (kWh/year) = Sum(64)m =				868.4047	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0338	55.1615	55.2873	55.8859	55.9994	56.5336	56.5336	56.6336	56.3266	55.9994	55.7704	55.5329	
alpha	4.6689	4.6774	4.6858	4.7257	4.7333	4.7689	4.7689	4.7756	4.7551	4.7333	4.7180	4.7022	
util living area													
	0.9960	0.9926	0.9850	0.9636	0.9058	0.7729	0.6070	0.6525	0.8601	0.9694	0.9924	0.9968	(86)
MIT	19.7078	19.8548	20.0906	20.4056	20.7007	20.9074	20.9773	20.9681	20.8336	20.4625	20.0291	19.6803	(87)
Th 2	19.8708	19.8731	19.8754	19.8861	19.8881	19.8974	19.8974	19.8991	19.8938	19.8881	19.8840	19.8798	(88)
util rest of house													
	0.9946	0.9900	0.9796	0.9491	0.8654	0.6795	0.4691	0.5165	0.7880	0.9543	0.9893	0.9957	(89)
MIT 2	18.1690	18.3844	18.7279	19.1852	19.5862	19.8331	19.8889	19.8857	19.7587	19.2724	18.6471	18.1352	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4180	18.6223	18.9483	19.3827	19.7665	20.0069	20.0650	20.0608	19.9326	19.4650	18.8707	18.3852	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4180	18.6223	18.9483	19.3827	19.7665	20.0069	20.0650	20.0608	19.9326	19.4650	18.8707	18.3852	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9733	0.9404	0.8600	0.6899	0.4913	0.5380	0.7911	0.9464	0.9851	0.9935	(94)
Useful gains	822.6995	913.7088	968.0955	985.7020	924.7833	719.4300	490.4691	512.7796	724.6118	811.7099	791.7380	784.2090	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W													
	2092.1694	2028.8245	1836.2806	1529.7571	1174.7841	780.0056	499.8567	527.1752	844.5082	1291.0648	1721.2775	2083.2317	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	944.4856	749.3578	645.9297	391.7197	186.0006	0.0000	0.0000	0.0000	0.0000	356.6400	669.2685	966.4729	(98)
Space heating												4909.8746	(98)
Space heating per m2											(98) / (4) =	41.8075	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5285.1180	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	944.4856	749.3578	645.9297	391.7197	186.0006	0.0000	0.0000	0.0000	0.0000	356.6400	669.2685	966.4729	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1016.6691	806.6284	695.2957	421.6573	200.2159	0.0000	0.0000	0.0000	0.0000	383.8967	720.4181	1040.3368	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4406	89.4652	89.4980	89.5579	89.6166	86.7000	86.7000	86.7000	86.7000	89.2171	89.3651	89.4524	(217)
Fuel for water heating, kWh/month													
	170.6949	127.0029	99.9981	50.4898	19.4503	2.1138	0.0000	29.2219	55.8028	104.5891	144.9477	169.4451	(219)
Water heating fuel used												973.7566	(219)
Annual totals kWh/year													
Space heating fuel - main system												5285.1180	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												5924.0581	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5285.1180	3.4800	183.9221	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.7566	3.4800	33.8867	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			293.6465	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7592	(257)
SAP value		89.4086	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5285.1180	0.2160	1141.5855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.7566	0.2160	210.3314	(264)
Space and water heating			1351.9169	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-939.9020	0.5190	-487.8092 (269)
Total kg/year			1178.1471 (272)
CO2 emissions per m2			10.0300 (273)
EI value			90.2812
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200	(1b)	x 2.5300	(2b) =	148.5616	(1b) - (3b)
First floor	58.7200	(1c)	x 2.6200	(2c) =	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3883	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053	(22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.8913	55.0656	55.3341	54.8040	54.8040	54.5491	54.3011	54.0598	53.8254	54.5491	54.0598	54.5491	(38)
Heat transfer coeff	145.3477	144.5220	144.7905	144.2604	144.2604	144.0055	143.7575	143.5162	143.2818	144.0055	143.5162	144.0055	(39)
Average = Sum(39)m / 12 =												144.1058	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2376	1.2306	1.2329	1.2284	1.2284	1.2262	1.2241	1.2220	1.2200	1.2262	1.2220	1.2262	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2653	(H8)
Utilisation factor												0.5463	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-915.1250	(H17)
Solar input	-29.8536	-42.4499	-72.9612	-98.4415	-115.6255	-123.5063	-120.9089	-108.2172	-84.7266	-58.5770	-35.3089	-24.5483	(63)
									Solar input (sum of months) = Sum(63)m =			-915.1250	(63)
Output from w/h													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
									Total per year (kWh/year) = Sum(64)m =			840.3783	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1106	56.4312	56.3266	56.5336	56.5336	56.6336	56.7313	56.8267	56.9197	56.6336	56.8267	56.6336	
alpha	4.7407	4.7621	4.7551	4.7689	4.7689	4.7756	4.7821	4.7884	4.7946	4.7756	4.7884	4.7756	
util living area													
	0.9944	0.9912	0.9810	0.9504	0.8708	0.6854	0.5189	0.5378	0.7997	0.9522	0.9880	0.9955	(86)
MIT	19.8333	19.9445	20.1878	20.5031	20.7830	20.9513	20.9897	20.9881	20.8952	20.5806	20.1734	19.8228	(87)
Th 2	19.8900	19.8956	19.8938	19.8974	19.8974	19.8991	19.9008	19.9024	19.9040	19.8991	19.9024	19.8991	(88)
util rest of house													
	0.9925	0.9882	0.9740	0.9307	0.8170	0.5763	0.3792	0.3943	0.7081	0.9283	0.9831	0.9939	(89)
MIT 2	18.3653	18.5307	18.8808	19.3286	19.6953	19.8713	19.8979	19.8990	19.8301	19.4434	18.8689	18.3565	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6028	18.7594	19.0923	19.5186	19.8713	20.0460	20.0745	20.0752	20.0024	19.6274	19.0800	18.5937	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9671	0.9221	0.8155	0.5920	0.4020	0.4177	0.7175	0.9205	0.9777	0.9910	(94)
Useful gains	853.3673	922.7474	981.9685	998.0265	890.5490	655.6315	424.2073	423.0140	690.7962	822.5122	824.0819	807.9520	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1991.6713	1945.1841	1750.8479	1445.2881	1063.3869	683.4488	427.6099	426.9917	759.7378	1184.7857	1604.5064	1957.5733 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	846.8982	687.0775	572.0463	322.0284	128.5914	0.0000	0.0000	0.0000	0.0000	269.5315	561.9057	855.3182 (98)

Space heating 4243.3972 (98)
Space heating per m2 (98) / (4) = 36.1325 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4567.7042 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	846.8982	687.0775	572.0463	322.0284	128.5914	0.0000	0.0000	0.0000	0.0000	269.5315	561.9057	855.3182	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	911.6234	739.5882	615.7657	346.6398	138.4192	0.0000	0.0000	0.0000	0.0000	290.1308	604.8500	920.6870	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4083	89.4313	89.4557	89.5042	89.4233	86.7000	86.7000	86.7000	86.7000	89.0832	89.3024	89.4122	(217)
Fuel for water heating, kWh/month													
	165.8665	127.1304	99.4382	48.9702	24.2752	0.0000	0.0000	21.6289	49.8896	100.0095	139.3561	165.9145	(219)
Water heating fuel used												942.4791	(219)
Annual totals kWh/year													
Space heating fuel - main system												4567.7042	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												5071.1153	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4567.7042	7.3800	337.0966	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.4791	7.3800	69.5550	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			387.8146	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4567.7042	0.2160	986.6241	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4791	0.2160	203.5755	(264)
Space and water heating			1190.1996	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			962.3233	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	4567.7042	1.2200	5572.5991	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4791	1.2200	1149.8245	(264)
Space and water heating			6722.4236	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			5374.4849	(272)
Primary energy kWh/m2/year			45.7637	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	798.36	(P1)
Transmission heat loss coefficient	89.46	(37)
Summer heat loss coefficient	887.81	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.7900	87.1704	0.7200	0.7000	0.7650	265.8842
South	7.0300	118.5567	0.7200	0.7000	0.7650	289.2117
total:						555.0959

	Jun	Jul	Aug	
Solar gains	595	555	501	(P3)
Internal gains	523	501	511	
Total summer gains	1118	1056	1011	(P5)
Summer gain/loss ratio	1.26	1.19	1.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	16.91	18.74	18.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 374 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	19 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.42	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.60		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.34	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.56	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.42	$kgCO_2/m^2$	Pass
	-4.14 (-23.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.34	$kWh/m^2/yr$	
	-3.6 (-6.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	8.79 m², No overhang 7.03 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.020	W/m²K	
Photovoltaic array	1.10	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 375 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	86 B	**DER**	15.27	**TER**	18.75
Environmental	88 B	**% DER<TER**	18.57		
CO_2 Emissions (t/year)	1.10	**DFEE**	53.99	**TFEE**	59.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.75 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.27 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.08 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.18 m², No overhang
Windows facing East: 1.30 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 5.23 m², No overhang
Windows facing South West: 1.02 m², No overhang
Windows facing West: 6.67 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Roof U-value 0.12 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4472	0.4384	0.4297	0.3858	0.3771	0.3332	0.3332	0.3245	0.3508	0.3771	0.3946	0.4121	(22b)
Effective ac	0.6000	0.5961	0.5923	0.5744	0.5711	0.5555	0.5555	0.5526	0.5615	0.5711	0.5779	0.5849	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.8515	49.5289	49.2126	47.7272	47.4493	46.1556	46.1556	45.9160	46.6539	47.4493	48.0115	48.5993	(38)
Heat transfer coeff	137.8896	137.5670	137.2507	135.7653	135.4874	134.1937	134.1937	133.9541	134.6920	135.4874	136.0496	136.6374	(39)
Average = Sum(39)m / 12 =												135.7640	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4154	1.4121	1.4089	1.3936	1.3908	1.3775	1.3775	1.3750	1.3826	1.3908	1.3965	1.4026	(40)
HLP (average)												1.3936	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	417.1807	415.0021	399.9443	375.5234	350.5213	326.5507	311.0480	317.3593	329.9595	354.6058	382.9520	404.4103	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	610.1372	757.4353	901.9360	1048.5658	1147.3383	1135.5266	1083.6009	995.4744	891.1960	742.3866	616.6493	567.8310	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.0630	49.1781	49.2914	49.8307	49.9329	50.4143	50.4143	50.5044	50.2278	49.9329	49.7265	49.5126	
alpha	4.2709	4.2785	4.2861	4.3220	4.3289	4.3610	4.3610	4.3670	4.3485	4.3289	4.3151	4.3008	
util living area													
	0.9975	0.9933	0.9813	0.9428	0.8483	0.6861	0.5266	0.5876	0.8297	0.9695	0.9946	0.9981	(86)
MIT	19.4421	19.6544	19.9827	20.3961	20.7352	20.9262	20.9817	20.9710	20.8243	20.3634	19.8211	19.4067	(87)
Th 2	19.7515	19.7541	19.7566	19.7682	19.7704	19.7806	19.7806	19.7825	19.7767	19.7704	19.7660	19.7614	(88)
util rest of house													
	0.9966	0.9909	0.9745	0.9211	0.7923	0.5821	0.3898	0.4471	0.7460	0.9537	0.9924	0.9975	(89)
MIT 2	17.7009	18.0118	18.4883	19.0791	19.5210	19.7343	19.7746	19.7716	19.6416	19.0475	18.2643	17.6558	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.0548	18.3456	18.7920	19.3468	19.7678	19.9765	20.0199	20.0154	19.8820	19.3149	18.5808	18.0116	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0548	18.3456	18.7920	19.3468	19.7678	19.9765	20.0199	20.0154	19.8820	19.3149	18.5808	18.0116	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9869	0.9670	0.9116	0.7922	0.6002	0.4177	0.4755	0.7545	0.9456	0.9890	0.9960	(94)
Useful gains	606.8690	747.5387	872.1859	955.9041	908.8690	681.5856	452.6246	473.3731	672.4132	702.0059	609.8360	565.5601	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1896.6385	1849.6737	1687.0883	1418.3117	1093.0806	721.4962	458.9301	484.2958	778.7857	1180.7649	1561.9525	1887.1865	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	959.5885	740.6347	606.2874	332.9335	137.0534	0.0000	0.0000	0.0000	0.0000	356.1967	685.5238	983.2901	(98)
Space heating												4801.5081	(98)
Space heating per m2											(98) / (4) =	49.2867	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5168.4694	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	959.5885	740.6347	606.2874	332.9335	137.0534	0.0000	0.0000	0.0000	0.0000	356.1967	685.5238	983.2901	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1032.9263	797.2386	652.6237	358.3783	147.5279	0.0000	0.0000	0.0000	0.0000	383.4195	737.9159	1058.4393	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3966	89.3402	89.2224	88.9379	88.2934	86.7000	86.7000	86.7000	86.7000	88.9582	89.2924	89.4192	(217)
Fuel for water heating, kWh/month													
	193.2700	169.5130	176.0355	155.2054	150.9395	134.0367	125.5844	142.1462	143.2609	161.0614	173.5463	187.5332	(219)
Water heating fuel used												1912.1326	(219)
Annual totals kWh/year													
Space heating fuel - main system												5168.4694	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												6999.7336	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5168.4694	0.2160	1116.3894	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.1326	0.2160	413.0206	(264)
Space and water heating			1529.4100	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1487.4393	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.2700	ZC1
Total Floor Area	TFA	97.4200	
Assumed number of occupants	N	2.7143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3338	ZC2
CO2 emissions from cooking, equation (L16)		1.8902	ZC3
Total CO2 emissions		32.4940	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4940	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1192	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3692	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6837	47.2620	43.7911	45.2508	47.2620	47.6837	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (64)
								Total per year (kWh/year) = Sum(64)m =				2130.4990 (64)
Heat gains from water heating, kWh/month												
	66.2554	58.3120	61.0384	54.0289	52.2191	45.8130	43.6205	48.8892	49.4374	56.4615	60.0545	64.5668 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	89.0530	86.7738	82.0409	75.0402	70.1870	63.6292	58.6297	65.7112	68.6630	75.8891	83.4090	86.7833	(72)
Total internal gains													
	430.4164	428.2307	413.1638	388.1707	362.4878	337.8443	322.3490	329.3371	342.6228	367.8413	396.1910	417.6510	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4500	10.6334	0.6300	0.7000	0.7700	20.9606	(74)
East	1.1700	19.6403	0.6300	0.7000	0.7700	7.0227	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	4.7000	46.7521	0.6300	0.7000	0.7700	67.1538	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	6.0000	19.6403	0.6300	0.7000	0.7700	36.0139	(80)

Solar gains	151.8412	269.4692	395.0300	529.6270	627.0155	636.5769	607.9186	533.6148	441.6496	305.1549	183.9014	128.5986 (83)
Total gains	582.2576	697.6999	808.1939	917.7977	989.5033	974.4212	930.2676	862.9519	784.2724	672.9962	580.0924	546.2496 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area													
	0.9980	0.9950	0.9865	0.9581	0.8807	0.7292	0.5649	0.6239	0.8570	0.9762	0.9957	0.9985	(86)
MIT	19.5635	19.7437	20.0327	20.4040	20.7275	20.9219	20.9812	20.9707	20.8252	20.3963	19.9061	19.5291	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house													
	0.9973	0.9933	0.9816	0.9416	0.8333	0.6311	0.4295	0.4870	0.7829	0.9637	0.9940	0.9980	(89)
MIT 2	17.9393	18.2033	18.6238	19.1577	19.5888	19.8108	19.8558	19.8519	19.7191	19.1568	18.4469	17.8936	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2695	18.5164	18.9101	19.4110	19.8202	20.0366	20.0845	20.0793	19.9439	19.4087	18.7435	18.2260	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2695	18.5164	18.9101	19.4110	19.8202	20.0366	20.0845	20.0793	19.9439	19.4087	18.7435	18.2260	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9903	0.9759	0.9334	0.8316	0.6475	0.4571	0.5147	0.7894	0.9570	0.9913	0.9968	(94)
Useful gains	579.7959	690.9414	788.6933	856.6628	822.8584	630.9823	425.2685	444.1289	619.1150	644.0383	575.0363	544.5030	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1766.0269	1718.4715	1563.6231	1313.9557	1013.5865	673.9341	431.9476	455.5089	726.3630	1099.5248	1457.7245	1761.4934	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	882.5559	690.5002	576.5477	329.2509	141.9017	0.0000	0.0000	0.0000	0.0000	338.8820	635.5355	905.4408	(98)
Space heating												4500.6147	(98)
Space heating per m2											(98) / (4) =	46.1981	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4818.6453	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	882.5559	690.5002	576.5477	329.2509	141.9017	0.0000	0.0000	0.0000	0.0000	338.8820	635.5355	905.4408	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	944.9206	739.2936	617.2888	352.5170	151.9290	0.0000	0.0000	0.0000	0.0000	362.8287	680.4449	969.4227	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2508	88.0422	87.6022	86.6281	84.6181	80.3000	80.3000	80.3000	80.3000	86.5885	87.8282	88.3340	(217)
Fuel for water heating, kWh/month													
	240.1205	212.1651	223.9877	201.2329	199.4569	185.1171	177.3563	197.7107	199.8942	210.7128	219.5776	234.1452	(219)
Water heating fuel used												2501.4771	(219)
Annual totals kWh/year													
Space heating fuel - main system												4818.6453	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.4259	(232)
Total delivered energy for all uses												7793.5483	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4818.6453	0.2160	1040.8274	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2501.4771	0.2160	540.3191	(264)
Space and water heating			1581.1464	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.4259	0.5190	206.7830	(268)
Total CO2, kg/m2/year			1826.8545	(272)
Emissions per m2 for space and water heating			16.2302	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1226	(272b)
Emissions per m2 for pumps and fans			0.3996	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2302 * 1.00) + 2.1226 + 0.3996, rounded to 2 d.p.			18.7500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.3732	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2892	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3687	0.3615	0.3543	0.3181	0.3109	0.2747	0.2747	0.2675	0.2892	0.3109	0.3253	0.3398	(22b)
Effective ac	0.5680	0.5653	0.5628	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1909	46.9716	46.7566	45.7468	45.5579	44.6785	44.6785	44.5156	45.0172	45.5579	45.9401	46.3397	(38)
Heat transfer coeff	135.2290	135.0097	134.7947	133.7850	133.5960	132.7166	132.7166	132.5537	133.0553	133.5960	133.9782	134.3778	(39)
Average = Sum(39)m / 12 =												133.7840	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3881	1.3859	1.3836	1.3733	1.3713	1.3623	1.3623	1.3606	1.3658	1.3713	1.3753	1.3794	(40)
HLP (average)												1.3733	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.2469	382.8934	369.5490	347.4597	323.9722	302.1328	288.4394	292.4302	304.2044	326.4377	352.0614	372.2982 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	577.2034	725.3266	871.5407	1020.5022	1120.7892	1111.1086	1060.9923	970.5453	865.4409	714.2185	585.7588	535.7189	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0283	50.1096	50.1895	50.5683	50.6398	50.9754	50.9754	51.0380	50.8456	50.6398	50.4954	50.3452	
alpha	4.3352	4.3406	4.3460	4.3712	4.3760	4.3984	4.3984	4.4025	4.3897	4.3760	4.3664	4.3563	
util living area	0.9980	0.9943	0.9832	0.9463	0.8534	0.6923	0.5317	0.5954	0.8377	0.9728	0.9956	0.9986	(86)
MIT	19.4456	19.6575	19.9851	20.3950	20.7350	20.9256	20.9816	20.9704	20.8209	20.3563	19.8155	19.4059	(87)
Th 2	19.7725	19.7742	19.7759	19.7839	19.7854	19.7923	19.7923	19.7936	19.7897	19.7854	19.7823	19.7792	(88)
util rest of house	0.9973	0.9923	0.9770	0.9257	0.7987	0.5890	0.3951	0.4549	0.7562	0.9586	0.9937	0.9980	(89)
MIT 2	18.3711	18.5833	18.9085	19.3102	19.6139	19.7602	19.7881	19.7859	19.6945	19.2827	18.7479	18.3367	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5895	18.8016	19.1273	19.5306	19.8417	19.9970	20.0307	20.0267	19.9235	19.5009	18.9649	18.5540	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5895	18.8016	19.1273	19.5306	19.8417	19.9970	20.0307	20.0267	19.9235	19.5009	18.9649	18.5540	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9900	0.9726	0.9204	0.8016	0.6080	0.4231	0.4837	0.7668	0.9541	0.9919	0.9973	(94)
Useful gains	575.0507	718.1011	847.6838	939.2932	898.4150	675.5680	448.9539	469.4690	663.6547	681.4576	581.0055	534.2588	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1932.3533	1876.8488	1702.0963	1422.2209	1087.7051	716.2775	455.3132	480.7281	774.8416	1189.1243	1589.6345	1928.8597	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1009.8331	778.6784	635.6829	347.7080	140.8318	0.0000	0.0000	0.0000	0.0000	377.7040	726.2129	1037.5831	(98)
Space heating												5054.2341	(98)
Space heating per m2											(98) / (4) =	51.8809	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1247.5359	982.1027	1007.4083	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8590	0.9165	0.8880	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1071.6672	900.1188	894.5465	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1402.2614	1341.4542	1237.5440	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	238.0278	328.3536	255.1901	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												821.5716 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	59.5070	82.0884	63.7975	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												205.3929 (107)
Space cooling per m2												2.1083 (108)
Energy for space heating												51.8809 (99)
Energy for space cooling												2.1083 (108)
Total												53.9892 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.3336	382.9704	369.6116	347.5071	324.0076	302.1627	288.4717	292.4722	304.2607	326.5093	352.1450	372.3873 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4500	10.6334	0.6300	0.7000	0.7700	20.9606	(74)
East	1.1700	19.6403	0.6300	0.7000	0.7700	7.0227	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	4.7000	46.7521	0.6300	0.7000	0.7700	67.1538	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	6.0000	19.6403	0.6300	0.7000	0.7700	36.0139	(80)

Solar gains	151.8412	269.4692	395.0300	529.6270	627.0155	636.5769	607.9186	533.6148	441.6496	305.1549	183.9014	128.5986	(83)
Total gains	536.1748	652.4396	764.6416	877.1341	951.0231	938.7396	896.3904	826.0870	745.9103	631.6642	536.0464	500.9858	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area	0.9986	0.9962	0.9891	0.9642	0.8930	0.7473	0.5832	0.6460	0.8745	0.9812	0.9969	0.9990	(86)
MIT	19.5207	19.7022	19.9942	20.3724	20.7066	20.9134	20.9786	20.9662	20.8065	20.3613	19.8655	19.4868	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house	0.9981	0.9949	0.9851	0.9497	0.8486	0.6500	0.4449	0.5069	0.8050	0.9711	0.9956	0.9986	(89)
MIT 2	18.5004	18.6827	18.9739	19.3492	19.6569	19.8227	19.8572	19.8543	19.7510	19.3453	18.8525	18.4719	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.7078	18.8899	19.1813	19.5572	19.8703	20.0443	20.0851	20.0803	19.9656	19.5518	19.0584	18.6782	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7078	18.8899	19.1813	19.5572	19.8703	20.0443	20.0851	20.0803	19.9656	19.5518	19.0584	18.6782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9933	0.9819	0.9449	0.8493	0.6671	0.4734	0.5354	0.8128	0.9674	0.9943	0.9981	(94)
Useful gains	534.7541	648.0899	750.7718	828.8279	807.7041	626.2781	424.3181	442.2631	606.2824	611.0614	532.9908	500.0090	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1821.4389	1765.6075	1597.7825	1332.2276	1019.8343	674.8914	432.0216	455.6249	729.0490	1117.3850	1497.1450	1818.2768	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	957.2935	750.9718	630.1759	362.4478	157.8248	0.0000	0.0000	0.0000	0.0000	376.7048	694.1910	980.7912	(98)
Space heating												4910.4009	(98)
Space heating per m2											(98) / (4) =	50.4044	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1165.2410	917.3174	940.8984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8348	0.9014	0.8709	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	972.7300	826.8358	819.4064	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1200.8310	1149.1054	1068.7526	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	164.2327	239.7686	185.5135	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												589.5148 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	41.0582	59.9422	46.3784	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												147.3787 (107)
Space cooling per m2												1.5128 (108)
Energy for space heating												50.4044 (99)
Energy for space cooling												1.5128 (108)
Total												51.9173 (109)
Target Fabric Energy Efficiency (TFEE)												59.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3683	0.3420	0.3508	0.3332	0.3332	0.3245	0.3157	0.3069	0.2981	0.3245	0.3069	0.3245	(22b)
Effective ac	0.5678	0.5585	0.5615	0.5555	0.5555	0.5526	0.5498	0.5471	0.5444	0.5526	0.5471	0.5526	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1778	46.4015	46.6539	46.1556	46.1556	45.9160	45.6828	45.4560	45.2356	45.9160	45.4560	45.9160	(38)
Heat transfer coeff	135.2159	134.4397	134.6920	134.1937	134.1937	133.9541	133.7209	133.4941	133.2737	133.9541	133.4941	133.9541	(39)
Average = Sum(39)m / 12 =												134.0483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3880	1.3800	1.3826	1.3775	1.3775	1.3750	1.3726	1.3703	1.3680	1.3750	1.3703	1.3750	(40)
HLP (average)												1.3760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602 (64)
RHI water heating demand												1691 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581	(83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0332	50.3220	50.2278	50.4143	50.4143	50.5044	50.5925	50.6785	50.7623	50.5044	50.6785	50.5044	
alpha	4.3355	4.3548	4.3485	4.3610	4.3610	4.3670	4.3728	4.3786	4.3842	4.3670	4.3786	4.3670	
util living area													
	0.9892	0.9809	0.9538	0.8797	0.7425	0.5296	0.3898	0.4131	0.6785	0.9073	0.9768	0.9914	(86)
MIT	19.7740	19.9346	20.2526	20.6175	20.8656	20.9759	20.9950	20.9938	20.9316	20.6265	20.1579	19.7514	(87)
Th 2	19.7726	19.7787	19.7767	19.7806	19.7806	19.7825	19.7844	19.7862	19.7879	19.7825	19.7862	19.7825	(88)
util rest of house													
	0.9855	0.9745	0.9384	0.8413	0.6679	0.4249	0.2705	0.2874	0.5733	0.8669	0.9674	0.9884	(89)
MIT 2	18.1973	18.4324	18.8817	19.3753	19.6699	19.7706	19.7832	19.7847	19.7459	19.4035	18.7618	18.1717	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9671	0.9285	0.8357	0.6767	0.4457	0.2948	0.3131	0.5919	0.8616	0.9596	0.9838	(94)
Useful gains	842.2970	945.7678	1049.0022	1073.4199	907.2403	620.5779	390.3902	389.4975	668.1823	838.2919	825.3965	788.8798	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1841.3317	1806.5563	1637.9030	1359.0861	994.7714	631.6741	391.7343	391.1938	704.5990	1105.4035	1487.8670	1807.4129	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	743.2818	578.4499	438.1422	205.6797	65.1231	0.0000	0.0000	0.0000	0.0000	198.7311	476.9788	757.7886	(98)
Space heating												3464.1752	(98)
RHI space heating demand												3464	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4472	0.4384	0.4297	0.3858	0.3771	0.3332	0.3332	0.3245	0.3508	0.3771	0.3946	0.4121	(22b)
Effective ac	0.6000	0.5961	0.5923	0.5744	0.5711	0.5555	0.5555	0.5526	0.5615	0.5711	0.5779	0.5849	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.8515	49.5289	49.2126	47.7272	47.4493	46.1556	46.1556	45.9160	46.6539	47.4493	48.0115	48.5993	(38)
Heat transfer coeff	137.8896	137.5670	137.2507	135.7653	135.4874	134.1937	134.1937	133.9541	134.6920	135.4874	136.0496	136.6374	(39)
Average = Sum(39)m / 12 =												135.7640	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4154	1.4121	1.4089	1.3936	1.3908	1.3775	1.3775	1.3750	1.3826	1.3908	1.3965	1.4026	(40)
HLP (average)												1.3936	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	812.5826	957.3999	1093.0625	1226.8648	1312.2575	1290.0990	1233.6318	1147.9861	1052.5460	916.5641	804.2065	765.7350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.0630	49.1781	49.2914	49.8307	49.9329	50.4143	50.4143	50.5044	50.2278	49.9329	49.7265	49.5126	
alpha	4.2709	4.2785	4.2861	4.3220	4.3289	4.3610	4.3610	4.3670	4.3485	4.3289	4.3151	4.3008	
util living area													
	0.9924	0.9841	0.9639	0.9091	0.7955	0.6232	0.4684	0.5197	0.7592	0.9396	0.9855	0.9941	(86)
MIT	19.6240	19.8290	20.1378	20.5131	20.8004	20.9492	20.9883	20.9819	20.8796	20.4940	19.9865	19.5859	(87)
Th 2	19.7515	19.7541	19.7566	19.7682	19.7704	19.7806	19.7806	19.7825	19.7767	19.7704	19.7660	19.7614	(88)
util rest of house													
	0.9899	0.9789	0.9518	0.8787	0.7318	0.5215	0.3438	0.3905	0.6660	0.9124	0.9797	0.9920	(89)
MIT 2	17.9652	18.2632	18.7060	19.2308	19.5903	19.7502	19.7769	19.7761	19.6905	19.2210	18.5022	17.9166	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3024	18.5815	18.9970	19.4914	19.8363	19.9939	20.0231	20.0212	19.9322	19.4797	18.8038	18.2559	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3024	18.5815	18.9970	19.4914	19.8363	19.9939	20.0231	20.0212	19.9322	19.4797	18.8038	18.2559	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9720	0.9421	0.8704	0.7356	0.5403	0.3692	0.4168	0.6793	0.9041	0.9733	0.9884	(94)
Useful gains	800.7810	930.5525	1029.7274	1067.8861	965.3038	697.0639	455.4636	478.4948	714.9552	828.7034	782.7541	756.8438	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1930.7822	1882.1207	1715.2249	1437.9461	1102.3615	723.8277	459.3637	485.0681	785.5488	1203.0889	1592.3024	1920.5598	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	840.7208	639.4539	510.0101	266.4432	101.9709	0.0000	0.0000	0.0000	0.0000	278.5429	582.8747	865.8047	(98)
Space heating												4085.8213	(98)
Space heating per m2											(98) / (4) =	41.9403	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4398.0853	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	840.7208	639.4539	510.0101	266.4432	101.9709	0.0000	0.0000	0.0000	0.0000	278.5429	582.8747	865.8047	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	904.9740	688.3249	548.9883	286.8065	109.7642	0.0000	0.0000	0.0000	0.0000	299.8309	627.4217	931.9749	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3379	89.2691	89.1255	88.7817	88.0587	86.7000	86.7000	86.7000	86.7000	88.7869	89.2085	89.3648	(217)
Fuel for water heating, kWh/month													
	193.3970	169.6480	176.2270	155.4785	151.3418	134.0367	125.5844	142.1462	143.2609	161.3721	173.7095	187.6473	(219)
Water heating fuel used												1913.8492	(219)
Annual totals kWh/year													
Space heating fuel - main system												4398.0853	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												6231.0661	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4398.0853	3.4800	153.0534	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1913.8492	3.4800	66.6020	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			328.9888	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9702	(257)
SAP value		86.4658	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4398.0853	0.2160	949.9864	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1913.8492	0.2160	413.3914	(264)
Space and water heating			1363.3779	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1321.4072	(272)
CO2 emissions per m2			13.5600	(273)
EI value			87.5672	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3683	0.3420	0.3508	0.3332	0.3332	0.3245	0.3157	0.3069	0.2981	0.3245	0.3069	0.3245	(22b)
Effective ac	0.5678	0.5585	0.5615	0.5555	0.5555	0.5526	0.5498	0.5471	0.5444	0.5526	0.5471	0.5526	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1778	46.4015	46.6539	46.1556	46.1556	45.9160	45.6828	45.4560	45.2356	45.9160	45.4560	45.9160	(38)
Heat transfer coeff	135.2159	134.4397	134.6920	134.1937	134.1937	133.9541	133.7209	133.4941	133.2737	133.9541	133.4941	133.9541	(39)
Average = Sum(39)m / 12 =												134.0483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3880	1.3800	1.3826	1.3775	1.3775	1.3750	1.3726	1.3703	1.3680	1.3750	1.3703	1.3750	(40)
HLP (average)												1.3760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581	(83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0332	50.3220	50.2278	50.4143	50.4143	50.5044	50.5925	50.6785	50.7623	50.5044	50.6785	50.5044	
alpha	4.3355	4.3548	4.3485	4.3610	4.3610	4.3670	4.3728	4.3786	4.3842	4.3670	4.3786	4.3670	
util living area													
	0.9892	0.9809	0.9538	0.8797	0.7425	0.5296	0.3898	0.4131	0.6785	0.9073	0.9768	0.9914	(86)
MIT	19.7740	19.9346	20.2526	20.6175	20.8656	20.9759	20.9950	20.9938	20.9316	20.6265	20.1579	19.7514	(87)
Th 2	19.7726	19.7787	19.7767	19.7806	19.7806	19.7825	19.7844	19.7862	19.7879	19.7825	19.7862	19.7825	(88)
util rest of house													
	0.9855	0.9745	0.9384	0.8413	0.6679	0.4249	0.2705	0.2874	0.5733	0.8669	0.9674	0.9884	(89)
MIT 2	18.1973	18.4324	18.8817	19.3753	19.6699	19.7706	19.7832	19.7847	19.7459	19.4035	18.7618	18.1717	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9671	0.9285	0.8357	0.6767	0.4457	0.2948	0.3131	0.5919	0.8616	0.9596	0.9838	(94)
Useful gains	842.2970	945.7678	1049.0022	1073.4199	907.2403	620.5779	390.3902	389.4975	668.1823	838.2919	825.3965	788.8798	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1841.3317	1806.5563	1637.9030	1359.0861	994.7714	631.6741	391.7343	391.1938	704.5990	1105.4035	1487.8670	1807.4129	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	743.2818	578.4499	438.1422	205.6797	65.1231	0.0000	0.0000	0.0000	0.0000	198.7311	476.9788	757.7886	(98)
Space heating												3464.1752	(98)
Space heating per m2											(98) / (4) =	35.5592	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3728.9292	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	743.2818	578.4499	438.1422	205.6797	65.1231	0.0000	0.0000	0.0000	0.0000	198.7311	476.9788	757.7886	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	800.0881	622.6587	471.6278	221.3990	70.1002	0.0000	0.0000	0.0000	0.0000	213.9193	513.4325	815.7035	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2785	89.2168	89.0329	88.5869	87.7250	86.7000	86.7000	86.7000	86.7000	88.5311	89.0936	89.3028	(217)
Fuel for water heating, kWh/month													
	193.5256	169.7475	176.4103	155.8204	151.9175	134.0367	125.5844	142.1462	143.2609	161.8383	173.9334	187.7776	(219)
Water heating fuel used												1915.9989	(219)
Annual totals kWh/year													
Space heating fuel - main system												3728.9292	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												5490.3431	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3728.9292	7.3800	275.1950	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1915.9989	7.3800	141.4007	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			479.2917	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3728.9292	0.2160	805.4487	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.9989	0.2160	413.8558	(264)
Space and water heating			1219.3044	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			1139.0749	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3728.9292	1.2200	4549.2936	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.9989	1.2200	2337.5186	(264)
Space and water heating			6886.8122	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			6412.2365	(272)
Primary energy kWh/m2/year			65.8205	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-193 kg (16.9%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£60	1.98 kg/m²	B 88	B 89
	Total Savings	£60	1.98 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£135	£150	-£14
Mains gas	£524	£449	£75
Space heating	£404	£404	£0
Water heating	£141	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£479	£419	£61
Total cost of uses	£479	£419	£60
Delivered energy	56 kWh/m²	46 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	66 kWh/m²	55 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4472	0.4384	0.4297	0.3858	0.3771	0.3332	0.3332	0.3245	0.3508	0.3771	0.3946	0.4121	(22b)
Effective ac	0.6000	0.5961	0.5923	0.5744	0.5711	0.5555	0.5555	0.5526	0.5615	0.5711	0.5779	0.5849	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.8515	49.5289	49.2126	47.7272	47.4493	46.1556	46.1556	45.9160	46.6539	47.4493	48.0115	48.5993	(38)
Heat transfer coeff	137.8896	137.5670	137.2507	135.7653	135.4874	134.1937	134.1937	133.9541	134.6920	135.4874	136.0496	136.6374	(39)
Average = Sum(39)m / 12 =												135.7640	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4154	1.4121	1.4089	1.3936	1.3908	1.3775	1.3775	1.3750	1.3826	1.3908	1.3965	1.4026	(40)
HLP (average)												1.3936	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1683	(H8)
Utilisation factor												0.5751	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-866.8465	(H17)
Solar input	-25.1368	-41.9461	-71.4391	-95.7424	-118.2817	-116.2897	-114.7529	-100.2602	-78.5238	-53.6225	-29.8159	-21.0352	(63)
								Solar input (sum of months) = Sum(63)m =				-866.8465	(63)
Output from w/h													
	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
								Total per year (kWh/year) = Sum(64)m =				830.1649	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	812.5826	957.3999	1093.0625	1226.8648	1312.2575	1290.0990	1233.6318	1147.9861	1052.5460	916.5641	804.2065	765.7350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.0630	49.1781	49.2914	49.8307	49.9329	50.4143	50.4143	50.5044	50.2278	49.9329	49.7265	49.5126	
alpha	4.2709	4.2785	4.2861	4.3220	4.3289	4.3610	4.3610	4.3670	4.3485	4.3289	4.3151	4.3008	
util living area													
	0.9924	0.9841	0.9639	0.9091	0.7955	0.6232	0.4684	0.5197	0.7592	0.9396	0.9855	0.9941	(86)
MIT	19.6240	19.8290	20.1378	20.5131	20.8004	20.9492	20.9883	20.9819	20.8796	20.4940	19.9865	19.5859	(87)
Th 2	19.7515	19.7541	19.7566	19.7682	19.7704	19.7806	19.7806	19.7825	19.7767	19.7704	19.7660	19.7614	(88)
util rest of house													
	0.9899	0.9789	0.9518	0.8787	0.7318	0.5215	0.3438	0.3905	0.6660	0.9124	0.9797	0.9920	(89)
MIT 2	17.9652	18.2632	18.7060	19.2308	19.5903	19.7502	19.7769	19.7761	19.6905	19.2210	18.5022	17.9166	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.3024	18.5815	18.9970	19.4914	19.8363	19.9939	20.0231	20.0212	19.9322	19.4797	18.8038	18.2559	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3024	18.5815	18.9970	19.4914	19.8363	19.9939	20.0231	20.0212	19.9322	19.4797	18.8038	18.2559	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9720	0.9421	0.8704	0.7356	0.5403	0.3692	0.4168	0.6793	0.9041	0.9733	0.9884	(94)
Useful gains	800.7810	930.5525	1029.7274	1067.8861	965.3038	697.0639	455.4636	478.4948	714.9552	828.7034	782.7541	756.8438	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1930.7822	1882.1207	1715.2249	1437.9461	1102.3615	723.8277	459.3637	485.0681	785.5488	1203.0889	1592.3024	1920.5598	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	840.7208	639.4539	510.0101	266.4432	101.9709	0.0000	0.0000	0.0000	0.0000	278.5429	582.8747	865.8047	(98)
Space heating												4085.8213	(98)
Space heating per m2											(98) / (4) =	41.9403	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4398.0853	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	840.7208	639.4539	510.0101	266.4432	101.9709	0.0000	0.0000	0.0000	0.0000	278.5429	582.8747	865.8047	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	904.9740	688.3249	548.9883	286.8065	109.7642	0.0000	0.0000	0.0000	0.0000	299.8309	627.4217	931.9749	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4071	89.4175	89.4255	89.4477	89.4768	86.7000	86.7000	86.7000	86.7000	89.0992	89.3173	89.4219	(217)
Fuel for water heating, kWh/month	165.1323	122.4560	95.7490	47.2835	16.7507	0.0000	0.0000	26.5058	52.6913	100.6234	140.1159	164.0039	(219)
Water heating fuel used												931.3119	(219)
Annual totals kWh/year													
Space heating fuel - main system												4398.0853	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5298.5288	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4398.0853	3.4800	153.0534	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	931.3119	3.4800	32.4097	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			301.3915	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8888	(257)
SAP value	87.6011	
SAP rating (Section 12)	88	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4398.0853	0.2160	949.9864	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	931.3119	0.2160	201.1634 (264)
Space and water heating			1151.1498 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.8950	0.5190	205.9885 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			1135.1291 (272)
CO2 emissions per m2			11.6500 (273)
EI value			89.3198
EI rating			89 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		5.0800	
Infiltration rate		0.4526	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3508	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3683	0.3420	0.3508	0.3332	0.3332	0.3245	0.3157	0.3069	0.2981	0.3245	0.3069	0.3245	(22b)
Effective ac	0.5678	0.5585	0.5615	0.5555	0.5555	0.5526	0.5498	0.5471	0.5444	0.5526	0.5471	0.5526	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1200	5.7708			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.9719			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	88.0381	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1778	46.4015	46.6539	46.1556	46.1556	45.9160	45.6828	45.4560	45.2356	45.9160	45.4560	45.9160	(38)
Heat transfer coeff	135.2159	134.4397	134.6920	134.1937	134.1937	133.9541	133.7209	133.4941	133.2737	133.9541	133.4941	133.9541	(39)
Average = Sum(39)m / 12 =												134.0483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3880	1.3800	1.3826	1.3775	1.3775	1.3750	1.3726	1.3703	1.3680	1.3750	1.3703	1.3750	(40)
HLP (average)												1.3760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3075	(H8)
Utilisation factor												0.5346	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-901.7521	(H17)
Solar input	-29.4173	-41.8296	-71.8950	-97.0030	-113.9358	-121.7015	-119.1421	-106.6358	-83.4884	-57.7210	-34.7930	-24.1896	(63)
								Solar input (sum of months) = Sum(63)m =				-901.7521	(63)
Output from w/h													
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010	(64)
								Total per year (kWh/year) = Sum(64)m =				805.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581	(83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0332	50.3220	50.2278	50.4143	50.4143	50.5044	50.5925	50.6785	50.7623	50.5044	50.6785	50.5044	
alpha	4.3355	4.3548	4.3485	4.3610	4.3610	4.3670	4.3728	4.3786	4.3842	4.3670	4.3786	4.3670	
util living area													
	0.9892	0.9809	0.9538	0.8797	0.7425	0.5296	0.3898	0.4131	0.6785	0.9073	0.9768	0.9914	(86)
MIT	19.7740	19.9346	20.2526	20.6175	20.8656	20.9759	20.9950	20.9938	20.9316	20.6265	20.1579	19.7514	(87)
Th 2	19.7726	19.7787	19.7767	19.7806	19.7806	19.7825	19.7844	19.7862	19.7879	19.7825	19.7862	19.7825	(88)
util rest of house													
	0.9855	0.9745	0.9384	0.8413	0.6679	0.4249	0.2705	0.2874	0.5733	0.8669	0.9674	0.9884	(89)
MIT 2	18.1973	18.4324	18.8817	19.3753	19.6699	19.7706	19.7832	19.7847	19.7459	19.4035	18.7618	18.1717	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5177	18.7377	19.1604	19.6278	19.9130	20.0156	20.0295	20.0304	19.9869	19.6521	19.0456	18.4928	(93)

8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9671	0.9285	0.8357	0.6767	0.4457	0.2948	0.3131	0.5919	0.8616	0.9596	0.9838	(94)
Useful gains	842.2970	945.7678	1049.0022	1073.4199	907.2403	620.5779	390.3902	389.4975	668.1823	838.2919	825.3965	788.8798	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1841.3317	1806.5563	1637.9030	1359.0861	994.7714	631.6741	391.7343	391.1938	704.5990	1105.4035	1487.8670	1807.4129	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	743.2818	578.4499	438.1422	205.6797	65.1231	0.0000	0.0000	0.0000	0.0000	198.7311	476.9788	757.7886	(98)
Space heating												3464.1752	(98)
Space heating per m2											(98) / (4) =	35.5592	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3728.9292	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	743.2818	578.4499	438.1422	205.6797	65.1231	0.0000	0.0000	0.0000	0.0000	198.7311	476.9788	757.7886	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	800.0881	622.6587	471.6278	221.3990	70.1002	0.0000	0.0000	0.0000	0.0000	213.9193	513.4325	815.7035	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3667	89.3745	89.3632	89.3515	89.1468	86.7000	86.7000	86.7000	86.7000	88.9124	89.2372	89.3748	(217)
Fuel for water heating, kWh/month													
	160.4171	122.6454	95.3056	45.9237	21.6876	0.0000	0.0000	19.1523	46.9652	96.2253	134.6643	160.5610	(219)
Water heating fuel used												903.5473	(219)
Annual totals kWh/year													
Space heating fuel - main system												3728.9292	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4527.8916	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3728.9292	7.3800	275.1950	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	903.5473	7.3800	66.6818	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			418.9027	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3728.9292	0.2160	805.4487	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.5473	0.2160	195.1662	(264)
Space and water heating			1000.6149	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			946.3354	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3728.9292	1.2200	4549.2936	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.5473	1.2200	1102.3278	(264)
Space and water heating			5651.6213	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			5330.5457	(272)
Primary energy kWh/m2/year			54.7172	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		664.69 (P1)
Transmission heat loss coefficient		88.04 (37)
Summer heat loss coefficient		752.72 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
South West	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.1800	87.1704	0.7200	0.7000	0.8865	251.6781
East	1.3000	125.2818	0.7200	0.7000	0.8865	65.4912
South East	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
South	5.2300	118.5567	0.7200	0.7000	0.8865	249.3328
South West	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
West	6.6700	125.2818	0.7200	0.7000	0.8865	336.0203
total:						1006.9586

	Jun	Jul	Aug	
Solar gains	1081	1007	900	(P3)
Internal gains	478	458	467	
Total summer gains	1559	1465	1367	(P5)
Summer gain/loss ratio	2.07	1.95	1.82	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.72	19.50	19.37	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 375 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	86 B	**DER**	15.27	**TER**	18.75
Environmental	88 B	**% DER<TER**	18.57		
CO_2 Emissions (t/year)	1.10	**DFEE**	53.99	**TFEE**	59.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.57		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.75	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.27	$kgCO_2/m^2$	Pass
	-3.48 (-18.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.70	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.99	$kWh/m^2/yr$	
	-5.7 (-9.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.08 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.18 m², No overhang
Windows facing East	1.30 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	5.23 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	6.67 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.08 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.12	W/m²K
Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 376 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.70	**TER**	18.70
Environmental	89 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.69	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.63 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.47 m², No overhang
Windows facing South: 0.50 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.4760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5159	0.5058	0.4957	0.4451	0.4350	0.3844	0.3844	0.3743	0.4046	0.4350	0.4552	0.4754	(22b)
Effective ac	0.6331	0.6279	0.6228	0.5991	0.5946	0.5739	0.5739	0.5700	0.5819	0.5946	0.6036	0.6130	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7176	42.3689	42.0271	40.4218	40.1214	38.7232	38.7232	38.4643	39.2618	40.1214	40.7290	41.3643	(38)
Heat transfer coeff	100.0532	99.7045	99.3628	97.7574	97.4571	96.0589	96.0589	95.8000	96.5975	97.4571	98.0647	98.6999	(39)
Average = Sum(39)m / 12 =												97.7560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2649	1.2605	1.2562	1.2359	1.2321	1.2144	1.2144	1.2111	1.2212	1.2321	1.2398	1.2478	(40)
HLP (average)												1.2359	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	457.1646	533.7917	621.3140	715.4609	775.7929	764.3461	728.4368	673.0240	601.0948	509.9519	447.6888	431.2291	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9013	55.0933	55.2828	56.1907	56.3638	57.1842	57.1842	57.3388	56.8654	56.3638	56.0146	55.6541	
alpha	4.6601	4.6729	4.6855	4.7460	4.7576	4.8123	4.8123	4.8226	4.7910	4.7576	4.7343	4.7103	
util living area													
	0.9983	0.9961	0.9889	0.9615	0.8838	0.7274	0.5617	0.6227	0.8671	0.9807	0.9965	0.9987	(86)
MIT	19.5876	19.7505	20.0375	20.4214	20.7418	20.9310	20.9842	20.9747	20.8297	20.3994	19.9288	19.5681	(87)
Th 2	19.8684	19.8719	19.8753	19.8914	19.8944	19.9085	19.9085	19.9111	19.9031	19.8944	19.8883	19.8820	(88)
util rest of house													
	0.9977	0.9947	0.9847	0.9463	0.8381	0.6322	0.4317	0.4908	0.7972	0.9705	0.9951	0.9982	(89)
MIT 2	17.9921	18.2324	18.6518	19.2109	19.6401	19.8625	19.9028	19.9007	19.7634	19.1904	18.5048	17.9729	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3011	18.5264	18.9202	19.4454	19.8535	20.0695	20.1122	20.1087	19.9699	19.4246	18.7806	18.2819	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3011	18.5264	18.9202	19.4454	19.8535	20.0695	20.1122	20.1087	19.9699	19.4246	18.7806	18.2819	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9922	0.9797	0.9384	0.8361	0.6475	0.4570	0.5162	0.8023	0.9644	0.9928	0.9972	(94)
Useful gains	455.4936	529.6526	608.6764	671.3813	648.6167	494.8992	332.8674	347.4017	482.2726	491.7851	444.4819	430.0273	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1400.8538	1358.6143	1234.1009	1030.8873	794.6146	525.3918	337.3789	355.2957	567.0200	860.0161	1145.4551	1389.8804	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	703.3480	557.0623	465.3158	258.8443	108.6225	0.0000	0.0000	0.0000	0.0000	273.9639	504.7007	714.1307	(98)
Space heating												3585.9882	(98)
Space heating per m2											(98) / (4) =	45.3349	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3860.0519	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	703.3480	557.0623	465.3158	258.8443	108.6225	0.0000	0.0000	0.0000	0.0000	273.9639	504.7007	714.1307	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	757.1023	599.6365	500.8781	278.6268	116.9241	0.0000	0.0000	0.0000	0.0000	294.9019	543.2731	768.7091	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2820	89.2298	89.1078	88.8052	88.1566	86.7000	86.7000	86.7000	86.7000	88.8192	89.1629	89.3041	(217)
Fuel for water heating, kWh/month													
	181.8380	159.4965	165.6865	146.1857	142.2324	126.1921	118.3152	133.8039	134.8180	151.7090	163.3630	176.4661	(219)
Water heating fuel used												1800.1065	(219)
Annual totals kWh/year													
Space heating fuel - main system												3860.0519	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5545.4056	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3860.0519	0.2160	833.7712	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.1065	0.2160	388.8230	(264)
Space and water heating			1222.5942	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1163.0375	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7000	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.2442	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.2442	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	459.6774	526.0846	600.3505	679.3876	728.7972	715.5082	682.3785	635.2717	574.3655	497.9833	447.2713	435.5922	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9983	0.9963	0.9895	0.9635	0.8867	0.7279	0.5581	0.6165	0.8636	0.9804	0.9965	0.9987	(86)
MIT	19.7308	19.8772	20.1372	20.4832	20.7753	20.9433	20.9882	20.9808	20.8578	20.4696	20.0389	19.7075	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9977	0.9950	0.9856	0.9494	0.8433	0.6374	0.4365	0.4928	0.7958	0.9703	0.9951	0.9983	(89)
MIT 2	18.2608	18.4764	18.8560	19.3581	19.7490	19.9440	19.9779	19.9761	19.8612	19.3477	18.7213	18.2337	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9812	0.9424	0.8421	0.6523	0.4601	0.5166	0.8017	0.9648	0.9930	0.9973	(94)
Useful gains	458.0554	522.2711	589.0734	640.2623	613.6941	466.7357	313.9674	328.2108	460.4959	480.4618	444.1185	434.4112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1304.6257	1264.8403	1148.2584	960.7034	740.4706	491.7722	317.3589	334.1897	531.0060	804.8636	1071.2668	1297.9090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating												3205.2717	(98)
Space heating per m2											(98) / (4) =	40.5218	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3431.7684	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	674.3558	534.2682	445.4321	247.0209	100.9868	0.0000	0.0000	0.0000	0.0000	258.4100	483.4547	687.8398	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7257	87.5215	87.0449	85.9249	83.8019	80.3000	80.3000	80.3000	80.3000	85.9192	87.2417	87.8106	(217)
Fuel for water heating, kWh/month													
	229.6885	201.8751	211.1880	189.7546	188.3700	173.1411	165.8823	184.9199	186.9622	198.9702	209.1771	224.0570	(219)
Water heating fuel used												2363.9861	(219)
Annual totals kWh/year													
Space heating fuel - main system												3431.7684	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6233.7652	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3431.7684	0.2160	741.2620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.9861	0.2160	510.6210	(264)
Space and water heating			1251.8830	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1479.2105	(272)
Emissions per m2 for space and water heating			15.8266	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8266 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.3782	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3215	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4099	0.4019	0.3938	0.3536	0.3456	0.3054	0.3054	0.2974	0.3215	0.3456	0.3617	0.3777	(22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5517	0.5597	0.5654	0.5713	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4066	39.1865	38.9707	37.9573	37.7677	36.8851	36.8851	36.7216	37.2251	37.7677	38.1513	38.5523	(38)
Heat transfer coeff	96.7422	96.5221	96.3064	95.2930	95.1034	94.2207	94.2207	94.0573	94.5607	95.1034	95.4869	95.8879	(39)
Average = Sum(39)m / 12 =												95.2921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2230	1.2203	1.2175	1.2047	1.2023	1.1912	1.1912	1.1891	1.1955	1.2023	1.2072	1.2122	(40)
HLP (average)												1.2047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	425.9154	503.3159	592.4432	688.7707	750.5189	741.0648	706.8475	649.2649	576.5633	483.1638	418.3523	400.7485	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7803	56.9098	57.0373	57.6439	57.7588	58.2999	58.2999	58.4012	58.0902	57.7588	57.5268	57.2862	
alpha	4.7854	4.7940	4.8025	4.8429	4.8506	4.8867	4.8867	4.8934	4.8727	4.8506	4.8351	4.8191	
util living area													
	0.9988	0.9970	0.9906	0.9651	0.8894	0.7350	0.5678	0.6328	0.8767	0.9839	0.9974	0.9991	(86)
MIT	19.6054	19.7665	20.0504	20.4259	20.7448	20.9312	20.9844	20.9743	20.8269	20.3959	19.9307	19.5788	(87)
Th 2	19.9016	19.9038	19.9060	19.9162	19.9181	19.9271	19.9271	19.9287	19.9236	19.9181	19.9143	19.9102	(88)
util rest of house													
	0.9983	0.9959	0.9870	0.9512	0.8454	0.6411	0.4388	0.5016	0.8101	0.9753	0.9963	0.9988	(89)
MIT 2	18.6313	18.7937	19.0776	19.4523	19.7452	19.8955	19.9232	19.9214	19.8252	19.4301	18.9662	18.6116	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8200	18.9821	19.2660	19.6409	19.9388	20.0961	20.1287	20.1253	20.0192	19.6172	19.1530	18.7989	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8200	18.9821	19.2660	19.6409	19.9388	20.0961	20.1287	20.1253	20.0192	19.6172	19.1530	18.7989	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9842	0.9467	0.8464	0.6572	0.4640	0.5272	0.8172	0.9720	0.9952	0.9983	(94)
Useful gains	424.9319	500.5996	583.0953	652.0603	635.2535	487.0417	328.0097	342.2960	471.1630	469.6449	416.3501	400.0584	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1404.6943	1359.2349	1229.4459	1023.5293	783.5380	517.8429	332.4787	350.3957	559.7236	857.5623	1150.9075	1399.8598	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	728.9433	577.0029	480.8849	267.4577	110.3237	0.0000	0.0000	0.0000	0.0000	288.6105	528.8814	743.8523	(98)
Space heating												3725.9566	(98)
Space heating per m2											(98) / (4) =	47.1044	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	885.6750	697.2335	714.8354	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8609	0.9213	0.8936	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.4754	642.3293	638.7743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7972	915.9608	850.3385	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	140.6316	203.5818	157.4038	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												501.6172 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.1579	50.8954	39.3509	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												125.4043 (107)
Space cooling per m2												1.5854 (108)
Energy for space heating												47.1044 (99)
Energy for space cooling												1.5854 (108)
Total												48.6898 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	415.2740	482.8240	559.3195	641.1606	692.6124	681.9410	650.4988	600.5977	538.2912	459.0289	405.1465	391.9549	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9989	0.9975	0.9922	0.9708	0.9028	0.7523	0.5823	0.6459	0.8867	0.9860	0.9978	0.9992	(86)
MIT	19.6785	19.8268	20.0908	20.4450	20.7504	20.9339	20.9857	20.9764	20.8354	20.4272	19.9896	19.6560	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9985	0.9966	0.9893	0.9590	0.8632	0.6626	0.4570	0.5192	0.8250	0.9785	0.9968	0.9989	(89)
MIT 2	18.7458	18.8958	19.1603	19.5165	19.8000	19.9512	19.9786	19.9772	19.8829	19.5053	19.0678	18.7310	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9955	0.9870	0.9550	0.8637	0.6780	0.4815	0.5439	0.8314	0.9757	0.9959	0.9985	(94)
Useful gains	414.4514	480.6553	552.0451	612.3297	598.2419	462.3329	313.2042	326.6667	447.5476	447.8568	403.4790	391.3762	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1339.5148	1294.8339	1169.7945	971.5266	743.7278	492.1263	317.3670	334.1920	532.1796	815.5373	1095.6064	1333.3522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2471	547.1280	459.6055	258.6218	108.2415	0.0000	0.0000	0.0000	0.0000	273.5543	498.3317	700.8301	(98)
Space heating												3534.5602	(98)
Space heating per m2											(98) / (4) =	44.6847	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8617	0.9235	0.8971	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.3441	606.8899	604.2870	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	888.6914	850.0987	793.4548	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.9301	180.9473	140.7409	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.6182	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   30.4825   45.2368   35.1852    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.9046 (107)
Space cooling per m2                                                                                                     1.4021 (108)
Energy for space heating                                                                                                44.6847 (99)
Energy for space cooling                                                                                                 1.4021 (108)
Total                                                                                                                   46.0868 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    53.0 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.4760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4249	0.3945	0.4046	0.3844	0.3844	0.3743	0.3642	0.3540	0.3439	0.3743	0.3540	0.3743	(22b)
Effective ac	0.5903	0.5778	0.5819	0.5739	0.5739	0.5700	0.5663	0.5627	0.5591	0.5700	0.5627	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.8280	38.9891	39.2618	38.7232	38.7232	38.4643	38.2123	37.9672	37.7290	38.4643	37.9672	38.4643	(38)
Heat transfer coeff	97.1636	96.3247	96.5975	96.0589	96.0589	95.8000	95.5480	95.3028	95.0646	95.8000	95.3028	95.8000	(39)
Average = Sum(39)m / 12 =												95.9018	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2284	1.2178	1.2212	1.2144	1.2144	1.2111	1.2079	1.2048	1.2018	1.2111	1.2048	1.2111	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5341	57.0264	56.8654	57.1842	57.1842	57.3388	57.4900	57.6379	57.7823	57.3388	57.6379	57.3388	
alpha	4.7689	4.8018	4.7910	4.8123	4.8123	4.8226	4.8327	4.8425	4.8522	4.8226	4.8425	4.8226	
util living area													
	0.9905	0.9845	0.9629	0.8975	0.7649	0.5511	0.4039	0.4248	0.6977	0.9204	0.9801	0.9922	(86)
MIT	19.9340	20.0634	20.3348	20.6619	20.8857	20.9812	20.9966	20.9958	20.9449	20.6741	20.2730	19.9278	(87)
Th 2	19.8974	19.9058	19.9031	19.9085	19.9085	19.9111	19.9137	19.9161	19.9185	19.9111	19.9161	19.9111	(88)
util rest of house													
	0.9873	0.9795	0.9506	0.8645	0.6969	0.4534	0.2931	0.3090	0.6010	0.8859	0.9723	0.9895	(89)
MIT 2	18.5162	18.7087	19.0933	19.5420	19.8114	19.9014	19.9128	19.9150	19.8831	19.5718	19.0206	18.5172	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9424	0.8592	0.7045	0.4718	0.3147	0.3315	0.6174	0.8810	0.9659	0.9856	(94)
Useful gains	648.6930	705.7580	768.0589	781.7786	662.2346	453.8462	288.0618	287.2976	488.4986	614.6535	620.9063	615.5751	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1349.6852	1316.8651	1191.4117	985.4565	722.3090	460.8475	288.8121	288.2304	512.2809	803.3084	1082.9386	1321.1225	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.5382	410.6639	314.9745	146.6481	44.6953	0.0000	0.0000	0.0000	0.0000	140.3593	332.6632	524.9273	(98)
Space heating												2436.4698	(98)
RHI space heating demand												2436	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.4760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5159	0.5058	0.4957	0.4451	0.4350	0.3844	0.3844	0.3743	0.4046	0.4350	0.4552	0.4754	(22b)
Effective ac	0.6331	0.6279	0.6228	0.5991	0.5946	0.5739	0.5739	0.5700	0.5819	0.5946	0.6036	0.6130	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7176	42.3689	42.0271	40.4218	40.1214	38.7232	38.7232	38.4643	39.2618	40.1214	40.7290	41.3643	(38)
Heat transfer coeff	100.0532	99.7045	99.3628	97.7574	97.4571	96.0589	96.0589	95.8000	96.5975	97.4571	98.0647	98.6999	(39)
Average = Sum(39)m / 12 =												97.7560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2649	1.2605	1.2562	1.2359	1.2321	1.2144	1.2144	1.2111	1.2212	1.2321	1.2398	1.2478	(40)
HLP (average)												1.2359	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9013	55.0933	55.2828	56.1907	56.3638	57.1842	57.1842	57.3388	56.8654	56.3638	56.0146	55.6541	
alpha	4.6601	4.6729	4.6855	4.7460	4.7576	4.8123	4.8123	4.8226	4.7910	4.7576	4.7343	4.7103	
util living area													
	0.9931	0.9875	0.9720	0.9249	0.8193	0.6436	0.4824	0.5315	0.7787	0.9493	0.9873	0.9944	(86)
MIT	19.7919	19.9486	20.2167	20.5613	20.8231	20.9592	20.9917	20.9870	20.8981	20.5524	20.1159	19.7695	(87)
Th 2	19.8684	19.8719	19.8753	19.8914	19.8944	19.9085	19.9085	19.9111	19.9031	19.8944	19.8883	19.8820	(88)
util rest of house													
	0.9908	0.9834	0.9625	0.8995	0.7623	0.5494	0.3670	0.4125	0.6938	0.9266	0.9823	0.9926	(89)
MIT 2	18.2894	18.5188	18.9059	19.3964	19.7300	19.8830	19.9056	19.9062	19.8273	19.3976	18.7748	18.2663	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5804	18.7957	19.1598	19.6221	19.9417	20.0914	20.1160	20.1155	20.0347	19.6212	19.0345	18.5575	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5804	18.7957	19.1598	19.6221	19.9417	20.0914	20.1160	20.1155	20.0347	19.6212	19.0345	18.5575	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9546	0.8920	0.7651	0.5660	0.3894	0.4356	0.7052	0.9194	0.9770	0.9894	(94)
Useful gains	628.2596	695.1288	754.5416	778.9063	705.1593	510.1111	335.4643	352.0978	524.9140	611.0499	599.9786	600.2576	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1428.7998	1385.4655	1257.9130	1048.1601	803.2144	527.5018	337.7417	355.9442	573.2804	879.1833	1170.3537	1417.0792	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.6019	463.9063	374.5083	193.8627	72.9530	0.0000	0.0000	0.0000	0.0000	199.4912	410.6701	607.7153	(98)
Space heating												2918.7088	(98)
Space heating per m2											(98) / (4) =	36.8990	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3141.7748	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.6019	463.9063	374.5083	193.8627	72.9530	0.0000	0.0000	0.0000	0.0000	199.4912	410.6701	607.7153	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	641.1215	499.3609	403.1306	208.6789	78.5285	0.0000	0.0000	0.0000	0.0000	214.7376	442.0561	654.1607	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1949	89.1277	88.9715	88.5886	87.8502	86.7000	86.7000	86.7000	86.7000	88.5819	89.0396	89.2219	(217)
Fuel for water heating, kWh/month													
	182.0157	159.6792	165.9404	146.5431	142.7284	126.1921	118.3152	133.8039	134.8180	152.1154	163.5894	176.6288	(219)
Water heating fuel used												1802.3696	(219)
Annual totals kWh/year													
Space heating fuel - main system												3141.7748	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4829.3917	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3141.7748	3.4800	109.3338	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.3696	3.4800	62.7225	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			276.9203	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9372	(257)
SAP value		86.9261	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3141.7748	0.2160	678.6234	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.3696	0.2160	389.3118	(264)
Space and water heating			1067.9352	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1008.3785	(272)
CO2 emissions per m2			12.7500	(273)
EI value			89.1118	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8811 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8811 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.6300
Infiltration rate		0.4760 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4249	0.3945	0.4046	0.3844	0.3844	0.3743	0.3642	0.3540	0.3439	0.3743	0.3540	0.3743	(22b)
Effective ac	0.5903	0.5778	0.5819	0.5739	0.5739	0.5700	0.5663	0.5627	0.5591	0.5700	0.5627	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.8280	38.9891	39.2618	38.7232	38.7232	38.4643	38.2123	37.9672	37.7290	38.4643	37.9672	38.4643	(38)
Heat transfer coeff	97.1636	96.3247	96.5975	96.0589	96.0589	95.8000	95.5480	95.3028	95.0646	95.8000	95.3028	95.8000	(39)
Average = Sum(39)m / 12 =												95.9018	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2284	1.2178	1.2212	1.2144	1.2144	1.2111	1.2079	1.2048	1.2018	1.2111	1.2048	1.2111	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5341	57.0264	56.8654	57.1842	57.1842	57.3388	57.4900	57.6379	57.7823	57.3388	57.6379	57.3388	
alpha	4.7689	4.8018	4.7910	4.8123	4.8123	4.8226	4.8327	4.8425	4.8522	4.8226	4.8425	4.8226	
util living area													
	0.9905	0.9845	0.9629	0.8975	0.7649	0.5511	0.4039	0.4248	0.6977	0.9204	0.9801	0.9922	(86)
MIT	19.9340	20.0634	20.3348	20.6619	20.8857	20.9812	20.9966	20.9958	20.9449	20.6741	20.2730	19.9278	(87)
Th 2	19.8974	19.9058	19.9031	19.9085	19.9085	19.9111	19.9137	19.9161	19.9185	19.9111	19.9161	19.9111	(88)
util rest of house													
	0.9873	0.9795	0.9506	0.8645	0.6969	0.4534	0.2931	0.3090	0.6010	0.8859	0.9723	0.9895	(89)
MIT 2	18.5162	18.7087	19.0933	19.5420	19.8114	19.9014	19.9128	19.9150	19.8831	19.5718	19.0206	18.5172	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9424	0.8592	0.7045	0.4718	0.3147	0.3315	0.6174	0.8810	0.9659	0.9856	(94)
Useful gains	648.6930	705.7580	768.0589	781.7786	662.2346	453.8462	288.0618	287.2976	488.4986	614.6535	620.9063	615.5751	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1349.6852	1316.8651	1191.4117	985.4565	722.3090	460.8475	288.8121	288.2304	512.2809	803.3084	1082.9386	1321.1225	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.5382	410.6639	314.9745	146.6481	44.6953	0.0000	0.0000	0.0000	0.0000	140.3593	332.6632	524.9273	(98)
Space heating												2436.4698	(98)
Space heating per m2											(98) / (4) =	30.8024	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2622.6801	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	521.5382	410.6639	314.9745	146.6481	44.6953	0.0000	0.0000	0.0000	0.0000	140.3593	332.6632	524.9273	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	561.3974	442.0495	339.0468	157.8558	48.1112	0.0000	0.0000	0.0000	0.0000	151.0864	358.0874	565.0455	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1192	89.0541	88.8534	88.3685	87.5186	86.7000	86.7000	86.7000	86.7000	88.3037	88.9008	89.1403	(217)
Fuel for water heating, kWh/month													
	182.1703	159.8112	166.1609	146.9082	143.2691	126.1921	118.3152	133.8039	134.8180	152.5948	163.8448	176.7904	(219)
Water heating fuel used												1804.6789	(219)
Annual totals kWh/year													
Space heating fuel - main system												2622.6801	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4238.8898	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2622.6801	7.3800	193.5538	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.6789	7.3800	133.1853	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			379.7238	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2622.6801	0.2160	566.4989	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.6789	0.2160	389.8106	(264)
Space and water heating			956.3095	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			858.4940	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2622.6801	1.2200	3199.6697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.6789	1.2200	2201.7083	(264)
Space and water heating			5401.3780	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4822.7775	(272)
Primary energy kWh/m2/year			60.9706	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£434	£362	£72
Space heating	£322	£322	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£380	£322	£58
Total cost of uses	£379	£322	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.4760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5159	0.5058	0.4957	0.4451	0.4350	0.3844	0.3844	0.3743	0.4046	0.4350	0.4552	0.4754	(22b)
Effective ac	0.6331	0.6279	0.6228	0.5991	0.5946	0.5739	0.5739	0.5700	0.5819	0.5946	0.6036	0.6130	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7176	42.3689	42.0271	40.4218	40.1214	38.7232	38.7232	38.4643	39.2618	40.1214	40.7290	41.3643	(38)
Heat transfer coeff	100.0532	99.7045	99.3628	97.7574	97.4571	96.0589	96.0589	95.8000	96.5975	97.4571	98.0647	98.6999	(39)
Average = Sum(39)m / 12 =												97.7560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2649	1.2605	1.2562	1.2359	1.2321	1.2144	1.2144	1.2111	1.2212	1.2321	1.2398	1.2478	(40)
HLP (average)												1.2359	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488 (83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9013	55.0933	55.2828	56.1907	56.3638	57.1842	57.1842	57.3388	56.8654	56.3638	56.0146	55.6541	
alpha	4.6601	4.6729	4.6855	4.7460	4.7576	4.8123	4.8123	4.8226	4.7910	4.7576	4.7343	4.7103	
util living area													
	0.9931	0.9875	0.9720	0.9249	0.8193	0.6436	0.4824	0.5315	0.7787	0.9493	0.9873	0.9944	(86)
MIT	19.7919	19.9486	20.2167	20.5613	20.8231	20.9592	20.9917	20.9870	20.8981	20.5524	20.1159	19.7695	(87)
Th 2	19.8684	19.8719	19.8753	19.8914	19.8944	19.9085	19.9085	19.9111	19.9031	19.8944	19.8883	19.8820	(88)
util rest of house													
	0.9908	0.9834	0.9625	0.8995	0.7623	0.5494	0.3670	0.4125	0.6938	0.9266	0.9823	0.9926	(89)
MIT 2	18.2894	18.5188	18.9059	19.3964	19.7300	19.8830	19.9056	19.9062	19.8273	19.3976	18.7748	18.2663	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5804	18.7957	19.1598	19.6221	19.9417	20.0914	20.1160	20.1155	20.0347	19.6212	19.0345	18.5575	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5804	18.7957	19.1598	19.6221	19.9417	20.0914	20.1160	20.1155	20.0347	19.6212	19.0345	18.5575	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9546	0.8920	0.7651	0.5660	0.3894	0.4356	0.7052	0.9194	0.9770	0.9894	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	628.2596	695.1288	754.5416	778.9063	705.1593	510.1111	335.4643	352.0978	524.9140	611.0499	599.9786	600.2576	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1428.7998	1385.4655	1257.9130	1048.1601	803.2144	527.5018	337.7417	355.9442	573.2804	879.1833	1170.3537	1417.0792	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	595.6019	463.9063	374.5083	193.8627	72.9530	0.0000	0.0000	0.0000	0.0000	199.4912	410.6701	607.7153	(98)

Space heating 2918.7088 (98)
Space heating per m2 (98) / (4) = 36.8990 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3141.7748 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.6019	463.9063	374.5083	193.8627	72.9530	0.0000	0.0000	0.0000	0.0000	199.4912	410.6701	607.7153	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	641.1215	499.3609	403.1306	208.6789	78.5285	0.0000	0.0000	0.0000	0.0000	214.7376	442.0561	654.1607	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2804	89.3079	89.3302	89.3736	89.4852	86.7000	86.7000	86.7000	86.7000	88.9384	89.1717	89.2931	(217)
Fuel for water heating, kWh/month	154.4890	113.7278	87.5817	41.1836	11.7082	0.0000	0.0000	21.4599	46.8301	92.9326	130.8636	153.6019	(219)

Water heating fuel used 854.3783 (219)
Annual totals kWh/year
Space heating fuel - main system 3141.7748 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) = -552.7634 -552.7634 (233)
Total delivered energy for all uses 3931.4004 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3141.7748	3.4800	109.3338	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3783	3.4800	29.7324	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			250.5252	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8479 (257)
SAP value 88.1722
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3141.7748	0.2160	678.6234	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3783	0.2160	184.5457	(264)
Space and water heating			863.1691	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			829.5624 (272)
CO2 emissions per m2			10.4900 (273)
EI value			91.0426
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.6300	
Infiltration rate		0.4760	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4046	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4249	0.3945	0.4046	0.3844	0.3844	0.3743	0.3642	0.3540	0.3439	0.3743	0.3540	0.3743	(22b)
Effective ac	0.5903	0.5778	0.5819	0.5739	0.5739	0.5700	0.5663	0.5627	0.5591	0.5700	0.5627	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.8280	38.9891	39.2618	38.7232	38.7232	38.4643	38.2123	37.9672	37.7290	38.4643	37.9672	38.4643	(38)
Heat transfer coeff	97.1636	96.3247	96.5975	96.0589	96.0589	95.8000	95.5480	95.3028	95.0646	95.8000	95.3028	95.8000	(39)
Average = Sum(39)m / 12 =												95.9018	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2284	1.2178	1.2212	1.2144	1.2144	1.2111	1.2079	1.2048	1.2018	1.2111	1.2048	1.2111	(40)
HLP (average)												1.2124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3979	(H8)
Utilisation factor												0.5110	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-874.1284	(H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486	(63)
									Solar input (sum of months) = Sum(63)m =			-874.1284	(63)
Output from w/h													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
									Total per year (kWh/year) = Sum(64)m =			737.7444	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5341	57.0264	56.8654	57.1842	57.1842	57.3388	57.4900	57.6379	57.7823	57.3388	57.6379	57.3388	
alpha	4.7689	4.8018	4.7910	4.8123	4.8123	4.8226	4.8327	4.8425	4.8522	4.8226	4.8425	4.8226	
util living area													
	0.9905	0.9845	0.9629	0.8975	0.7649	0.5511	0.4039	0.4248	0.6977	0.9204	0.9801	0.9922	(86)
MIT	19.9340	20.0634	20.3348	20.6619	20.8857	20.9812	20.9966	20.9958	20.9449	20.6741	20.2730	19.9278	(87)
Th 2	19.8974	19.9058	19.9031	19.9085	19.9085	19.9111	19.9137	19.9161	19.9185	19.9111	19.9161	19.9111	(88)
util rest of house													
	0.9873	0.9795	0.9506	0.8645	0.6969	0.4534	0.2931	0.3090	0.6010	0.8859	0.9723	0.9895	(89)
MIT 2	18.5162	18.7087	19.0933	19.5420	19.8114	19.9014	19.9128	19.9150	19.8831	19.5718	19.0206	18.5172	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7908	18.9711	19.3338	19.7589	20.0194	20.1105	20.1227	20.1244	20.0888	19.7853	19.2631	18.7904	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9424	0.8592	0.7045	0.4718	0.3147	0.3315	0.6174	0.8810	0.9659	0.9856	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	648.6930	705.7580	768.0589	781.7786	662.2346	453.8462	288.0618	287.2976	488.4986	614.6535	620.9063	615.5751	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1349.6852	1316.8651	1191.4117	985.4565	722.3090	460.8475	288.8121	288.2304	512.2809	803.3084	1082.9386	1321.1225	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	521.5382	410.6639	314.9745	146.6481	44.6953	0.0000	0.0000	0.0000	0.0000	140.3593	332.6632	524.9273	(98)
Space heating												2436.4698	(98)
Space heating per m2											(98) / (4) =	30.8024	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2622.6801 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	521.5382	410.6639	314.9745	146.6481	44.6953	0.0000	0.0000	0.0000	0.0000	140.3593	332.6632	524.9273	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	561.3974	442.0495	339.0468	157.8558	48.1112	0.0000	0.0000	0.0000	0.0000	151.0864	358.0874	565.0455	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2275	89.2458	89.2465	89.2538	89.0763	86.7000	86.7000	86.7000	86.7000	88.7226	89.0723	89.2297	(217)
Fuel for water heating, kWh/month	149.9902	114.0336	87.3390	40.0981	16.7739	0.0000	0.0000	14.5776	41.4721	88.8092	125.6644	150.3344	(219)
Water heating fuel used												829.0924	(219)

Annual totals kWh/year	
Space heating fuel - main system	2622.6801 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	363.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) = -626.4799	-626.4799 (233)
Total delivered energy for all uses	3313.3033 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2622.6801	7.3800	193.5538	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0924	7.3800	61.1870	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			322.0555	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2622.6801	0.2160	566.4989	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0924	0.2160	179.0840	(264)
Space and water heating			745.5829	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			673.7173	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2622.6801	1.2200	3199.6697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0924	1.2200	1011.4928	(264)
Space and water heating			4211.1624	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3786.0620	(272)
Primary energy kWh/m2/year			47.8642	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
South	0.5000	118.5567	0.7200	0.7000	0.7650	20.5698
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						508.3400

	Jun	Jul	Aug	
Solar gains	546	508	449	(P3)
Internal gains	425	408	416	
Total summer gains	971	916	865	(P5)
Summer gain/loss ratio	1.63	1.53	1.45	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.28	19.08	19.00	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 376 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.70	**TER**	18.70
Environmental	89 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.69	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.70	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.70	$kgCO_2/m^2$	Pass
	-4.00 (-21.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.69	$kWh/m^2/yr$	
	-4.3 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.63 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	6.47 m², No overhang 0.50 m², No overhang 4.75 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.63 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 377 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	5 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.77	**TER**	18.79
Environmental	89 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.99	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---

3 Air permeability
Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage: No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---

8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.50 m², No overhang
Windows facing East: 6.47 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.4685	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5078	0.4978	0.4879	0.4381	0.4281	0.3783	0.3783	0.3684	0.3983	0.4281	0.4480	0.4679	(22b)
Effective ac	0.6289	0.6239	0.6190	0.5960	0.5916	0.5716	0.5716	0.5679	0.5793	0.5916	0.6004	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.4368	42.0991	41.7680	40.2128	39.9219	38.5674	38.5674	38.3166	39.0891	39.9219	40.5105	41.1258	(38)
Heat transfer coeff	99.7725	99.4347	99.1036	97.5485	97.2575	95.9031	95.9031	95.6522	96.4248	97.2575	97.8461	98.4615	(39)
Average = Sum(39)m / 12 =												97.5471	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2613	1.2571	1.2529	1.2332	1.2296	1.2124	1.2124	1.2093	1.2190	1.2296	1.2370	1.2448	(40)
HLP (average)												1.2332	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	450.8570	523.9690	610.3113	705.8961	768.7803	759.0088	722.6152	665.0522	590.5522	499.7538	440.3018	425.7222	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0558	55.2428	55.4274	56.3110	56.4795	57.2772	57.2772	57.4274	56.9673	56.4795	56.1397	55.7889	
alpha	4.6704	4.6829	4.6952	4.7541	4.7653	4.8185	4.8185	4.8285	4.7978	4.7653	4.7426	4.7193	
util living area													
	0.9984	0.9964	0.9896	0.9632	0.8863	0.7303	0.5649	0.6281	0.8729	0.9821	0.9968	0.9988	(86)
MIT	19.5848	19.7436	20.0291	20.4147	20.7389	20.9301	20.9839	20.9738	20.8243	20.3906	19.9233	19.5656	(87)
Th 2	19.8712	19.8746	19.8779	19.8935	19.8964	19.9101	19.9101	19.9126	19.9048	19.8964	19.8905	19.8843	(88)
util rest of house													
	0.9978	0.9951	0.9857	0.9486	0.8412	0.6352	0.4346	0.4958	0.8046	0.9726	0.9954	0.9983	(89)
MIT 2	17.9900	18.2242	18.6417	19.2035	19.6385	19.8634	19.9042	19.9018	19.7596	19.1798	18.4984	17.9710	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2989	18.5185	18.9104	19.4381	19.8516	20.0700	20.1133	20.1094	19.9658	19.4143	18.7744	18.2798	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2989	18.5185	18.9104	19.4381	19.8516	20.0700	20.1133	20.1094	19.9658	19.4143	18.7744	18.2798	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9809	0.9407	0.8390	0.6504	0.4599	0.5212	0.8092	0.9666	0.9933	0.9974	(94)
Useful gains	449.3010	520.1866	598.6420	664.0439	645.0189	493.6588	332.3310	346.6383	477.8697	483.0832	437.3469	424.5987	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1396.7073	1354.1479	1229.9155	1027.9724	792.8057	524.5881	336.9376	354.8169	565.6085	857.2546	1142.2932	1386.3187	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	704.8703	560.4220	469.6675	262.0285	109.9534	0.0000	0.0000	0.0000	0.0000	278.3835	507.5613	715.5197	(98)
Space heating												3608.4062	(98)
Space heating per m2											(98) / (4) =	45.6183	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3884.1832	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	704.8703	560.4220	469.6675	262.0285	109.9534	0.0000	0.0000	0.0000	0.0000	278.3835	507.5613	715.5197	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	758.7409	603.2530	505.5624	282.0543	118.3567	0.0000	0.0000	0.0000	0.0000	299.6593	546.3523	770.2042	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2831	89.2330	89.1134	88.8140	88.1662	86.7000	86.7000	86.7000	86.7000	88.8306	89.1661	89.3051	(217)
Fuel for water heating, kWh/month													
	181.8358	159.4908	165.6762	146.1713	142.2168	126.1921	118.3152	133.8039	134.8180	151.6895	163.3572	176.4643	(219)
Water heating fuel used												1800.0310	(219)
Annual totals kWh/year													
Space heating fuel - main system												3884.1832	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5569.4614	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3884.1832	0.2160	838.9836	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.0310	0.2160	388.8067	(264)
Space and water heating			1227.7903	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1168.2336	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7700	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.3142	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3142	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	454.1583	517.4898	590.7231	671.0184	722.6612	710.8381	677.2846	628.2964	565.1407	489.0600	440.8077	430.7737	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9965	0.9902	0.9652	0.8895	0.7313	0.5618	0.6222	0.8697	0.9818	0.9967	0.9988	(86)
MIT	19.7243	19.8673	20.1264	20.4750	20.7712	20.9421	20.9878	20.9800	20.8523	20.4600	20.0313	19.7019	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9978	0.9953	0.9866	0.9516	0.8467	0.6408	0.4396	0.4979	0.8033	0.9724	0.9954	0.9983	(89)
MIT 2	18.2514	18.4618	18.8404	19.3468	19.7443	19.9430	19.9778	19.9757	19.8558	19.3343	18.7104	18.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9932	0.9823	0.9447	0.8453	0.6557	0.4634	0.5219	0.8087	0.9670	0.9934	0.9974	(94)
Useful gains	452.6357	513.9821	580.2826	633.8910	610.8462	466.0713	313.8404	327.8942	457.0336	472.9141	437.8813	429.6606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1303.8118	1263.5926	1146.9261	959.7421	740.0585	491.6845	317.3422	334.1484	530.5203	803.7285	1070.3374	1297.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating												3236.2880	(98)
Space heating per m2											(98) / (4) =	40.9139	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3464.9765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	678.0247	539.3343	451.3734	251.1914	102.9272	0.0000	0.0000	0.0000	0.0000	263.5181	487.5465	691.0610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7363	87.5409	87.0745	85.9666	83.8456	80.3000	80.3000	80.3000	80.3000	85.9680	87.2600	87.8196	(217)
Fuel for water heating, kWh/month													
	229.6607	201.8304	211.1162	189.6625	188.2719	173.1411	165.8823	184.9199	186.9622	198.8573	209.1333	224.0341	(219)
Water heating fuel used												2363.4720	(219)
Annual totals kWh/year													
Space heating fuel - main system												3464.9765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6266.4591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3464.9765	0.2160	748.4349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.4720	0.2160	510.5099	(264)
Space and water heating			1258.9449	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1486.2724	(272)
Emissions per m2 for space and water heating			15.9159	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9159 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4018	0.3939	0.3860	0.3466	0.3387	0.2994	0.2994	0.2915	0.3151	0.3387	0.3545	0.3703	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.1840	38.9725	38.7652	37.7916	37.6095	36.7615	36.7615	36.6045	37.0881	37.6095	37.9780	38.3632	(38)
Heat transfer coeff	96.5197	96.3082	96.1009	95.1273	94.9451	94.0972	94.0972	93.9401	94.4238	94.9451	95.3136	95.6989	(39)
Average = Sum(39)m / 12 =												95.1264	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2202	1.2175	1.2149	1.2026	1.2003	1.1896	1.1896	1.1876	1.1937	1.2003	1.2050	1.2098	(40)
HLP (average)												1.2026	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	419.6078	493.4932	581.4405	679.2059	743.5063	735.7275	701.0260	641.2931	566.0207	472.9657	410.9653	395.2416	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9113	57.0362	57.1593	57.7443	57.8550	58.3764	58.3764	58.4740	58.1745	57.8550	57.6314	57.3994	
alpha	4.7941	4.8024	4.8106	4.8496	4.8570	4.8918	4.8918	4.8983	4.8783	4.8570	4.8421	4.8266	
util living area													
	0.9988	0.9972	0.9912	0.9667	0.8920	0.7380	0.5713	0.6386	0.8826	0.9852	0.9976	0.9991	(86)
MIT	19.6017	19.7586	20.0412	20.4185	20.7414	20.9302	20.9841	20.9734	20.8210	20.3865	19.9245	19.5755	(87)
Th 2	19.9039	19.9060	19.9081	19.9179	19.9197	19.9283	19.9283	19.9299	19.9250	19.9197	19.9160	19.9121	(88)
util rest of house													
	0.9984	0.9962	0.9879	0.9534	0.8487	0.6443	0.4419	0.5070	0.8178	0.9772	0.9966	0.9988	(89)
MIT 2	18.6294	18.7876	19.0701	19.4468	19.7440	19.8961	19.9243	19.9223	19.8224	19.4225	18.9615	18.6098	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8177	18.9756	19.2582	19.6350	19.9372	20.0964	20.1296	20.1259	20.0158	19.6092	19.1480	18.7968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8177	18.9756	19.2582	19.6350	19.9372	20.0964	20.1296	20.1259	20.0158	19.6092	19.1480	18.7968	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9950	0.9853	0.9490	0.8495	0.6604	0.4672	0.5326	0.8244	0.9740	0.9956	0.9984	(94)
Useful gains	418.6997	491.0361	572.8833	644.5371	631.6334	485.8709	327.5446	341.5835	466.6010	460.6889	409.1387	394.6015	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.2446	1355.5977	1226.0748	1021.1941	782.0784	517.1954	332.1237	350.0089	558.5905	855.3766	1148.3418	1396.8996	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	731.0134	580.9854	485.9745	271.1930	111.9311	0.0000	0.0000	0.0000	0.0000	293.6476	532.2262	745.7097	(98)
Space heating												3752.6811	(98)
Space heating per m2											(98) / (4) =	47.4422	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	884.5134	696.3191	713.9451	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8591	0.9198	0.8907	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.8907	640.5048	635.8855	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.5588	909.1564	841.0208	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	138.0010	199.8767	152.6207	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											490.4984	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.5002	49.9692	38.1552	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											122.6246	(107)
Space cooling per m2											1.5502	(108)
Energy for space heating											47.4422	(99)
Energy for space cooling											1.5502	(108)
Total											48.9925	(109)
Dwelling Fabric Energy Efficiency (DFEE)											49.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	409.7548	474.2291	549.6922	632.7914	686.4764	677.2708	645.4050	593.6224	529.0664	450.1056	398.6828	387.1364	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9990	0.9977	0.9928	0.9722	0.9055	0.7557	0.5863	0.6520	0.8924	0.9871	0.9979	0.9993	(86)
MIT	19.6720	19.8167	20.0798	20.4364	20.7460	20.9325	20.9853	20.9754	20.8293	20.4174	19.9820	19.6503	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9986	0.9968	0.9901	0.9610	0.8665	0.6663	0.4604	0.5248	0.8324	0.9802	0.9971	0.9990	(89)
MIT 2	18.7393	18.8857	19.1495	19.5084	19.7964	19.9504	19.9785	19.9769	19.8785	19.4958	19.0603	18.7253	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9879	0.9570	0.8669	0.6815	0.4850	0.5496	0.8383	0.9774	0.9962	0.9986	(94)
Useful gains	408.9897	472.2560	543.0206	605.6016	595.1005	461.5536	313.0474	326.2660	443.5413	439.9348	397.1521	386.5956	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1338.9200	1293.9186	1168.8068	970.7914	743.3907	492.0467	317.3502	334.1500	531.7563	814.6767	1094.9241	1332.8361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	691.8682	552.1573	465.5849	262.9366	110.3279	0.0000	0.0000	0.0000	0.0000	278.8080	502.3958	704.0029	(98)
Space heating												3568.0816	(98)
Space heating per m2											(98) / (4) =	45.1085	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9217	0.8939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.3769	605.7087	602.0755	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.2328	844.1448	785.3018	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.4162	177.3965	136.3204	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												433.1331	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   29.8541   44.3491   34.0801    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        108.2833 (107)
Space cooling per m2                                                                                                   1.3689 (108)
Energy for space heating                                                                                              45.1085 (99)
Energy for space cooling                                                                                               1.3689 (108)
Total                                                                                                                 46.4774 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   53.4 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.4685	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4182	0.3883	0.3983	0.3783	0.3783	0.3684	0.3584	0.3485	0.3385	0.3684	0.3485	0.3684	(22b)
Effective ac	0.5874	0.5754	0.5793	0.5716	0.5716	0.5679	0.5642	0.5607	0.5573	0.5679	0.5607	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6376	38.8249	39.0891	38.5674	38.5674	38.3166	38.0724	37.8350	37.6042	38.3166	37.8350	38.3166	(38)
Heat transfer coeff	96.9733	96.1606	96.4248	95.9031	95.9031	95.6522	95.4081	95.1706	94.9399	95.6522	95.1706	95.6522	(39)
Average = Sum(39)m / 12 =												95.7509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2260	1.2157	1.2190	1.2124	1.2124	1.2093	1.2062	1.2032	1.2003	1.2093	1.2032	1.2093	(40)
HLP (average)												1.2105	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6451	57.1238	56.9673	57.2772	57.2772	57.4274	57.5743	57.7180	57.8583	57.4274	57.7180	57.4274	
alpha	4.7763	4.8083	4.7978	4.8185	4.8185	4.8285	4.8383	4.8479	4.8572	4.8285	4.8479	4.8285	
util living area													
	0.9909	0.9853	0.9646	0.9002	0.7675	0.5529	0.4057	0.4280	0.7042	0.9241	0.9811	0.9925	(86)
MIT	19.9287	20.0553	20.3266	20.6570	20.8844	20.9811	20.9966	20.9957	20.9428	20.6667	20.2655	19.9228	(87)
Th 2	19.8993	19.9075	19.9048	19.9101	19.9101	19.9126	19.9151	19.9175	19.9198	19.9126	19.9175	19.9126	(88)
util rest of house													
	0.9879	0.9805	0.9527	0.8678	0.6997	0.4551	0.2946	0.3115	0.6076	0.8907	0.9736	0.9899	(89)
MIT 2	18.5100	18.6984	19.0834	19.5374	19.8117	19.9028	19.9142	19.9163	19.8829	19.5640	19.0109	18.5112	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8624	0.7071	0.4736	0.3162	0.3342	0.6239	0.8856	0.9674	0.9861	(94)
Useful gains	641.7159	696.9892	759.5749	776.7028	660.3567	453.1713	287.7355	286.9685	486.8006	608.1126	613.3790	609.5006	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.4497	1313.6693	1188.3584	983.4107	721.1367	460.2407	288.4962	287.9285	511.5496	801.3323	1080.5564	1318.5271	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	524.3220	414.4090	319.0149	148.8297	45.2204	0.0000	0.0000	0.0000	0.0000	143.7555	336.3677	527.5157	(98)
Space heating												2459.4349	(98)
RHI space heating demand												2459	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.4800
Infiltration rate		0.4685 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3983 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5078	0.4978	0.4879	0.4381	0.4281	0.3783	0.3783	0.3684	0.3983	0.4281	0.4480	0.4679	(22b)
Effective ac	0.6289	0.6239	0.6190	0.5960	0.5916	0.5716	0.5716	0.5679	0.5793	0.5916	0.6004	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.4368	42.0991	41.7680	40.2128	39.9219	38.5674	38.5674	38.3166	39.0891	39.9219	40.5105	41.1258	(38)
Heat transfer coeff	99.7725	99.4347	99.1036	97.5485	97.2575	95.9031	95.9031	95.6522	96.4248	97.2575	97.8461	98.4615	(39)
Average = Sum(39)m / 12 =												97.5471	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2613	1.2571	1.2529	1.2332	1.2296	1.2124	1.2124	1.2093	1.2190	1.2296	1.2370	1.2448	(40)
HLP (average)												1.2332	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0558	55.2428	55.4274	56.3110	56.4795	57.2772	57.2772	57.4274	56.9673	56.4795	56.1397	55.7889	
alpha	4.6704	4.6829	4.6952	4.7541	4.7653	4.8185	4.8185	4.8285	4.7978	4.7653	4.7426	4.7193	
util living area													
	0.9933	0.9881	0.9733	0.9272	0.8219	0.6459	0.4847	0.5355	0.7846	0.9518	0.9878	0.9946	(86)
MIT	19.7895	19.9423	20.2093	20.5560	20.8213	20.9588	20.9915	20.9866	20.8950	20.5451	20.1109	19.7672	(87)
Th 2	19.8712	19.8746	19.8779	19.8935	19.8964	19.9101	19.9101	19.9126	19.9048	19.8964	19.8905	19.8843	(88)
util rest of house													
	0.9912	0.9842	0.9642	0.9024	0.7653	0.5517	0.3690	0.4161	0.7005	0.9300	0.9831	0.9929	(89)
MIT 2	18.2879	18.5116	18.8976	19.3914	19.7299	19.8843	19.9072	19.9075	19.8263	19.3897	18.7692	18.2648	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5787	18.7887	19.1517	19.6170	19.9413	20.0924	20.1172	20.1165	20.0333	19.6135	19.0291	18.5558	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5787	18.7887	19.1517	19.6170	19.9413	20.0924	20.1172	20.1165	20.0333	19.6135	19.0291	18.5558	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9790	0.9565	0.8949	0.7679	0.5683	0.3915	0.4392	0.7115	0.9227	0.9779	0.9898	(94)
Useful gains	622.3223	686.2332	745.4904	772.7975	702.3741	509.1419	334.9951	351.5317	522.1149	603.8335	593.3250	595.0229	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.6236	1381.0184	1253.8269	1045.4229	801.5262	526.7345	337.3093	355.4919	572.1138	876.6315	1167.2123	1413.4892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	596.9122	466.8956	378.2024	196.2903	73.7692	0.0000	0.0000	0.0000	0.0000	202.9617	413.1989	608.9390	(98)
Space heating												2937.1691	(98)
Space heating per m2											(98) / (4) =	37.1324	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3161.6460	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	596.9122	466.8956	378.2024	196.2903	73.7692	0.0000	0.0000	0.0000	0.0000	202.9617	413.1989	608.9390	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	642.5320	502.5787	407.1070	211.2920	79.4071	0.0000	0.0000	0.0000	0.0000	218.4733	444.7781	655.4779	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1961	89.1315	88.9779	88.5982	87.8584	86.7000	86.7000	86.7000	86.7000	88.5953	89.0434	89.2230	(217)
Fuel for water heating, kWh/month													
	182.0132	159.6724	165.9283	146.5272	142.7151	126.1921	118.3152	133.8039	134.8180	152.0925	163.5823	176.6267	(219)
Water heating fuel used												1802.2870	(219)
Annual totals kWh/year													
Space heating fuel - main system												3161.6460	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4849.1803	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3161.6460	3.4800	110.0253	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.2870	3.4800	62.7196	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			277.6090	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9395	(257)
SAP value		86.8935	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3161.6460	0.2160	682.9155	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.2870	0.2160	389.2940	(264)
Space and water heating			1072.2095	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1012.6529	(272)
CO2 emissions per m2			12.8000	(273)
EI value			89.0656	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.4800	
Infiltration rate			0.4685	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4182	0.3883	0.3983	0.3783	0.3783	0.3684	0.3584	0.3485	0.3385	0.3684	0.3485	0.3684	(22b)
Effective ac	0.5874	0.5754	0.5793	0.5716	0.5716	0.5679	0.5642	0.5607	0.5573	0.5679	0.5607	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6376	38.8249	39.0891	38.5674	38.5674	38.3166	38.0724	37.8350	37.6042	38.3166	37.8350	38.3166	(38)
Heat transfer coeff	96.9733	96.1606	96.4248	95.9031	95.9031	95.6522	95.4081	95.1706	94.9399	95.6522	95.1706	95.6522	(39)
Average = Sum(39)m / 12 =												95.7509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2260	1.2157	1.2190	1.2124	1.2124	1.2093	1.2062	1.2032	1.2003	1.2093	1.2032	1.2093	(40)
HLP (average)												1.2105	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6451	57.1238	56.9673	57.2772	57.2772	57.4274	57.5743	57.7180	57.8583	57.4274	57.7180	57.4274	
alpha	4.7763	4.8083	4.7978	4.8185	4.8185	4.8285	4.8383	4.8479	4.8572	4.8285	4.8479	4.8285	
util living area													
	0.9909	0.9853	0.9646	0.9002	0.7675	0.5529	0.4057	0.4280	0.7042	0.9241	0.9811	0.9925	(86)
MIT	19.9287	20.0553	20.3266	20.6570	20.8844	20.9811	20.9966	20.9957	20.9428	20.6667	20.2655	19.9228	(87)
Th 2	19.8993	19.9075	19.9048	19.9101	19.9101	19.9126	19.9151	19.9175	19.9198	19.9126	19.9175	19.9126	(88)
util rest of house													
	0.9879	0.9805	0.9527	0.8678	0.6997	0.4551	0.2946	0.3115	0.6076	0.8907	0.9736	0.9899	(89)
MIT 2	18.5100	18.6984	19.0834	19.5374	19.8117	19.9028	19.9142	19.9163	19.8829	19.5640	19.0109	18.5112	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8624	0.7071	0.4736	0.3162	0.3342	0.6239	0.8856	0.9674	0.9861	(94)
Useful gains	641.7159	696.9892	759.5749	776.7028	660.3567	453.1713	287.7355	286.9685	486.8006	608.1126	613.3790	609.5006	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.4497	1313.6693	1188.3584	983.4107	721.1367	460.2407	288.4962	287.9285	511.5496	801.3323	1080.5564	1318.5271	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	524.3220	414.4090	319.0149	148.8297	45.2204	0.0000	0.0000	0.0000	0.0000	143.7555	336.3677	527.5157	(98)
Space heating												2459.4349	(98)
Space heating per m2											(98) / (4) =	31.0927	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2647.4003	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
(98)	524.3220	414.4090	319.0149	148.8297	45.2204	0.0000	0.0000	0.0000	0.0000	143.7555	336.3677	527.5157	
Space heating efficiency (main heating system 1)													
(210)	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	
Space heating fuel (main heating system)													
(211)	564.3940	446.0808	343.3960	160.2042	48.6764	0.0000	0.0000	0.0000	0.0000	154.7422	362.0750	567.8318	
Water heating requirement													
(215)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating													
Water heating requirement													
(64)	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	
Efficiency of water heater												86.7000	(216)
(217)m	89.1223	89.0597	88.8623	88.3803	87.5258	86.7000	86.7000	86.7000	86.7000	88.3228	88.9084	89.1432	(217)
Fuel for water heating, kWh/month													
(219)	182.1639	159.8011	166.1442	146.8886	143.2574	126.1921	118.3152	133.8039	134.8180	152.5617	163.8308	176.7847	
Water heating fuel used												1804.5617	(219)
Annual totals kWh/year													
Space heating fuel - main system												2647.4003	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4263.4928	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2647.4003	7.3800	195.3781	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.5617	7.3800	133.1767	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			381.5395	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2647.4003	0.2160	571.8385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5617	0.2160	389.7853	(264)
Space and water heating			961.6238	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			863.8083	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2647.4003	1.2200	3229.8284	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5617	1.2200	2201.5653	(264)
Space and water heating			5431.3937	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4852.7932	(272)
Primary energy kWh/m2/year			61.3501	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£436	£364	£72
Space heating	£324	£324	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£382	£324	£58
Total cost of uses	£381	£324	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.4685	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5078	0.4978	0.4879	0.4381	0.4281	0.3783	0.3783	0.3684	0.3983	0.4281	0.4480	0.4679	(22b)
Effective ac	0.6289	0.6239	0.6190	0.5960	0.5916	0.5716	0.5716	0.5679	0.5793	0.5916	0.6004	0.6095	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.4368	42.0991	41.7680	40.2128	39.9219	38.5674	38.5674	38.3166	39.0891	39.9219	40.5105	41.1258	(38)
Heat transfer coeff	99.7725	99.4347	99.1036	97.5485	97.2575	95.9031	95.9031	95.6522	96.4248	97.2575	97.8461	98.4615	(39)
Average = Sum(39)m / 12 =												97.5471	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2613	1.2571	1.2529	1.2332	1.2296	1.2124	1.2124	1.2093	1.2190	1.2296	1.2370	1.2448	(40)
HLP (average)												1.2332	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2491	(H8)
Utilisation factor												0.5509	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-842.1367	(H17)
Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
								Total per year (kWh/year) = Sum(64)m =				760.7271	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0558	55.2428	55.4274	56.3110	56.4795	57.2772	57.2772	57.4274	56.9673	56.4795	56.1397	55.7889	
alpha	4.6704	4.6829	4.6952	4.7541	4.7653	4.8185	4.8185	4.8285	4.7978	4.7653	4.7426	4.7193	
util living area													
	0.9933	0.9881	0.9733	0.9272	0.8219	0.6459	0.4847	0.5355	0.7846	0.9518	0.9878	0.9946	(86)
MIT	19.7895	19.9423	20.2093	20.5560	20.8213	20.9588	20.9915	20.9866	20.8950	20.5451	20.1109	19.7672	(87)
Th 2	19.8712	19.8746	19.8779	19.8935	19.8964	19.9101	19.9101	19.9126	19.9048	19.8964	19.8905	19.8843	(88)
util rest of house													
	0.9912	0.9842	0.9642	0.9024	0.7653	0.5517	0.3690	0.4161	0.7005	0.9300	0.9831	0.9929	(89)
MIT 2	18.2879	18.5116	18.8976	19.3914	19.7299	19.8843	19.9072	19.9075	19.8263	19.3897	18.7692	18.2648	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5787	18.7887	19.1517	19.6170	19.9413	20.0924	20.1172	20.1165	20.0333	19.6135	19.0291	18.5558	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5787	18.7887	19.1517	19.6170	19.9413	20.0924	20.1172	20.1165	20.0333	19.6135	19.0291	18.5558	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9790	0.9565	0.8949	0.7679	0.5683	0.3915	0.4392	0.7115	0.9227	0.9779	0.9898	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	622.3223	686.2332	745.4904	772.7975	702.3741	509.1419	334.9951	351.5317	522.1149	603.8335	593.3250	595.0229	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1424.6236	1381.0184	1253.8269	1045.4229	801.5262	526.7345	337.3093	355.4919	572.1138	876.6315	1167.2123	1413.4892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	596.9122	466.8956	378.2024	196.2903	73.7692	0.0000	0.0000	0.0000	0.0000	202.9617	413.1989	608.9390	(98)

Space heating 2937.1691 (98)
Space heating per m2 (98) / (4) = 37.1324 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3161.6460 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	596.9122	466.8956	378.2024	196.2903	73.7692	0.0000	0.0000	0.0000	0.0000	202.9617	413.1989	608.9390	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	642.5320	502.5787	407.1070	211.2920	79.4071	0.0000	0.0000	0.0000	0.0000	218.4733	444.7781	655.4779	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2815	89.3110	89.3348	89.3791	89.4892	86.7000	86.7000	86.7000	86.7000	88.9499	89.1752	89.2941	(217)
Fuel for water heating, kWh/month	154.4871	113.7239	87.5772	41.1811	11.7077	0.0000	0.0000	21.4599	46.8301	92.9205	130.8585	153.6002	(219)

Water heating fuel used 854.3461 (219)
Annual totals kWh/year
Space heating fuel - main system 3161.6460 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) = -552.7634 -552.7634 (233)
Total delivered energy for all uses 3951.2394 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3161.6460	3.4800	110.0253	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3461	3.4800	29.7312	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			251.2156	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8502 (257)
SAP value 88.1396
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3161.6460	0.2160	682.9155	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3461	0.2160	184.5388	(264)
Space and water heating			867.4543	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			833.8476 (272)
CO2 emissions per m2			10.5400 (273)
EI value			90.9963
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.4685	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4182	0.3883	0.3983	0.3783	0.3783	0.3684	0.3584	0.3485	0.3385	0.3684	0.3485	0.3684	(22b)
Effective ac	0.5874	0.5754	0.5793	0.5716	0.5716	0.5679	0.5642	0.5607	0.5573	0.5679	0.5607	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6376	38.8249	39.0891	38.5674	38.5674	38.3166	38.0724	37.8350	37.6042	38.3166	37.8350	38.3166	(38)
Heat transfer coeff	96.9733	96.1606	96.4248	95.9031	95.9031	95.6522	95.4081	95.1706	94.9399	95.6522	95.1706	95.6522	(39)
Average = Sum(39)m / 12 =												95.7509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2260	1.2157	1.2190	1.2124	1.2124	1.2093	1.2062	1.2032	1.2003	1.2093	1.2032	1.2093	(40)
HLP (average)												1.2105	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3979 (H8)
Utilisation factor												0.5110 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2821 (H14)
Volume ratio Veff/V												0.8127 (H15)
Solar storage volume factor												0.9585 (H16)
Solar input												-874.1284 (H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6451	57.1238	56.9673	57.2772	57.2772	57.4274	57.5743	57.7180	57.8583	57.4274	57.7180	57.4274	
alpha	4.7763	4.8083	4.7978	4.8185	4.8185	4.8285	4.8383	4.8479	4.8572	4.8285	4.8479	4.8285	
util living area													
	0.9909	0.9853	0.9646	0.9002	0.7675	0.5529	0.4057	0.4280	0.7042	0.9241	0.9811	0.9925	(86)
MIT	19.9287	20.0553	20.3266	20.6570	20.8844	20.9811	20.9966	20.9957	20.9428	20.6667	20.2655	19.9228	(87)
Th 2	19.8993	19.9075	19.9048	19.9101	19.9101	19.9126	19.9151	19.9175	19.9198	19.9126	19.9175	19.9126	(88)
util rest of house													
	0.9879	0.9805	0.9527	0.8678	0.6997	0.4551	0.2946	0.3115	0.6076	0.8907	0.9736	0.9899	(89)
MIT 2	18.5100	18.6984	19.0834	19.5374	19.8117	19.9028	19.9142	19.9163	19.8829	19.5640	19.0109	18.5112	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7848	18.9612	19.3242	19.7542	20.0194	20.1116	20.1238	20.1254	20.0881	19.7776	19.2539	18.7846	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8624	0.7071	0.4736	0.3162	0.3342	0.6239	0.8856	0.9674	0.9861	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	641.7159	696.9892	759.5749	776.7028	660.3567	453.1713	287.7355	286.9685	486.8006	608.1126	613.3790	609.5006	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1346.4497	1313.6693	1188.3584	983.4107	721.1367	460.2407	288.4962	287.9285	511.5496	801.3323	1080.5564	1318.5271	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	524.3220	414.4090	319.0149	148.8297	45.2204	0.0000	0.0000	0.0000	0.0000	143.7555	336.3677	527.5157	(98)
Space heating												2459.4349	(98)
Space heating per m2											(98) / (4) =	31.0927	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2647.4003	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	524.3220	414.4090	319.0149	148.8297	45.2204	0.0000	0.0000	0.0000	0.0000	143.7555	336.3677	527.5157	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	564.3940	446.0808	343.3960	160.2042	48.6764	0.0000	0.0000	0.0000	0.0000	154.7422	362.0750	567.8318	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2303	89.2505	89.2531	89.2613	89.0834	86.7000	86.7000	86.7000	86.7000	88.7404	89.0791	89.2323	(217)
Fuel for water heating, kWh/month													
	149.9854	114.0276	87.3325	40.0947	16.7725	0.0000	0.0000	14.5776	41.4721	88.7915	125.6548	150.3300	(219)
Water heating fuel used												829.0387	(219)
Annual totals kWh/year													
Space heating fuel - main system												2647.4003	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3337.9699	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2647.4003	7.3800	195.3781	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0387	7.3800	61.1831	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			323.8759	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2647.4003	0.2160	571.8385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0387	0.2160	179.0724	(264)
Space and water heating			750.9108	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			679.0453	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2647.4003	1.2200	3229.8284	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0387	1.2200	1011.4273	(264)
Space and water heating			4241.2557	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3816.1552	(272)
Primary energy kWh/m2/year			48.2447	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.5000	87.1704	0.7200	0.7000	0.7650	15.1242
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						502.8945

	Jun	Jul	Aug	
Solar gains	541	503	441	(P3)
Internal gains	425	408	416	
Total summer gains	966	911	857	(P5)
Summer gain/loss ratio	1.62	1.52	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.07	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 377 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	5 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.77	**TER**	18.79
Environmental	89 B	**% DER<TER**	21.39		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.99	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.34		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.77	$kgCO_2/m^2$	Pass
	-4.02 (-21.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.99	$kWh/m^2/yr$	
	-4.4 (-8.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.50 m², No overhang 6.47 m², No overhang 4.75 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 378 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.80	**TER**	18.70
Environmental	89 B	**% DER<TER**	20.86		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.03	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.80 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.00 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.47 m², No overhang
Windows facing South: 0.50 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5359	0.5254	0.5149	0.4624	0.4519	0.3993	0.3993	0.3888	0.4204	0.4519	0.4729	0.4939	(22b)
Effective ac	0.6436	0.6380	0.6326	0.6069	0.6021	0.5797	0.5797	0.5756	0.5883	0.6021	0.6118	0.6220	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4291	43.0527	42.6839	40.9514	40.6272	39.1182	39.1182	38.8388	39.6995	40.6272	41.2830	41.9685	(38)
Heat transfer coeff	100.7647	100.3884	100.0195	98.2870	97.9629	96.4539	96.4539	96.1745	97.0351	97.9629	98.6186	99.3042	(39)
Average = Sum(39)m / 12 =												98.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2739	1.2691	1.2645	1.2426	1.2385	1.2194	1.2194	1.2159	1.2267	1.2385	1.2468	1.2554	(40)
HLP (average)												1.2425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	457.1646	533.7917	621.3140	715.4609	775.7929	764.3461	728.4368	673.0240	601.0948	509.9519	447.6888	431.2291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5137	54.7180	54.9198	55.8879	56.0728	56.9501	56.9501	57.1155	56.6089	56.0728	55.7000	55.3155	
alpha	4.6342	4.6479	4.6613	4.7259	4.7382	4.7967	4.7967	4.8077	4.7739	4.7382	4.7133	4.6877	
util living area													
	0.9983	0.9961	0.9889	0.9618	0.8849	0.7291	0.5636	0.6245	0.8682	0.9808	0.9965	0.9987	(86)
MIT	19.5760	19.7397	20.0279	20.4149	20.7376	20.9296	20.9837	20.9741	20.8271	20.3940	19.9212	19.5582	(87)
Th 2	19.8613	19.8651	19.8688	19.8861	19.8893	19.9045	19.9045	19.9073	19.8987	19.8893	19.8828	19.8759	(88)
util rest of house													
	0.9977	0.9947	0.9848	0.9467	0.8393	0.6336	0.4328	0.4920	0.7984	0.9707	0.9951	0.9982	(89)
MIT 2	17.9704	18.2118	18.6333	19.1978	19.6307	19.8576	19.8986	19.8967	19.7568	19.1791	18.4898	17.9543	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2813	18.5077	18.9034	19.4336	19.8451	20.0652	20.1088	20.1054	19.9641	19.4144	18.7670	18.2650	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2813	18.5077	18.9034	19.4336	19.8451	20.0652	20.1088	20.1054	19.9641	19.4144	18.7670	18.2650	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9922	0.9797	0.9387	0.8371	0.6489	0.4582	0.5175	0.8034	0.9645	0.9928	0.9972	(94)
Useful gains	455.4846	529.6465	608.7115	671.6272	649.4396	496.0006	333.7976	348.2739	482.9100	491.8532	444.4772	430.0205	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1408.8261	1366.0579	1240.5791	1035.3118	797.9144	527.1411	338.4364	356.3613	569.0190	863.4827	1150.5877	1396.7113	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.2861	562.0684	470.1095	261.8530	110.4652	0.0000	0.0000	0.0000	0.0000	276.4923	508.3996	719.2179	(98)
Space heating												3617.8921	(98)
Space heating per m2											(98) / (4) =	45.7382	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3894.3940	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	709.2861	562.0684	470.1095	261.8530	110.4652	0.0000	0.0000	0.0000	0.0000	276.4923	508.3996	719.2179	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	763.4942	605.0252	506.0382	281.8654	118.9077	0.0000	0.0000	0.0000	0.0000	297.6236	547.2547	774.1851	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2862	89.2346	89.1139	88.8135	88.1699	86.7000	86.7000	86.7000	86.7000	88.8258	89.1671	89.3076	(217)
Fuel for water heating, kWh/month													
	181.8295	159.4880	165.6752	146.1721	142.2108	126.1921	118.3152	133.8039	134.8180	151.6978	163.3555	176.4594	(219)
Water heating fuel used												1800.0174	(219)
Annual totals kWh/year													
Space heating fuel - main system												3894.3940	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5579.6587	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3894.3940	0.2160	841.1891	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.0174	0.2160	388.8037	(264)
Space and water heating			1229.9929	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1170.4362	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.8000	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.3442	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3442	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	459.6774	526.0846	600.3505	679.3876	728.7972	715.5082	682.3785	635.2717	574.3655	497.9833	447.2713	435.5922	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9983	0.9963	0.9895	0.9635	0.8867	0.7279	0.5581	0.6165	0.8636	0.9804	0.9965	0.9987	(86)
MIT	19.7308	19.8772	20.1372	20.4832	20.7753	20.9433	20.9882	20.9808	20.8578	20.4696	20.0389	19.7075	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9977	0.9950	0.9856	0.9494	0.8433	0.6374	0.4365	0.4928	0.7958	0.9703	0.9951	0.9983	(89)
MIT 2	18.2608	18.4764	18.8560	19.3581	19.7490	19.9440	19.9779	19.9761	19.8612	19.3477	18.7213	18.2337	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9812	0.9424	0.8421	0.6523	0.4601	0.5166	0.8017	0.9648	0.9930	0.9973	(94)
Useful gains	458.0554	522.2711	589.0734	640.2623	613.6941	466.7357	313.9674	328.2108	460.4959	480.4618	444.1185	434.4112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1304.6257	1264.8403	1148.2584	960.7034	740.4706	491.7722	317.3589	334.1897	531.0060	804.8636	1071.2668	1297.9090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating												3205.2717	(98)
Space heating per m2											(98) / (4) =	40.5218	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3431.7684	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	674.3558	534.2682	445.4321	247.0209	100.9868	0.0000	0.0000	0.0000	0.0000	258.4100	483.4547	687.8398	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7257	87.5215	87.0449	85.9249	83.8019	80.3000	80.3000	80.3000	80.3000	85.9192	87.2417	87.8106	(217)
Fuel for water heating, kWh/month													
	229.6885	201.8751	211.1880	189.7546	188.3700	173.1411	165.8823	184.9199	186.9622	198.9702	209.1771	224.0570	(219)
Water heating fuel used												2363.9861	(219)
Annual totals kWh/year													
Space heating fuel - main system												3431.7684	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6233.7652	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3431.7684	0.2160	741.2620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.9861	0.2160	510.6210	(264)
Space and water heating			1251.8830	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1479.2105	(272)
Emissions per m2 for space and water heating			15.8266	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8266 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	97.3103	97.0681	96.8308	95.7158	95.5072	94.5361	94.5361	94.3563	94.9102	95.5072	95.9292	96.3704	(39)
Average = Sum(39)m / 12 =												95.7148	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2302	1.2272	1.2242	1.2101	1.2074	1.1951	1.1951	1.1929	1.1999	1.2074	1.2128	1.2183	(40)
HLP (average)												1.2100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Average daily hot water use (litres/day)												92.2821	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	425.9154	503.3159	592.4432	688.7707	750.5189	741.0648	706.8475	649.2649	576.5633	483.1638	418.3523	400.7485	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4488	56.5897	56.7284	57.3892	57.5146	58.1054	58.1054	58.2161	57.8764	57.5146	57.2615	56.9994	
alpha	4.7633	4.7726	4.7819	4.8259	4.8343	4.8737	4.8737	4.8811	4.8584	4.8343	4.8174	4.8000	
util living area													
	0.9987	0.9970	0.9906	0.9653	0.8903	0.7363	0.5693	0.6343	0.8775	0.9840	0.9974	0.9991	(86)
MIT	19.5961	19.7577	20.0427	20.4207	20.7414	20.9301	20.9841	20.9738	20.8248	20.3915	19.9245	19.5709	(87)
Th 2	19.8959	19.8983	19.9007	19.9120	19.9141	19.9239	19.9239	19.9257	19.9201	19.9141	19.9098	19.9054	(88)
util rest of house													
	0.9983	0.9959	0.9871	0.9515	0.8464	0.6423	0.4398	0.5026	0.8111	0.9754	0.9963	0.9988	(89)
MIT 2	18.6175	18.7806	19.0657	19.4437	19.7387	19.8917	19.9199	19.9183	19.8204	19.4226	18.9566	18.5998	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8070	18.9699	19.2549	19.6329	19.9329	20.0928	20.1260	20.1227	20.0149	19.6102	19.1441	18.7879	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8070	18.9699	19.2549	19.6329	19.9329	20.0928	20.1260	20.1227	20.0149	19.6102	19.1441	18.7879	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9843	0.9470	0.8473	0.6584	0.4651	0.5283	0.8181	0.9721	0.9952	0.9983	(94)
Useful gains	424.9270	500.5963	583.1207	652.2484	635.9191	487.9315	328.7626	342.9976	471.6613	469.6903	416.3473	400.0548	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1411.6848	1365.7351	1235.0665	1027.3121	786.3014	519.2704	333.3351	351.2592	561.3844	860.5434	1155.3771	1405.8396	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	734.1478	581.3733	485.0477	270.0459	111.8844	0.0000	0.0000	0.0000	0.0000	290.7947	532.1015	748.3039	(98)
Space heating												3753.6991	(98)
Space heating per m2											(98) / (4) =	47.4551	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	888.6396	699.5673	717.1079	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8593	0.9201	0.8922	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	763.5846	643.6470	639.8379	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7972	915.9608	850.3385	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	139.8331	202.6014	156.6124	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											499.0469	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.9583	50.6504	39.1531	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											124.7617	(107)
Space cooling per m2											1.5773	(108)
Energy for space heating											47.4551	(99)
Energy for space cooling											1.5773	(108)
Total											49.0324	(109)
Dwelling Fabric Energy Efficiency (DFEE)											49.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	415.2740	482.8240	559.3195	641.1606	692.6124	681.9410	650.4988	600.5977	538.2912	459.0289	405.1465	391.9549	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9989	0.9975	0.9922	0.9708	0.9028	0.7523	0.5823	0.6459	0.8867	0.9860	0.9978	0.9992	(86)
MIT	19.6785	19.8268	20.0908	20.4450	20.7504	20.9339	20.9857	20.9764	20.8354	20.4272	19.9896	19.6560	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9985	0.9966	0.9893	0.9590	0.8632	0.6626	0.4570	0.5192	0.8250	0.9785	0.9968	0.9989	(89)
MIT 2	18.7458	18.8958	19.1603	19.5165	19.8000	19.9512	19.9786	19.9772	19.8829	19.5053	19.0678	18.7310	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9955	0.9870	0.9550	0.8637	0.6780	0.4815	0.5439	0.8314	0.9757	0.9959	0.9985	(94)
Useful gains	414.4514	480.6553	552.0451	612.3297	598.2419	462.3329	313.2042	326.6667	447.5476	447.8568	403.4790	391.3762	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1339.5148	1294.8339	1169.7945	971.5266	743.7278	492.1263	317.3670	334.1920	532.1796	815.5373	1095.6064	1333.3522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2471	547.1280	459.6055	258.6218	108.2415	0.0000	0.0000	0.0000	0.0000	273.5543	498.3317	700.8301	(98)
Space heating												3534.5602	(98)
Space heating per m2											(98) / (4) =	44.6847	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8617	0.9235	0.8971	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.3441	606.8899	604.2870	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	888.6914	850.0987	793.4548	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.9301	180.9473	140.7409	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.6182	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   30.4825   45.2368   35.1852    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.9046 (107)
Space cooling per m2                                                                                                     1.4021 (108)
Energy for space heating                                                                                                44.6847 (99)
Energy for space cooling                                                                                                 1.4021 (108)
Total                                                                                                                   46.0868 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    53.0 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4414	0.4098	0.4204	0.3993	0.3993	0.3888	0.3783	0.3678	0.3573	0.3888	0.3678	0.3888	(22b)
Effective ac	0.5974	0.5840	0.5883	0.5797	0.5797	0.5756	0.5716	0.5676	0.5638	0.5756	0.5676	0.5756	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.3105	39.4051	39.6995	39.1182	39.1182	38.8388	38.5668	38.3023	38.0452	38.8388	38.3023	38.8388	(38)
Heat transfer coeff	97.6462	96.7408	97.0351	96.4539	96.4539	96.1745	95.9025	95.6379	95.3809	96.1745	95.6379	96.1745	(39)
Average = Sum(39)m / 12 =												96.2844	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2230	1.2267	1.2194	1.2194	1.2159	1.2124	1.2091	1.2058	1.2159	1.2091	1.2159	(40)
HLP (average)												1.2172	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2547	56.7812	56.6089	56.9501	56.9501	57.1155	57.2775	57.4359	57.5908	57.1155	57.4359	57.1155	
alpha	4.7503	4.7854	4.7739	4.7967	4.7967	4.8077	4.8185	4.8291	4.8394	4.8077	4.8291	4.8077	
util living area													
	0.9905	0.9846	0.9632	0.8983	0.7665	0.5528	0.4053	0.4262	0.6991	0.9209	0.9802	0.9922	(86)
MIT	19.9262	20.0567	20.3285	20.6577	20.8835	20.9807	20.9965	20.9957	20.9439	20.6706	20.2685	19.9217	(87)
Th 2	19.8925	19.9016	19.8987	19.9045	19.9045	19.9073	19.9101	19.9127	19.9153	19.9073	19.9127	19.9073	(88)
util rest of house													
	0.9874	0.9796	0.9509	0.8654	0.6984	0.4546	0.2938	0.3097	0.6023	0.8866	0.9724	0.9895	(89)
MIT 2	18.5014	18.6961	19.0812	19.5333	19.8055	19.8973	19.9092	19.9116	19.8793	19.5642	19.0116	18.5057	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8600	0.7059	0.4732	0.3155	0.3324	0.6186	0.8816	0.9660	0.9856	(94)
Useful gains	648.7150	705.8141	768.2844	782.4665	663.5435	455.1335	288.8291	288.0183	489.4519	615.0576	620.9694	615.5861	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1355.0682	1321.4385	1195.7445	988.7534	724.7831	462.3266	289.6030	288.9783	513.6717	805.7992	1085.9725	1325.2789	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	525.5268	413.6996	318.0303	148.5265	45.5623	0.0000	0.0000	0.0000	0.0000	141.9118	334.8022	528.0114	(98)
Space heating												2456.0709	(98)
RHI space heating demand												2456	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5359	0.5254	0.5149	0.4624	0.4519	0.3993	0.3993	0.3888	0.4204	0.4519	0.4729	0.4939	(22b)
Effective ac	0.6436	0.6380	0.6326	0.6069	0.6021	0.5797	0.5797	0.5756	0.5883	0.6021	0.6118	0.6220	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss (33) + (36) =	57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4291	43.0527	42.6839	40.9514	40.6272	39.1182	39.1182	38.8388	39.6995	40.6272	41.2830	41.9685	(38)
Heat transfer coeff	100.7647	100.3884	100.0195	98.2870	97.9629	96.4539	96.4539	96.1745	97.0351	97.9629	98.6186	99.3042	(39)
Average = Sum(39)m / 12 =												98.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2739	1.2691	1.2645	1.2426	1.2385	1.2194	1.2194	1.2159	1.2267	1.2385	1.2468	1.2554	(40)
HLP (average)												1.2425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5137	54.7180	54.9198	55.8879	56.0728	56.9501	56.9501	57.1155	56.6089	56.0728	55.7000	55.3155	
alpha	4.6342	4.6479	4.6613	4.7259	4.7382	4.7967	4.7967	4.8077	4.7739	4.7382	4.7133	4.6877	
util living area													
	0.9931	0.9876	0.9722	0.9256	0.8209	0.6454	0.4841	0.5332	0.7803	0.9497	0.9873	0.9944	(86)
MIT	19.7801	19.9375	20.2070	20.5551	20.8196	20.9582	20.9914	20.9866	20.8961	20.5471	20.1081	19.7593	(87)
Th 2	19.8613	19.8651	19.8688	19.8861	19.8893	19.9045	19.9045	19.9073	19.8987	19.8893	19.8828	19.8759	(88)
util rest of house													
	0.9908	0.9835	0.9628	0.9003	0.7640	0.5508	0.3680	0.4136	0.6954	0.9272	0.9824	0.9926	(89)
MIT 2	18.2672	18.4979	18.8874	19.3839	19.7215	19.8784	19.9016	19.9022	19.8214	19.3865	18.7595	18.2474	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5602	18.7767	19.1430	19.6107	19.9341	20.0875	20.1127	20.1123	20.0295	19.6113	19.0207	18.5402	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5602	18.7767	19.1430	19.6107	19.9341	20.0875	20.1127	20.1123	20.0295	19.6113	19.0207	18.5402	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9549	0.8928	0.7665	0.5675	0.3906	0.4368	0.7067	0.9199	0.9771	0.9894	(94)
Useful gains	628.2677	695.1806	754.7504	779.5338	706.5301	511.4719	336.4602	353.0712	526.0034	611.3585	600.0203	600.2591	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1436.9292	1393.0616	1264.5434	1052.7256	806.6403	529.2946	338.8094	357.0257	575.3727	882.7698	1175.6036	1424.0411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	601.6442	468.9761	379.2860	196.6981	74.4820	0.0000	0.0000	0.0000	0.0000	201.9300	414.4200	612.8938	(98)
Space heating												2950.3302	(98)
Space heating per m2											(98) / (4) =	37.2987	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3175.8129	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	601.6442	468.9761	379.2860	196.6981	74.4820	0.0000	0.0000	0.0000	0.0000	201.9300	414.4200	612.8938	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	647.6256	504.8182	408.2734	211.7310	80.1744	0.0000	0.0000	0.0000	0.0000	217.3628	446.0925	659.7350	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2004	89.1341	88.9798	88.5998	87.8655	86.7000	86.7000	86.7000	86.7000	88.5913	89.0453	89.2264	(217)
Fuel for water heating, kWh/month													
	182.0044	159.6678	165.9248	146.5246	142.7035	126.1921	118.3152	133.8039	134.8180	152.0992	163.5789	176.6198	(219)
Water heating fuel used												1802.2524	(219)
Annual totals kWh/year													
Space heating fuel - main system												3175.8129	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4863.3126	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3175.8129	3.4800	110.5183	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.2524	3.4800	62.7184	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			278.1008	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9412	(257)
SAP value		86.8703	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3175.8129	0.2160	685.9756	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.2524	0.2160	389.2865	(264)
Space and water heating			1075.2621	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1015.7054	(272)
CO2 emissions per m2			12.8400	(273)
EI value			89.0327	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4414	0.4098	0.4204	0.3993	0.3993	0.3888	0.3783	0.3678	0.3573	0.3888	0.3678	0.3888	(22b)
Effective ac	0.5974	0.5840	0.5883	0.5797	0.5797	0.5756	0.5716	0.5676	0.5638	0.5756	0.5676	0.5756	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.3105	39.4051	39.6995	39.1182	39.1182	38.8388	38.5668	38.3023	38.0452	38.8388	38.3023	38.8388	(38)
Heat transfer coeff	97.6462	96.7408	97.0351	96.4539	96.4539	96.1745	95.9025	95.6379	95.3809	96.1745	95.6379	96.1745	(39)
Average = Sum(39)m / 12 =												96.2844	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2230	1.2267	1.2194	1.2194	1.2159	1.2124	1.2091	1.2058	1.2159	1.2091	1.2159	(40)
HLP (average)												1.2172	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2547	56.7812	56.6089	56.9501	56.9501	57.1155	57.2775	57.4359	57.5908	57.1155	57.4359	57.1155	
alpha	4.7503	4.7854	4.7739	4.7967	4.7967	4.8077	4.8185	4.8291	4.8394	4.8077	4.8291	4.8077	
util living area													
	0.9905	0.9846	0.9632	0.8983	0.7665	0.5528	0.4053	0.4262	0.6991	0.9209	0.9802	0.9922	(86)
MIT	19.9262	20.0567	20.3285	20.6577	20.8835	20.9807	20.9965	20.9957	20.9439	20.6706	20.2685	19.9217	(87)
Th 2	19.8925	19.9016	19.8987	19.9045	19.9045	19.9073	19.9101	19.9127	19.9153	19.9073	19.9127	19.9073	(88)
util rest of house													
	0.9874	0.9796	0.9509	0.8654	0.6984	0.4546	0.2938	0.3097	0.6023	0.8866	0.9724	0.9895	(89)
MIT 2	18.5014	18.6961	19.0812	19.5333	19.8055	19.8973	19.9092	19.9116	19.8793	19.5642	19.0116	18.5057	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8600	0.7059	0.4732	0.3155	0.3324	0.6186	0.8816	0.9660	0.9856	(94)
Useful gains	648.7150	705.8141	768.2844	782.4665	663.5435	455.1335	288.8291	288.0183	489.4519	615.0576	620.9694	615.5861	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1355.0682	1321.4385	1195.7445	988.7534	724.7831	462.3266	289.6030	288.9783	513.6717	805.7992	1085.9725	1325.2789	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	525.5268	413.6996	318.0303	148.5265	45.5623	0.0000	0.0000	0.0000	0.0000	141.9118	334.8022	528.0114	(98)
Space heating												2456.0709	(98)
Space heating per m2											(98) / (4) =	31.0502	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2643.7793	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	525.5268	413.6996	318.0303	148.5265	45.5623	0.0000	0.0000	0.0000	0.0000	141.9118	334.8022	528.0114	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	565.6908	445.3172	342.3362	159.8778	49.0445	0.0000	0.0000	0.0000	0.0000	152.7575	360.3899	568.3653	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1236	89.0586	88.8602	88.3786	87.5304	86.7000	86.7000	86.7000	86.7000	88.3125	88.9052	89.1437	(217)
Fuel for water heating, kWh/month													
	182.1611	159.8030	166.1483	146.8913	143.2499	126.1921	118.3152	133.8039	134.8180	152.5796	163.8366	176.7837	(219)
Water heating fuel used												1804.5827	(219)
Annual totals kWh/year													
Space heating fuel - main system												2643.7793	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4259.8927	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2643.7793	7.3800	195.1109	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.5827	7.3800	133.1782	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			381.2738	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2643.7793	0.2160	571.0563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5827	0.2160	389.7899	(264)
Space and water heating			960.8462	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			863.0307	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2643.7793	1.2200	3225.4107	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5827	1.2200	2201.5909	(264)
Space and water heating			5427.0016	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4848.4011	(272)
Primary energy kWh/m2/year			61.2946	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£435	£363	£72
Space heating	£324	£324	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£381	£323	£58
Total cost of uses	£381	£324	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5359	0.5254	0.5149	0.4624	0.4519	0.3993	0.3993	0.3888	0.4204	0.4519	0.4729	0.4939	(22b)
Effective ac	0.6436	0.6380	0.6326	0.6069	0.6021	0.5797	0.5797	0.5756	0.5883	0.6021	0.6118	0.6220	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4291	43.0527	42.6839	40.9514	40.6272	39.1182	39.1182	38.8388	39.6995	40.6272	41.2830	41.9685	(38)
Heat transfer coeff	100.7647	100.3884	100.0195	98.2870	97.9629	96.4539	96.4539	96.1745	97.0351	97.9629	98.6186	99.3042	(39)
Average = Sum(39)m / 12 =												98.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2739	1.2691	1.2645	1.2426	1.2385	1.2194	1.2194	1.2159	1.2267	1.2385	1.2468	1.2554	(40)
HLP (average)												1.2425	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2491	(H8)
Utilisation factor												0.5509	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-842.1367	(H17)
Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
								Total per year (kWh/year) = Sum(64)m =				760.7271	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	636.4952	710.7868	790.3931	873.1646	921.7096	901.2228	861.4427	808.3654	744.3522	664.5848	614.1086	606.6889	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5137	54.7180	54.9198	55.8879	56.0728	56.9501	56.9501	57.1155	56.6089	56.0728	55.7000	55.3155	
alpha	4.6342	4.6479	4.6613	4.7259	4.7382	4.7967	4.7967	4.8077	4.7739	4.7382	4.7133	4.6877	
util living area													
	0.9931	0.9876	0.9722	0.9256	0.8209	0.6454	0.4841	0.5332	0.7803	0.9497	0.9873	0.9944	(86)
MIT	19.7801	19.9375	20.2070	20.5551	20.8196	20.9582	20.9914	20.9866	20.8961	20.5471	20.1081	19.7593	(87)
Th 2	19.8613	19.8651	19.8688	19.8861	19.8893	19.9045	19.9045	19.9073	19.8987	19.8893	19.8828	19.8759	(88)
util rest of house													
	0.9908	0.9835	0.9628	0.9003	0.7640	0.5508	0.3680	0.4136	0.6954	0.9272	0.9824	0.9926	(89)
MIT 2	18.2672	18.4979	18.8874	19.3839	19.7215	19.8784	19.9016	19.9022	19.8214	19.3865	18.7595	18.2474	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5602	18.7767	19.1430	19.6107	19.9341	20.0875	20.1127	20.1123	20.0295	19.6113	19.0207	18.5402	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5602	18.7767	19.1430	19.6107	19.9341	20.0875	20.1127	20.1123	20.0295	19.6113	19.0207	18.5402	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9549	0.8928	0.7665	0.5675	0.3906	0.4368	0.7067	0.9199	0.9771	0.9894	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	628.2677	695.1806	754.7504	779.5338	706.5301	511.4719	336.4602	353.0712	526.0034	611.3585	600.0203	600.2591	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1436.9292	1393.0616	1264.5434	1052.7256	806.6403	529.2946	338.8094	357.0257	575.3727	882.7698	1175.6036	1424.0411	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	601.6442	468.9761	379.2860	196.6981	74.4820	0.0000	0.0000	0.0000	0.0000	201.9300	414.4200	612.8938	(98)
Space heating												2950.3302	(98)
Space heating per m2											(98) / (4) =	37.2987	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3175.8129	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.6442	468.9761	379.2860	196.6981	74.4820	0.0000	0.0000	0.0000	0.0000	201.9300	414.4200	612.8938	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	647.6256	504.8182	408.2734	211.7310	80.1744	0.0000	0.0000	0.0000	0.0000	217.3628	446.0925	659.7350	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2854	89.3132	89.3362	89.3800	89.4927	86.7000	86.7000	86.7000	86.7000	88.9465	89.1768	89.2973	(217)
Fuel for water heating, kWh/month	154.4803	113.7212	87.5759	41.1807	11.7073	0.0000	0.0000	21.4599	46.8301	92.9241	130.8561	153.5947	(219)
Water heating fuel used												854.3301	(219)
Annual totals kWh/year													
Space heating fuel - main system												3175.8129	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												3965.3903	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3175.8129	3.4800	110.5183	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3301	3.4800	29.7307	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			251.7081	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8519	(257)
SAP value		88.1164	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3175.8129	0.2160	685.9756	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3301	0.2160	184.5353	(264)
Space and water heating			870.5109	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			836.9042 (272)
CO2 emissions per m2			10.5800 (273)
EI value			90.9633
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4204	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4414	0.4098	0.4204	0.3993	0.3993	0.3888	0.3783	0.3678	0.3573	0.3888	0.3678	0.3888	(22b)
Effective ac	0.5974	0.5840	0.5883	0.5797	0.5797	0.5756	0.5716	0.5676	0.5638	0.5756	0.5676	0.5756	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.3105	39.4051	39.6995	39.1182	39.1182	38.8388	38.5668	38.3023	38.0452	38.8388	38.3023	38.8388	(38)
Heat transfer coeff	97.6462	96.7408	97.0351	96.4539	96.4539	96.1745	95.9025	95.6379	95.3809	96.1745	95.6379	96.1745	(39)
Average = Sum(39)m / 12 =												96.2844	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2230	1.2267	1.2194	1.2194	1.2159	1.2124	1.2091	1.2058	1.2159	1.2091	1.2159	(40)
HLP (average)												1.2172	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317 (83)
Total gains	660.0007	724.8973	815.0299	909.8395	940.0319	961.8957	915.4553	866.5583	791.2012	697.6535	642.8541	624.5718 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2547	56.7812	56.6089	56.9501	56.9501	57.1155	57.2775	57.4359	57.5908	57.1155	57.4359	57.1155	
alpha	4.7503	4.7854	4.7739	4.7967	4.7967	4.8077	4.8185	4.8291	4.8394	4.8077	4.8291	4.8077	
util living area													
	0.9905	0.9846	0.9632	0.8983	0.7665	0.5528	0.4053	0.4262	0.6991	0.9209	0.9802	0.9922	(86)
MIT	19.9262	20.0567	20.3285	20.6577	20.8835	20.9807	20.9965	20.9957	20.9439	20.6706	20.2685	19.9217	(87)
Th 2	19.8925	19.9016	19.8987	19.9045	19.9045	19.9073	19.9101	19.9127	19.9153	19.9073	19.9127	19.9073	(88)
util rest of house													
	0.9874	0.9796	0.9509	0.8654	0.6984	0.4546	0.2938	0.3097	0.6023	0.8866	0.9724	0.9895	(89)
MIT 2	18.5014	18.6961	19.0812	19.5333	19.8055	19.8973	19.9092	19.9116	19.8793	19.5642	19.0116	18.5057	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7773	18.9596	19.3228	19.7510	20.0143	20.1072	20.1198	20.1216	20.0855	19.7785	19.2550	18.7799	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9737	0.9426	0.8600	0.7059	0.4732	0.3155	0.3324	0.6186	0.8816	0.9660	0.9856	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	648.7150	705.8141	768.2844	782.4665	663.5435	455.1335	288.8291	288.0183	489.4519	615.0576	620.9694	615.5861 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1355.0682	1321.4385	1195.7445	988.7534	724.7831	462.3266	289.6030	288.9783	513.6717	805.7992	1085.9725	1325.2789 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	525.5268	413.6996	318.0303	148.5265	45.5623	0.0000	0.0000	0.0000	0.0000	141.9118	334.8022	528.0114 (98)
Space heating												2456.0709 (98)
Space heating per m2											(98) / (4) =	31.0502 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2643.7793 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	525.5268	413.6996	318.0303	148.5265	45.5623	0.0000	0.0000	0.0000	0.0000	141.9118	334.8022	528.0114	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	565.6908	445.3172	342.3362	159.8778	49.0445	0.0000	0.0000	0.0000	0.0000	152.7575	360.3899	568.3653	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2315	89.2496	89.2516	89.2603	89.0880	86.7000	86.7000	86.7000	86.7000	88.7308	89.0762	89.2328	(217)
Fuel for water heating, kWh/month													
	149.9834	114.0287	87.3341	40.0952	16.7717	0.0000	0.0000	14.5776	41.4721	88.8010	125.6588	150.3292	(219)
Water heating fuel used												829.0518	(219)
Annual totals kWh/year													
Space heating fuel - main system												2643.7793	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3334.3618	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2643.7793	7.3800	195.1109	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0518	7.3800	61.1840	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			323.6097	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2643.7793	0.2160	571.0563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0518	0.2160	179.0752	(264)
Space and water heating			750.1315	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			678.2660	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2643.7793	1.2200	3225.4107	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0518	1.2200	1011.4432	(264)
Space and water heating			4236.8539	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3811.7534	(272)
Primary energy kWh/m2/year			48.1890	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
South	0.5000	118.5567	0.7200	0.7000	0.7650	20.5698
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						508.3400

	Jun	Jul	Aug	
Solar gains	546	508	449	(P3)
Internal gains	425	408	416	
Total summer gains	971	916	865	(P5)
Summer gain/loss ratio	1.63	1.53	1.45	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.28	19.08	19.00	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 378 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.80	**TER**	18.70
Environmental	89 B	**% DER<TER**	20.86		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.03	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.70	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.80	$kgCO_2/m^2$	Pass
	-3.90 (-20.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.03	$kWh/m^2/yr$	
	-4.0 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	6.47 m², No overhang
Windows facing South	0.50 m², No overhang
Windows facing West	4.75 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 379 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	9 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.75	**TER**	18.79
Environmental	89 B	**% DER<TER**	21.50		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.94	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.75 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.9 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.42 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.50 m², No overhang
Windows facing East: 6.47 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.4655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3957	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5045	0.4946	0.4847	0.4353	0.4254	0.3759	0.3759	0.3660	0.3957	0.4254	0.4452	0.4649	(22b)
Effective ac	0.6273	0.6223	0.6175	0.5947	0.5905	0.5707	0.5707	0.5670	0.5783	0.5905	0.5991	0.6081	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3258	41.9923	41.6655	40.1302	39.8429	38.5058	38.5058	38.2581	39.0208	39.8429	40.4240	41.0315	(38)
Heat transfer coeff	99.6615	99.3280	99.0011	97.4658	97.1786	95.8414	95.8414	95.5938	96.3565	97.1786	97.7597	98.3672	(39)
Average = Sum(39)m / 12 =												97.4645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2599	1.2557	1.2516	1.2322	1.2286	1.2116	1.2116	1.2085	1.2182	1.2286	1.2359	1.2436	(40)
HLP (average)												1.2322	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	450.8570	523.9690	610.3113	705.8961	768.7803	759.0088	722.6152	665.0522	590.5522	499.7538	440.3018	425.7222	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1172	55.3022	55.4848	56.3588	56.5254	57.3140	57.3140	57.4625	57.0076	56.5254	56.1894	55.8424	
alpha	4.6745	4.6868	4.6990	4.7573	4.7684	4.8209	4.8209	4.8308	4.8005	4.7684	4.7460	4.7228	
util living area													
	0.9984	0.9964	0.9896	0.9631	0.8862	0.7300	0.5646	0.6278	0.8727	0.9821	0.9968	0.9988	(86)
MIT	19.5866	19.7453	20.0306	20.4157	20.7396	20.9304	20.9839	20.9739	20.8247	20.3915	19.9245	19.5672	(87)
Th 2	19.8723	19.8757	19.8789	19.8943	19.8972	19.9107	19.9107	19.9132	19.9055	19.8972	19.8914	19.8853	(88)
util rest of house													
	0.9978	0.9951	0.9857	0.9485	0.8410	0.6349	0.4344	0.4956	0.8044	0.9726	0.9954	0.9983	(89)
MIT 2	17.9934	18.2274	18.6446	19.2055	19.6400	19.8641	19.9049	19.9024	19.7606	19.1815	18.5007	17.9739	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3020	18.5214	18.9130	19.4399	19.8529	20.0707	20.1138	20.1100	19.9667	19.4159	18.7765	18.2824	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3020	18.5214	18.9130	19.4399	19.8529	20.0707	20.1138	20.1100	19.9667	19.4159	18.7765	18.2824	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9928	0.9809	0.9407	0.8389	0.6502	0.4597	0.5210	0.8090	0.9666	0.9933	0.9974	(94)
Useful gains	449.3024	520.1876	598.6372	664.0073	644.8920	493.4873	332.1857	346.5026	477.7740	483.0737	437.3477	424.5998	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1395.4608	1352.9846	1228.9034	1027.2815	792.2904	524.3149	336.7723	354.6504	565.2969	856.7135	1141.4912	1385.2509	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	703.9419	559.6396	468.9180	261.5574	109.6643	0.0000	0.0000	0.0000	0.0000	277.9880	506.9834	714.7245	(98)
Space heating												3603.4171	(98)
Space heating per m2											(98) / (4) =	45.5552	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3878.8128	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	703.9419	559.6396	468.9180	261.5574	109.6643	0.0000	0.0000	0.0000	0.0000	277.9880	506.9834	714.7245	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	757.7415	602.4107	504.7557	281.5473	118.0456	0.0000	0.0000	0.0000	0.0000	299.2336	545.7302	769.3482	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2824	89.2323	89.1124	88.8127	88.1641	86.7000	86.7000	86.7000	86.7000	88.8296	89.1655	89.3045	(217)
Fuel for water heating, kWh/month													
	181.8371	159.4921	165.6780	146.1734	142.2201	126.1921	118.3152	133.8039	134.8180	151.6912	163.3583	176.4654	(219)
Water heating fuel used												1800.0449	(219)
Annual totals kWh/year													
Space heating fuel - main system												3878.8128	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5564.1049	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3878.8128	0.2160	837.8236	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.0449	0.2160	388.8097	(264)
Space and water heating			1226.6333	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1167.0766	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.2942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.2942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	454.1583	517.4898	590.7231	671.0184	722.6612	710.8381	677.2846	628.2964	565.1407	489.0600	440.8077	430.7737	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9965	0.9902	0.9652	0.8895	0.7313	0.5618	0.6222	0.8697	0.9818	0.9967	0.9988	(86)
MIT	19.7243	19.8673	20.1264	20.4750	20.7712	20.9421	20.9878	20.9800	20.8523	20.4600	20.0313	19.7019	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9978	0.9953	0.9866	0.9516	0.8467	0.6408	0.4396	0.4979	0.8033	0.9724	0.9954	0.9983	(89)
MIT 2	18.2514	18.4618	18.8404	19.3468	19.7443	19.9430	19.9778	19.9757	19.8558	19.3343	18.7104	18.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9932	0.9823	0.9447	0.8453	0.6557	0.4634	0.5219	0.8087	0.9670	0.9934	0.9974	(94)
Useful gains	452.6357	513.9821	580.2826	633.8910	610.8462	466.0713	313.8404	327.8942	457.0336	472.9141	437.8813	429.6606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1303.8118	1263.5926	1146.9261	959.7421	740.0585	491.6845	317.3422	334.1484	530.5203	803.7285	1070.3374	1297.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating												3236.2880	(98)
Space heating per m2											(98) / (4) =	40.9139	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3464.9765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	678.0247	539.3343	451.3734	251.1914	102.9272	0.0000	0.0000	0.0000	0.0000	263.5181	487.5465	691.0610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7363	87.5409	87.0745	85.9666	83.8456	80.3000	80.3000	80.3000	80.3000	85.9680	87.2600	87.8196	(217)
Fuel for water heating, kWh/month													
	229.6607	201.8304	211.1162	189.6625	188.2719	173.1411	165.8823	184.9199	186.9622	198.8573	209.1333	224.0341	(219)
Water heating fuel used												2363.4720	(219)
Annual totals kWh/year													
Space heating fuel - main system												3464.9765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6266.4591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3464.9765	0.2160	748.4349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.4720	0.2160	510.5099	(264)
Space and water heating			1258.9449	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1486.2724	(272)
Emissions per m2 for space and water heating			15.9159	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9159 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3677	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3126	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3985	0.3907	0.3829	0.3438	0.3360	0.2969	0.2969	0.2891	0.3126	0.3360	0.3516	0.3673	(22b)
Effective ac	0.5794	0.5763	0.5733	0.5591	0.5564	0.5441	0.5441	0.5418	0.5488	0.5564	0.5618	0.5674	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0962	38.8882	38.6842	37.7263	37.5471	36.7128	36.7128	36.5583	37.0341	37.5471	37.9096	38.2887	(38)
Heat transfer coeff	96.4319	96.2238	96.0199	95.0620	94.8827	94.0484	94.0484	93.8939	94.3698	94.8827	95.2453	95.6243	(39)
Average = Sum(39)m / 12 =												95.0611	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2191	1.2165	1.2139	1.2018	1.1995	1.1890	1.1890	1.1870	1.1930	1.1995	1.2041	1.2089	(40)
HLP (average)												1.2018	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225 (71)

Water heating gains (Table 5)

	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394 (72)

Total internal gains

	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419 (83)
Total gains	419.6078	493.4932	581.4405	679.2059	743.5063	735.7275	701.0260	641.2931	566.0207	472.9657	410.9653	395.2416 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9631	57.0862	57.2075	57.7839	57.8931	58.4067	58.4067	58.5028	58.2078	57.8931	57.6727	57.4441	
alpha	4.7975	4.8057	4.8138	4.8523	4.8595	4.8938	4.8938	4.9002	4.8805	4.8595	4.8448	4.8296	
util living area	0.9988	0.9972	0.9912	0.9667	0.8919	0.7378	0.5711	0.6384	0.8824	0.9852	0.9976	0.9991	(86)
MIT	19.6032	19.7599	20.0424	20.4193	20.7420	20.9303	20.9841	20.9734	20.8213	20.3872	19.9255	19.5767	(87)
Th 2	19.9047	19.9068	19.9089	19.9186	19.9204	19.9288	19.9288	19.9304	19.9256	19.9204	19.9167	19.9129	(88)
util rest of house	0.9984	0.9962	0.9879	0.9533	0.8486	0.6442	0.4418	0.5069	0.8176	0.9772	0.9966	0.9988	(89)
MIT 2	18.6315	18.7896	19.0720	19.4482	19.7450	19.8967	19.9248	19.9228	19.8231	19.4236	18.9630	18.6116	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8197	18.9775	19.2599	19.6363	19.9381	20.0969	20.1300	20.1263	20.0164	19.6102	19.1494	18.7985	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8197	18.9775	19.2599	19.6363	19.9381	20.0969	20.1300	20.1263	20.0164	19.6102	19.1494	18.7985	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9950	0.9853	0.9489	0.8494	0.6602	0.4671	0.5325	0.8242	0.9740	0.9956	0.9984	(94)
Useful gains	418.7004	491.0367	572.8799	644.5097	631.5323	485.7340	327.4283	341.4757	466.5274	460.6828	409.1391	394.6020	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1400.1632	1354.5925	1225.2058	1020.6094	781.6513	516.9747	331.9912	349.8754	558.3341	854.9159	1147.6506	1395.9747	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	730.2084	580.3095	485.3304	270.7918	111.6886	0.0000	0.0000	0.0000	0.0000	293.3095	531.7283	745.0212	(98)
Space heating												3748.3876	(98)
Space heating per m2											(98) / (4) =	47.3880	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	884.0553	695.9584	713.5939	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9200	0.8909	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.7206	640.3024	635.7236	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.5588	909.1564	841.0208	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	138.1235	200.0274	152.7411	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												490.8919 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.5309	50.0068	38.1853	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												122.7230 (107)
Space cooling per m2												1.5515 (108)
Energy for space heating												47.3880 (99)
Energy for space cooling												1.5515 (108)
Total												48.9395 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	409.7548	474.2291	549.6922	632.7914	686.4764	677.2708	645.4050	593.6224	529.0664	450.1056	398.6828	387.1364	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9990	0.9977	0.9928	0.9722	0.9055	0.7557	0.5863	0.6520	0.8924	0.9871	0.9979	0.9993	(86)
MIT	19.6720	19.8167	20.0798	20.4364	20.7460	20.9325	20.9853	20.9754	20.8293	20.4174	19.9820	19.6503	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9986	0.9968	0.9901	0.9610	0.8665	0.6663	0.4604	0.5248	0.8324	0.9802	0.9971	0.9990	(89)
MIT 2	18.7393	18.8857	19.1495	19.5084	19.7964	19.9504	19.9785	19.9769	19.8785	19.4958	19.0603	18.7253	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9879	0.9570	0.8669	0.6815	0.4850	0.5496	0.8383	0.9774	0.9962	0.9986	(94)
Useful gains	408.9897	472.2560	543.0206	605.6016	595.1005	461.5536	313.0474	326.2660	443.5413	439.9348	397.1521	386.5956	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1338.9200	1293.9186	1168.8068	970.7914	743.3907	492.0467	317.3502	334.1500	531.7563	814.6767	1094.9241	1332.8361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	691.8682	552.1573	465.5849	262.9366	110.3279	0.0000	0.0000	0.0000	0.0000	278.8080	502.3958	704.0029	(98)
Space heating												3568.0816	(98)
Space heating per m2											(98) / (4) =	45.1085	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9217	0.8939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.3769	605.7087	602.0755	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.2328	844.1448	785.3018	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.4162	177.3965	136.3204	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												433.1331	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   29.8541   44.3491   34.0801    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        108.2833 (107)
Space cooling per m2                                                                                                   1.3689 (108)
Energy for space heating                                                                                              45.1085 (99)
Energy for space cooling                                                                                               1.3689 (108)
Total                                                                                                                 46.4774 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   53.4 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.4655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3957	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4155	0.3858	0.3957	0.3759	0.3759	0.3660	0.3561	0.3462	0.3363	0.3660	0.3462	0.3660	(22b)
Effective ac	0.5863	0.5744	0.5783	0.5707	0.5707	0.5670	0.5634	0.5599	0.5566	0.5670	0.5599	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5623	38.7600	39.0208	38.5058	38.5058	38.2581	38.0171	37.7827	37.5549	38.2581	37.7827	38.2581	(38)
Heat transfer coeff	96.8979	96.0956	96.3565	95.8414	95.8414	95.5938	95.3528	95.1183	94.8905	95.5938	95.1183	95.5938	(39)
Average = Sum(39)m / 12 =												95.6912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2149	1.2182	1.2116	1.2116	1.2085	1.2055	1.2025	1.1996	1.2085	1.2025	1.2085	(40)
HLP (average)												1.2097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6891	57.1624	57.0076	57.3140	57.3140	57.4625	57.6077	57.7497	57.8883	57.4625	57.7497	57.4625	
alpha	4.7793	4.8108	4.8005	4.8209	4.8209	4.8308	4.8405	4.8500	4.8592	4.8308	4.8500	4.8308	
util living area													
	0.9909	0.9853	0.9645	0.9001	0.7672	0.5526	0.4055	0.4278	0.7040	0.9240	0.9811	0.9925	(86)
MIT	19.9300	20.0563	20.3276	20.6577	20.8847	20.9811	20.9966	20.9957	20.9429	20.6672	20.2662	19.9238	(87)
Th 2	19.9000	19.9081	19.9055	19.9107	19.9107	19.9132	19.9156	19.9180	19.9203	19.9132	19.9180	19.9132	(88)
util rest of house													
	0.9879	0.9805	0.9526	0.8677	0.6995	0.4549	0.2945	0.3114	0.6074	0.8906	0.9736	0.9899	(89)
MIT 2	18.5123	18.7004	19.0853	19.5387	19.8126	19.9034	19.9147	19.9169	19.8835	19.5652	19.0123	18.5130	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8623	0.7069	0.4734	0.3161	0.3341	0.6237	0.8855	0.9674	0.9861	(94)
Useful gains	641.7127	696.9811	759.5415	776.5978	660.1529	452.9701	287.6155	286.8559	486.6536	608.0525	613.3699	609.4990	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1345.6088	1312.9553	1187.6821	982.8963	720.7503	460.0096	288.3725	287.8115	511.3327	800.9440	1080.0830	1317.8780	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	523.6987	413.9347	318.5366	148.5349	45.0844	0.0000	0.0000	0.0000	0.0000	143.5113	336.0334	527.0340	(98)
Space heating												2456.3680	(98)
RHI space heating demand												2456	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.4200
Infiltration rate		0.4655 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3957 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5045	0.4946	0.4847	0.4353	0.4254	0.3759	0.3759	0.3660	0.3957	0.4254	0.4452	0.4649	(22b)
Effective ac	0.6273	0.6223	0.6175	0.5947	0.5905	0.5707	0.5707	0.5670	0.5783	0.5905	0.5991	0.6081	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3258	41.9923	41.6655	40.1302	39.8429	38.5058	38.5058	38.2581	39.0208	39.8429	40.4240	41.0315	(38)
Heat transfer coeff	99.6615	99.3280	99.0011	97.4658	97.1786	95.8414	95.8414	95.5938	96.3565	97.1786	97.7597	98.3672	(39)
Average = Sum(39)m / 12 =												97.4645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2599	1.2557	1.2516	1.2322	1.2286	1.2116	1.2116	1.2085	1.2182	1.2286	1.2359	1.2436	(40)
HLP (average)												1.2322	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1172	55.3022	55.4848	56.3588	56.5254	57.3140	57.3140	57.4625	57.0076	56.5254	56.1894	55.8424	
alpha	4.6745	4.6868	4.6990	4.7573	4.7684	4.8209	4.8209	4.8308	4.8005	4.7684	4.7460	4.7228	
util living area													
	0.9933	0.9881	0.9733	0.9271	0.8216	0.6456	0.4845	0.5353	0.7844	0.9517	0.9878	0.9946	(86)
MIT	19.7914	19.9440	20.2108	20.5570	20.8218	20.9589	20.9916	20.9867	20.8953	20.5460	20.1121	19.7688	(87)
Th 2	19.8723	19.8757	19.8789	19.8943	19.8972	19.9107	19.9107	19.9132	19.9055	19.8972	19.8914	19.8853	(88)
util rest of house													
	0.9912	0.9842	0.9642	0.9022	0.7650	0.5514	0.3689	0.4159	0.7002	0.9299	0.9831	0.9928	(89)
MIT 2	18.2914	18.5149	18.9005	19.3934	19.7312	19.8850	19.9078	19.9081	19.8272	19.3915	18.7716	18.2677	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5819	18.7917	19.1543	19.6187	19.9425	20.0930	20.1177	20.1170	20.0341	19.6151	19.0312	18.5585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5819	18.7917	19.1543	19.6187	19.9425	20.0930	20.1177	20.1170	20.0341	19.6151	19.0312	18.5585	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9790	0.9565	0.8947	0.7676	0.5681	0.3913	0.4390	0.7113	0.9227	0.9779	0.9898	(94)
Useful gains	622.3212	686.2257	745.4594	772.7019	702.1610	508.9294	334.8394	351.3797	521.9478	603.7878	593.3189	595.0227	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.3525	1379.8313	1252.7911	1044.7101	800.9910	526.4543	337.1423	355.3229	571.7874	876.0717	1166.3921	1412.4010	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.9673	466.1029	377.4548	195.8459	73.5295	0.0000	0.0000	0.0000	0.0000	202.5792	412.6126	608.1294	(98)
Space heating												2932.2216	(98)
Space heating per m2											(98) / (4) =	37.0698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3156.3204	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.9673	466.1029	377.4548	195.8459	73.5295	0.0000	0.0000	0.0000	0.0000	202.5792	412.6126	608.1294	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	641.5148	501.7254	406.3022	210.8136	79.1491	0.0000	0.0000	0.0000	0.0000	218.0616	444.1471	654.6065	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1952	89.1305	88.9766	88.5965	87.8560	86.7000	86.7000	86.7000	86.7000	88.5938	89.0425	89.2223	(217)
Fuel for water heating, kWh/month													
	182.0150	159.6742	165.9308	146.5301	142.7190	126.1921	118.3152	133.8039	134.8180	152.0950	163.5840	176.6281	(219)
Water heating fuel used												1802.3053	(219)
Annual totals kWh/year													
Space heating fuel - main system												3156.3204	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4843.8730	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3156.3204	3.4800	109.8399	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.3053	3.4800	62.7202	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			277.4243	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9389	(257)
SAP value		86.9023	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3156.3204	0.2160	681.7652	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.3053	0.2160	389.2979	(264)
Space and water heating			1071.0632	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1011.5065	(272)
CO2 emissions per m2			12.7900	(273)
EI value			89.0780	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.4655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3957	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4155	0.3858	0.3957	0.3759	0.3759	0.3660	0.3561	0.3462	0.3363	0.3660	0.3462	0.3660	(22b)
Effective ac	0.5863	0.5744	0.5783	0.5707	0.5707	0.5670	0.5634	0.5599	0.5566	0.5670	0.5599	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5623	38.7600	39.0208	38.5058	38.5058	38.2581	38.0171	37.7827	37.5549	38.2581	37.7827	38.2581	(38)
Heat transfer coeff	96.8979	96.0956	96.3565	95.8414	95.8414	95.5938	95.3528	95.1183	94.8905	95.5938	95.1183	95.5938	(39)
Average = Sum(39)m / 12 =												95.6912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2149	1.2182	1.2116	1.2116	1.2085	1.2055	1.2025	1.1996	1.2085	1.2025	1.2085	(40)
HLP (average)												1.2097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6891	57.1624	57.0076	57.3140	57.3140	57.4625	57.6077	57.7497	57.8883	57.4625	57.7497	57.4625	
alpha	4.7793	4.8108	4.8005	4.8209	4.8209	4.8308	4.8405	4.8500	4.8592	4.8308	4.8500	4.8308	
util living area													
	0.9909	0.9853	0.9645	0.9001	0.7672	0.5526	0.4055	0.4278	0.7040	0.9240	0.9811	0.9925	(86)
MIT	19.9300	20.0563	20.3276	20.6577	20.8847	20.9811	20.9966	20.9957	20.9429	20.6672	20.2662	19.9238	(87)
Th 2	19.9000	19.9081	19.9055	19.9107	19.9107	19.9132	19.9156	19.9180	19.9203	19.9132	19.9180	19.9132	(88)
util rest of house													
	0.9879	0.9805	0.9526	0.8677	0.6995	0.4549	0.2945	0.3114	0.6074	0.8906	0.9736	0.9899	(89)
MIT 2	18.5123	18.7004	19.0853	19.5387	19.8126	19.9034	19.9147	19.9169	19.8835	19.5652	19.0123	18.5130	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8623	0.7069	0.4734	0.3161	0.3341	0.6237	0.8855	0.9674	0.9861	(94)
Useful gains	641.7127	696.9811	759.5415	776.5978	660.1529	452.9701	287.6155	286.8559	486.6536	608.0525	613.3699	609.4990	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1345.6088	1312.9553	1187.6821	982.8963	720.7503	460.0096	288.3725	287.8115	511.3327	800.9440	1080.0830	1317.8780	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	523.6987	413.9347	318.5366	148.5349	45.0844	0.0000	0.0000	0.0000	0.0000	143.5113	336.0334	527.0340	(98)
Space heating												2456.3680	(98)
Space heating per m2											(98) / (4) =	31.0540	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2644.0991	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	523.6987	413.9347	318.5366	148.5349	45.0844	0.0000	0.0000	0.0000	0.0000	143.5113	336.0334	527.0340	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	563.7231	445.5701	342.8812	159.8869	48.5301	0.0000	0.0000	0.0000	0.0000	154.4793	361.7152	567.3132	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1216	89.0590	88.8613	88.3787	87.5239	86.7000	86.7000	86.7000	86.7000	88.3214	88.9077	89.1427	(217)
Fuel for water heating, kWh/month													
	182.1653	159.8024	166.1462	146.8912	143.2604	126.1921	118.3152	133.8039	134.8180	152.5641	163.8320	176.7858	(219)
Water heating fuel used												1804.5767	(219)
Annual totals kWh/year													
Space heating fuel - main system												2644.0991	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4260.2065	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2644.0991	7.3800	195.1345	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.5767	7.3800	133.1778	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			381.2970	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2644.0991	0.2160	571.1254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5767	0.2160	389.7886	(264)
Space and water heating			960.9140	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			863.0984	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2644.0991	1.2200	3225.8008	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.5767	1.2200	2201.5835	(264)
Space and water heating			5427.3844	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4848.7839	(272)
Primary energy kWh/m2/year			61.2994	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£435	£363	£72
Space heating	£324	£324	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£381	£323	£58
Total cost of uses	£381	£324	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.4200	
Infiltration rate			0.4655	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3957	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5045	0.4946	0.4847	0.4353	0.4254	0.3759	0.3759	0.3660	0.3957	0.4254	0.4452	0.4649	(22b)
Effective ac	0.6273	0.6223	0.6175	0.5947	0.5905	0.5707	0.5707	0.5670	0.5783	0.5905	0.5991	0.6081	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3258	41.9923	41.6655	40.1302	39.8429	38.5058	38.5058	38.2581	39.0208	39.8429	40.4240	41.0315	(38)
Heat transfer coeff	99.6615	99.3280	99.0011	97.4658	97.1786	95.8414	95.8414	95.5938	96.3565	97.1786	97.7597	98.3672	(39)
Average = Sum(39)m / 12 =												97.4645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2599	1.2557	1.2516	1.2322	1.2286	1.2116	1.2116	1.2085	1.2182	1.2286	1.2359	1.2436	(40)
HLP (average)												1.2322	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419 (83)
Total gains	630.1876	700.9641	779.3904	863.5998	914.6971	895.8855	855.6212	800.3935	733.8096	654.3867	606.7216	601.1820 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1172	55.3022	55.4848	56.3588	56.5254	57.3140	57.3140	57.4625	57.0076	56.5254	56.1894	55.8424	
alpha	4.6745	4.6868	4.6990	4.7573	4.7684	4.8209	4.8209	4.8308	4.8005	4.7684	4.7460	4.7228	
util living area													
	0.9933	0.9881	0.9733	0.9271	0.8216	0.6456	0.4845	0.5353	0.7844	0.9517	0.9878	0.9946	(86)
MIT	19.7914	19.9440	20.2108	20.5570	20.8218	20.9589	20.9916	20.9867	20.8953	20.5460	20.1121	19.7688	(87)
Th 2	19.8723	19.8757	19.8789	19.8943	19.8972	19.9107	19.9107	19.9132	19.9055	19.8972	19.8914	19.8853	(88)
util rest of house													
	0.9912	0.9842	0.9642	0.9022	0.7650	0.5514	0.3689	0.4159	0.7002	0.9299	0.9831	0.9928	(89)
MIT 2	18.2914	18.5149	18.9005	19.3934	19.7312	19.8850	19.9078	19.9081	19.8272	19.3915	18.7716	18.2677	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5819	18.7917	19.1543	19.6187	19.9425	20.0930	20.1177	20.1170	20.0341	19.6151	19.0312	18.5585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5819	18.7917	19.1543	19.6187	19.9425	20.0930	20.1177	20.1170	20.0341	19.6151	19.0312	18.5585	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9790	0.9565	0.8947	0.7676	0.5681	0.3913	0.4390	0.7113	0.9227	0.9779	0.9898	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	622.3212	686.2257	745.4594	772.7019	702.1610	508.9294	334.8394	351.3797	521.9478	603.7878	593.3189	595.0227	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1423.3525	1379.8313	1252.7911	1044.7101	800.9910	526.4543	337.1423	355.3229	571.7874	876.0717	1166.3921	1412.4010	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	595.9673	466.1029	377.4548	195.8459	73.5295	0.0000	0.0000	0.0000	0.0000	202.5792	412.6126	608.1294	(98)

Space heating 2932.2216 (98)
Space heating per m2 (98) / (4) = 37.0698 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3156.3204 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.9673	466.1029	377.4548	195.8459	73.5295	0.0000	0.0000	0.0000	0.0000	202.5792	412.6126	608.1294	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	641.5148	501.7254	406.3022	210.8136	79.1491	0.0000	0.0000	0.0000	0.0000	218.0616	444.1471	654.6065	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2807	89.3102	89.3339	89.3781	89.4881	86.7000	86.7000	86.7000	86.7000	88.9487	89.1744	89.2935	(217)
Fuel for water heating, kWh/month	154.4884	113.7249	87.5781	41.1816	11.7079	0.0000	0.0000	21.4599	46.8301	92.9218	130.8597	153.6013	(219)

Water heating fuel used 854.3536 (219)
Annual totals kWh/year
Space heating fuel - main system 3156.3204 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) = -552.7634 -552.7634 (233)
Total delivered energy for all uses 3945.9213 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3156.3204	3.4800	109.8399	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.3536	3.4800	29.7315	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			251.0306	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8496 (257)
SAP value 88.1484
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3156.3204	0.2160	681.7652	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.3536	0.2160	184.5404	(264)
Space and water heating			866.3056	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			832.6989 (272)
CO2 emissions per m2			10.5300 (273)
EI value			91.0087
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.4655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3957	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4155	0.3858	0.3957	0.3759	0.3759	0.3660	0.3561	0.3462	0.3363	0.3660	0.3462	0.3660	(22b)
Effective ac	0.5863	0.5744	0.5783	0.5707	0.5707	0.5670	0.5634	0.5599	0.5566	0.5670	0.5599	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5623	38.7600	39.0208	38.5058	38.5058	38.2581	38.0171	37.7827	37.5549	38.2581	37.7827	38.2581	(38)
Heat transfer coeff	96.8979	96.0956	96.3565	95.8414	95.8414	95.5938	95.3528	95.1183	94.8905	95.5938	95.1183	95.5938	(39)
Average = Sum(39)m / 12 =												95.6912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2149	1.2182	1.2116	1.2116	1.2085	1.2055	1.2025	1.1996	1.2085	1.2025	1.2085	(40)
HLP (average)												1.2097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264 (83)
Total gains	652.4438	715.0050	804.1161	900.6177	933.8555	956.9256	910.0069	858.6124	780.2933	686.6586	634.0618	618.0665 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6891	57.1624	57.0076	57.3140	57.3140	57.4625	57.6077	57.7497	57.8883	57.4625	57.7497	57.4625	
alpha	4.7793	4.8108	4.8005	4.8209	4.8209	4.8308	4.8405	4.8500	4.8592	4.8308	4.8500	4.8308	
util living area													
	0.9909	0.9853	0.9645	0.9001	0.7672	0.5526	0.4055	0.4278	0.7040	0.9240	0.9811	0.9925	(86)
MIT	19.9300	20.0563	20.3276	20.6577	20.8847	20.9811	20.9966	20.9957	20.9429	20.6672	20.2662	19.9238	(87)
Th 2	19.9000	19.9081	19.9055	19.9107	19.9107	19.9132	19.9156	19.9180	19.9203	19.9132	19.9180	19.9132	(88)
util rest of house													
	0.9879	0.9805	0.9526	0.8677	0.6995	0.4549	0.2945	0.3114	0.6074	0.8906	0.9736	0.9899	(89)
MIT 2	18.5123	18.7004	19.0853	19.5387	19.8126	19.9034	19.9147	19.9169	19.8835	19.5652	19.0123	18.5130	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7869	18.9630	19.3259	19.7554	20.0202	20.1121	20.1243	20.1258	20.0887	19.7786	19.2551	18.7862	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9748	0.9446	0.8623	0.7069	0.4734	0.3161	0.3341	0.6237	0.8855	0.9674	0.9861	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	641.7127	696.9811	759.5415	776.5978	660.1529	452.9701	287.6155	286.8559	486.6536	608.0525	613.3699	609.4990	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1345.6088	1312.9553	1187.6821	982.8963	720.7503	460.0096	288.3725	287.8115	511.3327	800.9440	1080.0830	1317.8780	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	523.6987	413.9347	318.5366	148.5349	45.0844	0.0000	0.0000	0.0000	0.0000	143.5113	336.0334	527.0340	(98)
Space heating												2456.3680	(98)
Space heating per m2											(98) / (4) =	31.0540	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2644.0991	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.6987	413.9347	318.5366	148.5349	45.0844	0.0000	0.0000	0.0000	0.0000	143.5113	336.0334	527.0340	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	563.7231	445.5701	342.8812	159.8869	48.5301	0.0000	0.0000	0.0000	0.0000	154.4793	361.7152	567.3132	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2297	89.2499	89.2524	89.2603	89.0816	86.7000	86.7000	86.7000	86.7000	88.7391	89.0785	89.2318	(217)
Fuel for water heating, kWh/month	149.9865	114.0283	87.3333	40.0952	16.7729	0.0000	0.0000	14.5776	41.4721	88.7927	125.6557	150.3309	(219)
Water heating fuel used												829.0451	(219)
Annual totals kWh/year													
Space heating fuel - main system												2644.0991	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3334.6749	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2644.0991	7.3800	195.1345	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.0451	7.3800	61.1835	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			323.6328	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2644.0991	0.2160	571.1254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0451	0.2160	179.0737	(264)
Space and water heating			750.1991	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			678.3336	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2644.0991	1.2200	3225.8008	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.0451	1.2200	1011.4350	(264)
Space and water heating			4237.2358	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3812.1353	(272)
Primary energy kWh/m2/year			48.1939	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.5000	87.1704	0.7200	0.7000	0.7650	15.1242
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						502.8945

	Jun	Jul	Aug	
Solar gains	541	503	441	(P3)
Internal gains	425	408	416	
Total summer gains	966	911	857	(P5)
Summer gain/loss ratio	1.62	1.52	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.07	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 379 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	9 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.75	**TER**	18.79
Environmental	89 B	**% DER<TER**	21.50		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.94	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.75	$kgCO_2/m^2$	Pass
	-4.04 (-21.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.94	$kWh/m^2/yr$	
	-4.5 (-8.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.42 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.50 m², No overhang 6.47 m², No overhang 4.75 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.42 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 380 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 380	**Prop Type Ref**	
Property	11 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.67	**TER**	19.65
Environmental	91 B	**% DER<TER**	30.42		
CO_2 Emissions (t/year)	0.62	**DFEE**	46.81	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.11		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached Maisonette, total floor area 62 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.65 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.67 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.10 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.98 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 5.10 m², No overhang
Windows facing West: 2.98 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.1000	
Infiltration rate		0.3436	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2920	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3723	0.3650	0.3577	0.3212	0.3139	0.2774	0.2774	0.2701	0.2920	0.3139	0.3285	0.3431	(22b)
Effective ac	0.5693	0.5666	0.5640	0.5516	0.5493	0.5385	0.5385	0.5365	0.5426	0.5493	0.5540	0.5589	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1198	26.9916	26.8659	26.2757	26.1652	25.6511	25.6511	25.5559	25.8491	26.1652	26.3886	26.6222	(38)
Heat transfer coeff	78.4948	78.3666	78.2409	77.6506	77.5402	77.0261	77.0261	76.9309	77.2241	77.5402	77.7636	77.9972	(39)
Average = Sum(39)m / 12 =												77.6501	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2561	1.2541	1.2521	1.2426	1.2408	1.2326	1.2326	1.2311	1.2358	1.2408	1.2444	1.2482	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134	(64)
Heat gains from water heating, kWh/month													
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	316.5595	314.6858	303.3269	285.0916	266.7454	248.9284	237.2666	242.6107	251.9013	270.3259	291.4855	307.1939	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	436.2185	521.7427	594.5501	658.1117	694.8856	678.3036	649.4433	613.1429	571.4434	501.3677	435.4144	409.1969	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2850	55.3754	55.4644	55.8860	55.9656	56.3392	56.3392	56.4089	56.1947	55.9656	55.8048	55.6377	
alpha	4.6857	4.6917	4.6976	4.7257	4.7310	4.7559	4.7559	4.7606	4.7463	4.7310	4.7203	4.7092	
util living area													
	0.9961	0.9906	0.9765	0.9360	0.8404	0.6750	0.5103	0.5585	0.7959	0.9573	0.9918	0.9971	(86)
MIT	19.7079	19.9014	20.1827	20.5217	20.7973	20.9480	20.9889	20.9831	20.8845	20.5173	20.0410	19.6677	(87)
Th 2	19.8754	19.8770	19.8786	19.8861	19.8875	19.8940	19.8940	19.8952	19.8915	19.8875	19.8846	19.8817	(88)
util rest of house													
	0.9948	0.9875	0.9684	0.9133	0.7863	0.5787	0.3879	0.4336	0.7123	0.9374	0.9885	0.9962	(89)
MIT 2	18.1724	18.4545	18.8608	19.3406	19.6958	19.8609	19.8901	19.8887	19.8043	19.3457	18.6646	18.1181	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	18.8022	19.0479	19.4030	19.8250	20.1476	20.3068	20.3408	20.3376	20.2474	19.8262	19.2291	18.7537	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8022	19.0479	19.4030	19.8250	20.1476	20.3068	20.3408	20.3376	20.2474	19.8262	19.2291	18.7537	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9844	0.9641	0.9119	0.8003	0.6165	0.4384	0.4852	0.7418	0.9360	0.9858	0.9947	(94)
Useful gains	433.1999	513.5893	573.1825	600.1026	556.0966	418.1484	284.7453	297.4852	423.8845	469.2825	429.2399	407.0473	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1138.3456	1108.7256	1009.5417	848.3338	655.0279	439.5689	288.1371	302.9192	474.7246	715.4049	943.2052	1135.1451	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	524.6283	399.9316	324.6513	178.7264	73.6049	0.0000	0.0000	0.0000	0.0000	183.1150	370.0550	541.7048	(98)
Space heating												2596.4174	(98)
Space heating per m2											(98) / (4) =	41.5493	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2782.8696	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	524.6283	399.9316	324.6513	178.7264	73.6049	0.0000	0.0000	0.0000	0.0000	183.1150	370.0550	541.7048	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	562.3026	428.6512	347.9649	191.5610	78.8906	0.0000	0.0000	0.0000	0.0000	196.2648	396.6292	580.6053	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4865	89.3951	89.2187	88.8349	88.0791	86.7000	86.7000	86.7000	86.7000	88.8236	89.3248	89.5246	(217)
Fuel for water heating, kWh/month													
	164.3198	144.2221	149.9872	132.5642	129.2171	114.6651	107.6272	121.5494	122.4208	137.6081	147.7780	159.4736	(219)
Water heating fuel used												1631.4325	(219)
Annual totals kWh/year													
Space heating fuel - main system												2782.8696	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4222.7233	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2782.8696	0.2160	601.0998	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1631.4325	0.2160	352.3894	(264)
Space and water heating			953.4893	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			854.0599	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6700	ZC1
Total Floor Area	TFA	62.4900	
Assumed number of occupants	N	2.0511	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9913	ZC2
CO2 emissions from cooking, equation (L16)		2.6920	ZC3
Total CO2 emissions		33.3533	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3533	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3886	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3303	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4211	0.4128	0.4046	0.3633	0.3550	0.3138	0.3138	0.3055	0.3303	0.3550	0.3716	0.3881	(22b)
Effective ac	0.5887	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7700	1.3258	15.6042			(27)
Ground floor			62.4900	0.1300	8.1237			(28a)
External Wall	72.5500	13.8900	58.6600	0.1800	10.5588			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.8307			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0066	(36)
Total fabric heat loss					(33) + (36) =		47.8373	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0414	27.8774	27.7167	26.9616	26.8204	26.1628	26.1628	26.0410	26.4161	26.8204	27.1062	27.4049	(38)
Heat transfer coeff	75.8787	75.7147	75.5540	74.7989	74.6576	74.0000	74.0000	73.8782	74.2533	74.6576	74.9434	75.2422	(39)
Average = Sum(39)m / 12 =												74.7982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2143	1.2116	1.2091	1.1970	1.1947	1.1842	1.1842	1.1822	1.1882	1.1947	1.1993	1.2041	(40)
HLP (average)												1.1970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	46.4769	40.4526	43.0968	40.0710	39.7166	36.7999	38.0266	39.7166	40.0710	43.0968	43.3421	46.4769	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(64)
								Total per year (kWh/year) = Sum(64)m =				1801.8945	(64)
Heat gains from water heating, kWh/month													
	56.5912	49.4459	51.3621	45.4032	43.8824	38.4990	36.6565	41.0840	41.5447	47.5158	50.9419	55.1722	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	76.0634	73.5802	69.0350	63.0601	58.9817	53.4709	49.2695	55.2205	57.7010	63.8654	70.7526	74.1561	(72)
Total internal gains													
	328.2150	325.7793	313.8608	295.0674	276.1602	257.7835	246.1267	252.0301	261.8840	280.8667	302.5828	318.8522	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.6300	0.7000	0.7700	9.6841	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.1000	46.7521	0.6300	0.7000	0.7700	72.8690	(78)
West	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(80)

Solar gains	104.7017	181.1748	254.8203	326.3926	374.6227	375.7033	360.6546	324.2157	279.5993	202.1615	125.9379	89.2526	(83)
Total gains	432.9166	506.9540	568.6811	621.4600	650.7829	633.4868	606.7813	576.2458	541.4833	483.0283	428.5207	408.1047	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1911	57.3149	57.4369	58.0167	58.1264	58.6430	58.6430	58.7397	58.4429	58.1264	57.9048	57.6749	
alpha	4.8127	4.8210	4.8291	4.8678	4.8751	4.9095	4.9095	4.9160	4.8962	4.8751	4.8603	4.8450	
util living area													
	0.9962	0.9914	0.9793	0.9435	0.8555	0.6925	0.5246	0.5709	0.8066	0.9602	0.9921	0.9972	(86)
MIT	19.7583	19.9353	20.1991	20.5251	20.7949	20.9478	20.9891	20.9838	20.8872	20.5339	20.0816	19.7244	(87)
Th 2	19.9086	19.9107	19.9128	19.9224	19.9242	19.9327	19.9327	19.9342	19.9294	19.9242	19.9206	19.9167	(88)
util rest of house													
	0.9950	0.9886	0.9721	0.9232	0.8048	0.5984	0.4035	0.4480	0.7263	0.9416	0.9890	0.9962	(89)
MIT 2	18.2689	18.5277	18.9097	19.3752	19.7271	19.8987	19.9288	19.9278	19.8429	19.3974	18.7490	18.2253	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	18.8798	19.1050	19.4385	19.8468	20.1651	20.3290	20.3637	20.3609	20.2712	19.8635	19.2955	18.8401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8798	19.1050	19.4385	19.8468	20.1651	20.3290	20.3637	20.3609	20.2712	19.8635	19.2955	18.8401	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9857	0.9681	0.9215	0.8174	0.6352	0.4535	0.4987	0.7545	0.9403	0.9865	0.9949	(94)
Useful gains	430.0218	499.7292	550.5251	572.6600	531.9514	402.4217	275.1854	287.3800	408.5576	454.2114	422.7200	406.0069	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1106.2953	1075.5274	977.5584	818.8077	631.9831	423.9476	278.5126	292.6236	458.2333	691.5943	913.9758	1101.5549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	503.1475	386.9364	317.7128	177.2263	74.4236	0.0000	0.0000	0.0000	0.0000	176.6129	353.7042	517.4877	(98)
Space heating												2507.2513	(98)
Space heating per m2											(98) / (4) =	40.1224	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2684.4232	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	503.1475	386.9364	317.7128	177.2263	74.4236	0.0000	0.0000	0.0000	0.0000	176.6129	353.7042	517.4877	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	538.7018	414.2788	340.1636	189.7498	79.6827	0.0000	0.0000	0.0000	0.0000	189.0930	378.6983	554.0553	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4803	87.2090	86.6713	85.5316	83.5110	80.3000	80.3000	80.3000	80.3000	85.4034	86.9366	87.5868	(217)
Fuel for water heating, kWh/month													
	207.7391	182.0302	190.5656	171.2741	169.8358	155.5633	149.0415	166.1464	167.9813	179.8500	188.6004	202.6140	(219)
Water heating fuel used												2131.2418	(219)
Annual totals kWh/year													
Space heating fuel - main system												2684.4232	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Total delivered energy for all uses												5176.8496	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2684.4232	0.2160	579.8354	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2131.2418	0.2160	460.3482	(264)
Space and water heating			1040.1836	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Total CO2, kg/m2/year			1227.6384	(272)
Emissions per m2 for space and water heating			16.6456	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3769	(272b)
Emissions per m2 for pumps and fans			0.6229	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6456 * 1.00) + 2.3769 + 0.6229, rounded to 2 d.p.			19.6500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.1000	
Infiltration rate		0.3436	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2920	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3723	0.3650	0.3577	0.3212	0.3139	0.2774	0.2774	0.2701	0.2920	0.3139	0.3285	0.3431	(22b)
Effective ac	0.5693	0.5666	0.5640	0.5516	0.5493	0.5385	0.5385	0.5365	0.5426	0.5493	0.5540	0.5589	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1198	26.9916	26.8659	26.2757	26.1652	25.6511	25.6511	25.5559	25.8491	26.1652	26.3886	26.6222	(38)
Heat transfer coeff	78.4948	78.3666	78.2409	77.6506	77.5402	77.0261	77.0261	76.9309	77.2241	77.5402	77.7636	77.9972	(39)
Average = Sum(39)m / 12 =												77.6501	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2561	1.2541	1.2521	1.2426	1.2408	1.2326	1.2326	1.2311	1.2358	1.2408	1.2444	1.2482	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	28.7415	25.1375	25.9396	22.6148	21.6994	18.7250	17.3514	19.9110	20.1488	23.4815	25.6319	27.8346 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	38.6310	37.4070	34.8651	31.4094	29.1659	26.0069	23.3218	26.7621	27.9845	31.5612	35.5999	37.4121	(72)
Total internal gains													
	287.7826	286.6060	276.6908	260.4168	243.3444	227.3195	217.1789	220.5718	229.1674	245.5625	264.4300	279.1081	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	407.4416	493.6629	567.9140	633.4369	671.4846	656.6947	629.3556	591.1040	548.7095	476.6043	408.3590	381.1111	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2850	55.3754	55.4644	55.8860	55.9656	56.3392	56.3392	56.4089	56.1947	55.9656	55.8048	55.6377	
alpha	4.6857	4.6917	4.6976	4.7257	4.7310	4.7559	4.7559	4.7606	4.7463	4.7310	4.7203	4.7092	
util living area	0.9971	0.9925	0.9803	0.9435	0.8536	0.6915	0.5250	0.5766	0.8136	0.9643	0.9937	0.9979	(86)
MIT	19.6663	19.8617	20.1475	20.4947	20.7813	20.9424	20.9874	20.9807	20.8722	20.4872	20.0025	19.6268	(87)
Th 2	19.8754	19.8770	19.8786	19.8861	19.8875	19.8940	19.8940	19.8952	19.8915	19.8875	19.8846	19.8817	(88)
util rest of house	0.9961	0.9900	0.9733	0.9229	0.8016	0.5949	0.3999	0.4490	0.7325	0.9471	0.9911	0.9972	(89)
MIT 2	18.6712	18.8667	19.1497	19.4893	19.7446	19.8686	19.8910	19.8900	19.8244	19.4901	19.0137	18.6368	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.0793	19.2748	19.5589	19.9016	20.1698	20.3090	20.3407	20.3374	20.2541	19.8991	19.4193	19.0429	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0793	19.2748	19.5589	19.9016	20.1698	20.3090	20.3407	20.3374	20.2541	19.8991	19.4193	19.0429	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9882	0.9708	0.9233	0.8162	0.6332	0.4517	0.5019	0.7619	0.9473	0.9897	0.9964	(94)
Useful gains	405.4738	487.8293	551.3475	584.8273	548.0853	415.7914	284.2868	296.6483	418.0347	451.4740	404.1416	379.7433	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1160.0991	1126.5035	1021.7435	854.2844	656.7503	439.7451	288.1316	302.9057	475.2468	721.0505	957.9905	1157.7010	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	561.4412	429.1891	349.9746	194.0091	80.8467	0.0000	0.0000	0.0000	0.0000	200.5649	398.7712	578.8006	(98)
Space heating												2793.5974	(98)
Space heating per m2											(98) / (4) =	44.7047	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	724.0450	569.9929	584.6745	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8831	0.9360	0.9175	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	639.3992	533.4939	536.4212	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	844.1059	810.6448	767.1643	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	147.3889	206.2002	171.6729	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												525.2620	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   36.8472   51.5501   42.9182    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          131.3155 (107)
Space cooling per m2                                                                                                     2.1014 (108)
Energy for space heating                                                                                                44.7047 (99)
Energy for space cooling                                                                                                 2.1014 (108)
Total                                                                                                                   46.8061 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   46.8 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3886	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3303	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4211	0.4128	0.4046	0.3633	0.3550	0.3138	0.3138	0.3055	0.3303	0.3550	0.3716	0.3881	(22b)
Effective ac	0.5887	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7700	1.3258	15.6042			(27)
Ground floor			62.4900	0.1300	8.1237			(28a)
External Wall	72.5500	13.8900	58.6600	0.1800	10.5588			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8307			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0066	(36)
Total fabric heat loss					(33) + (36) =		47.8373	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0414	27.8774	27.7167	26.9616	26.8204	26.1628	26.1628	26.0410	26.4161	26.8204	27.1062	27.4049	(38)
Heat transfer coeff	75.8787	75.7147	75.5540	74.7989	74.6576	74.0000	74.0000	73.8782	74.2533	74.6576	74.9434	75.2422	(39)
Average = Sum(39)m / 12 =												74.7982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2143	1.2116	1.2091	1.1970	1.1947	1.1842	1.1842	1.1822	1.1882	1.1947	1.1993	1.2041	(40)
HLP (average)												1.1970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	28.7415	25.1375	25.9396	22.6148	21.6994	18.7250	17.3514	19.9110	20.1488	23.4815	25.6319	27.8346 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	38.6310	37.4070	34.8651	31.4094	29.1659	26.0069	23.3218	26.7621	27.9845	31.5612	35.5999	37.4121	(72)
Total internal gains													
	287.7826	286.6060	276.6908	260.4168	243.3444	227.3195	217.1789	220.5718	229.1674	245.5625	264.4300	279.1081	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.6300	0.7000	0.7700	9.6841	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.1000	46.7521	0.6300	0.7000	0.7700	72.8690	(78)
West	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(80)

Solar gains	104.7017	181.1748	254.8203	326.3926	374.6227	375.7033	360.6546	324.2157	279.5993	202.1615	125.9379	89.2526	(83)
Total gains	392.4842	467.7808	531.5111	586.8094	617.9671	603.0228	577.8335	544.7875	508.7668	447.7240	390.3679	368.3607	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1911	57.3149	57.4369	58.0167	58.1264	58.6430	58.6430	58.7397	58.4429	58.1264	57.9048	57.6749	
alpha	4.8127	4.8210	4.8291	4.8678	4.8751	4.9095	4.9095	4.9160	4.8962	4.8751	4.8603	4.8450	
util living area													
	0.9975	0.9939	0.9841	0.9537	0.8743	0.7177	0.5483	0.5992	0.8333	0.9699	0.9947	0.9982	(86)
MIT	19.6992	19.8793	20.1488	20.4853	20.7703	20.9390	20.9869	20.9800	20.8681	20.4899	20.0267	19.6660	(87)
Th 2	19.9086	19.9107	19.9128	19.9224	19.9242	19.9327	19.9327	19.9342	19.9294	19.9242	19.9206	19.9167	(88)
util rest of house													
	0.9967	0.9918	0.9784	0.9363	0.8271	0.6237	0.4230	0.4725	0.7571	0.9551	0.9925	0.9976	(89)
MIT 2	18.7304	18.9111	19.1792	19.5125	19.7709	19.9050	19.9294	19.9287	19.8583	19.5240	19.0665	18.7037	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.1277	19.3082	19.5769	19.9115	20.1808	20.3291	20.3631	20.3599	20.2724	19.9201	19.4603	19.0984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1277	19.3082	19.5769	19.9115	20.1808	20.3291	20.3631	20.3599	20.2724	19.9201	19.4603	19.0984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9903	0.9762	0.9361	0.8397	0.6608	0.4749	0.5250	0.7843	0.9551	0.9913	0.9969	(94)
Useful gains	390.8727	463.2405	518.8691	549.2836	518.9097	398.4501	274.4104	286.0113	399.0388	427.6113	386.9594	367.2330	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1125.1084	1090.9121	988.0099	823.6481	633.1566	423.9534	278.4711	292.5493	458.3247	695.8200	926.3259	1120.9860	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.2714	421.7953	349.0408	197.5424	84.9997	0.0000	0.0000	0.0000	0.0000	199.5473	388.3439	560.7923	(98)
Space heating												2748.3329	(98)
Space heating per m2											(98) / (4) =	43.9804	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	695.6002	547.6002	561.4746	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8752	0.9319	0.9132	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	608.7885	510.2954	512.7581	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	781.3726	750.4242	713.0281	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.2605	178.6558	149.0009	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												451.9172	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0651   44.6640   37.2502    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          112.9793 (107)
Space cooling per m2                                                                                                     1.8080 (108)
Energy for space heating                                                                                                43.9804 (99)
Energy for space cooling                                                                                                 1.8080 (108)
Total                                                                                                                   45.7883 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   52.7 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.1000	
Infiltration rate		0.3436	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2920	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3066	0.2847	0.2920	0.2774	0.2774	0.2701	0.2628	0.2555	0.2482	0.2701	0.2555	0.2701	(22b)
Effective ac	0.5470	0.5405	0.5426	0.5385	0.5385	0.5365	0.5345	0.5326	0.5308	0.5365	0.5326	0.5365	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0573	25.7488	25.8491	25.6511	25.6511	25.5559	25.4632	25.3731	25.2855	25.5559	25.3731	25.5559	(38)
Heat transfer coeff	77.4323	77.1238	77.2241	77.0261	77.0261	76.9309	76.8382	76.7481	76.6605	76.9309	76.7481	76.9309	(39)
Average = Sum(39)m / 12 =												76.9683	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2391	1.2342	1.2358	1.2326	1.2326	1.2311	1.2296	1.2282	1.2268	1.2311	1.2282	1.2311	(40)
HLP (average)												1.2317	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0511	(42)
Average daily hot water use (litres/day)	82.9134	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134 (64)
RHI water heating demand												1443 (64)
Heat gains from water heating, kWh/month												
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	13.4839	0.7200	0.7000	0.7700	14.0344	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.1000	56.7559	0.7200	0.7000	0.7700	101.0985	(78)
West	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(80)

Solar gains	147.6014	217.5441	309.4360	401.2451	440.1455	480.6652	457.3163	419.3601	359.3924	262.1262	176.9821	123.6808	(83)
Total gains	613.3344	679.6014	753.7948	818.1903	829.1866	844.5129	806.2838	775.4738	731.1362	661.4729	607.0462	576.8298	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0436	56.2677	56.1947	56.3392	56.3392	56.4089	56.4769	56.5432	56.6078	56.4089	56.5432	56.4089	
alpha	4.7362	4.7512	4.7463	4.7559	4.7559	4.7606	4.7651	4.7695	4.7739	4.7606	4.7695	4.7606	
util living area	0.9820	0.9707	0.9375	0.8574	0.7169	0.5080	0.3696	0.3834	0.6265	0.8686	0.9622	0.9854	(86)
MIT	20.0471	20.1842	20.4458	20.7271	20.9108	20.9859	20.9975	20.9971	20.9631	20.7571	20.3757	20.0189	(87)
Th 2	19.8888	19.8928	19.8915	19.8940	19.8940	19.8952	19.8964	19.8975	19.8986	19.8952	19.8975	19.8952	(88)
util rest of house	0.9764	0.9618	0.9187	0.8172	0.6461	0.4147	0.2661	0.2764	0.5310	0.8214	0.9486	0.9807	(89)
MIT 2	18.6720	18.8700	19.2347	19.6077	19.8208	19.8881	19.8958	19.8968	19.8763	19.6561	19.1490	18.6367	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.2360	19.4090	19.7315	20.0668	20.2678	20.3384	20.3476	20.3481	20.3220	20.1077	19.6521	19.2036	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2360	19.4090	19.7315	20.0668	20.2678	20.3384	20.3476	20.3481	20.3220	20.1077	19.6521	19.2036	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9721	0.9570	0.9155	0.8241	0.6713	0.4528	0.3087	0.3205	0.5691	0.8316	0.9449	0.9769	(94)
Useful gains	596.2397	650.3930	690.1230	674.2694	556.6680	382.4000	248.8969	248.5281	416.0895	550.0746	573.6128	563.4838	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1110.0694	1088.1390	983.1764	813.9218	598.3256	387.6050	249.5422	249.2834	430.9855	669.8912	901.9525	1092.6922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	382.2893	294.1653	218.0317	100.5497	30.9933	0.0000	0.0000	0.0000	0.0000	89.1436	236.4046	393.7310	(98)
Space heating												1745.3086	(98)
RHI space heating demand												1745	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.1000	
Infiltration rate		0.3436	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2920	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3723	0.3650	0.3577	0.3212	0.3139	0.2774	0.2774	0.2701	0.2920	0.3139	0.3285	0.3431	(22b)
Effective ac	0.5693	0.5666	0.5640	0.5516	0.5493	0.5385	0.5385	0.5365	0.5426	0.5493	0.5540	0.5589	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1198	26.9916	26.8659	26.2757	26.1652	25.6511	25.6511	25.5559	25.8491	26.1652	26.3886	26.6222	(38)
Heat transfer coeff	78.4948	78.3666	78.2409	77.6506	77.5402	77.0261	77.0261	76.9309	77.2241	77.5402	77.7636	77.9972	(39)
Average = Sum(39)m / 12 =												77.6501	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2561	1.2541	1.2521	1.2426	1.2408	1.2326	1.2326	1.2311	1.2358	1.2408	1.2444	1.2482	(40)
HLP (average)												1.2426	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134	(64)
Heat gains from water heating, kWh/month													
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	585.3920	669.1142	735.5820	789.9653	817.1813	793.2229	761.1442	726.6458	691.2858	630.3885	573.9932	555.1520	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2850	55.3754	55.4644	55.8860	55.9656	56.3392	56.3392	56.4089	56.1947	55.9656	55.8048	55.6377	
alpha	4.6857	4.6917	4.6976	4.7257	4.7310	4.7559	4.7559	4.7606	4.7463	4.7310	4.7203	4.7092	
util living area													
	0.9872	0.9754	0.9498	0.8886	0.7702	0.5953	0.4400	0.4787	0.7046	0.9100	0.9757	0.9898	(86)
MIT	19.9193	20.1017	20.3570	20.6488	20.8644	20.9692	20.9940	20.9911	20.9323	20.6558	20.2304	19.8766	(87)
Th 2	19.8754	19.8770	19.8786	19.8861	19.8875	19.8940	19.8940	19.8952	19.8915	19.8875	19.8846	19.8817	(88)
util rest of house													
	0.9832	0.9679	0.9346	0.8555	0.7082	0.5033	0.3321	0.3680	0.6155	0.8756	0.9670	0.9866	(89)
MIT 2	18.4781	18.7406	19.1021	19.5023	19.7660	19.8754	19.8920	19.8920	19.8443	19.5233	18.9343	18.4211	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.0692	19.2988	19.6168	19.9725	20.2165	20.3241	20.3440	20.3428	20.2905	19.9878	19.4659	19.0181	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0692	19.2988	19.6168	19.9725	20.2165	20.3241	20.3440	20.3428	20.2905	19.9878	19.4659	19.0181	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9794	0.9631	0.9303	0.8584	0.7278	0.5402	0.3765	0.4136	0.6494	0.8792	0.9628	0.9833	(94)
Useful gains	573.3518	644.3932	684.3035	678.0877	594.7809	428.4882	286.6062	300.5423	448.9522	554.2308	552.6224	545.8812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1159.3081	1128.3860	1026.2678	859.7895	660.3715	440.9020	288.3852	303.3209	478.0586	727.9312	961.6174	1155.7664	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	435.9514	325.2432	254.4214	130.8253	48.7994	0.0000	0.0000	0.0000	0.0000	129.2331	294.4764	453.7545	(98)
Space heating												2072.7048	(98)
Space heating per m2											(98) / (4) =	33.1686	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2221.5486	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	435.9514	325.2432	254.4214	130.8253	48.7994	0.0000	0.0000	0.0000	0.0000	129.2331	294.4764	453.7545	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	467.2577	348.5993	272.6918	140.2201	52.3038	0.0000	0.0000	0.0000	0.0000	138.5135	315.6231	486.3393	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3641	89.2480	89.0259	88.5580	87.7498	86.7000	86.7000	86.7000	86.7000	88.5135	89.1542	89.4115	(217)
Fuel for water heating, kWh/month													
	164.5449	144.4598	150.3121	132.9786	129.7019	114.6651	107.6272	121.5494	122.4208	138.0902	148.0608	159.6755	(219)
Water heating fuel used												1634.0863	(219)
Annual totals kWh/year													
Space heating fuel - main system												2221.5486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												3664.0560	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2221.5486	3.4800	77.3099	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1634.0863	3.4800	56.8662	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	286.1846	13.1900	37.7477	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			228.9068	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8944	(257)
SAP value		87.5229	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2221.5486	0.2160	479.8545	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1634.0863	0.2160	352.9626	(264)
Space and water heating			832.8171	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			733.3877	(272)
CO2 emissions per m2			11.7400	(273)
EI value			90.8574	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.1000	
Infiltration rate		0.3436	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2920	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3066	0.2847	0.2920	0.2774	0.2774	0.2701	0.2628	0.2555	0.2482	0.2701	0.2555	0.2701	(22b)
Effective ac	0.5470	0.5405	0.5426	0.5385	0.5385	0.5365	0.5345	0.5326	0.5308	0.5365	0.5326	0.5365	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0573	25.7488	25.8491	25.6511	25.6511	25.5559	25.4632	25.3731	25.2855	25.5559	25.3731	25.5559	(38)
Heat transfer coeff	77.4323	77.1238	77.2241	77.0261	77.0261	76.9309	76.8382	76.7481	76.6605	76.9309	76.7481	76.9309	(39)
Average = Sum(39)m / 12 =												76.9683	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2391	1.2342	1.2358	1.2326	1.2326	1.2311	1.2296	1.2282	1.2268	1.2311	1.2282	1.2311	(40)
HLP (average)												1.2317	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134	(64)
Heat gains from water heating, kWh/month													
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	13.4839	0.7200	0.7000	0.7700	14.0344	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.1000	56.7559	0.7200	0.7000	0.7700	101.0985	(78)
West	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(80)

Solar gains	147.6014	217.5441	309.4360	401.2451	440.1455	480.6652	457.3163	419.3601	359.3924	262.1262	176.9821	123.6808	(83)
Total gains	613.3344	679.6014	753.7948	818.1903	829.1866	844.5129	806.2838	775.4738	731.1362	661.4729	607.0462	576.8298	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0436	56.2677	56.1947	56.3392	56.3392	56.4089	56.4769	56.5432	56.6078	56.4089	56.5432	56.4089	
alpha	4.7362	4.7512	4.7463	4.7559	4.7559	4.7606	4.7651	4.7695	4.7739	4.7606	4.7695	4.7606	
util living area													
	0.9820	0.9707	0.9375	0.8574	0.7169	0.5080	0.3696	0.3834	0.6265	0.8686	0.9622	0.9854	(86)
MIT	20.0471	20.1842	20.4458	20.7271	20.9108	20.9859	20.9975	20.9971	20.9631	20.7571	20.3757	20.0189	(87)
Th 2	19.8888	19.8928	19.8915	19.8940	19.8940	19.8952	19.8964	19.8975	19.8986	19.8952	19.8975	19.8952	(88)
util rest of house													
	0.9764	0.9618	0.9187	0.8172	0.6461	0.4147	0.2661	0.2764	0.5310	0.8214	0.9486	0.9807	(89)
MIT 2	18.6720	18.8700	19.2347	19.6077	19.8208	19.8881	19.8958	19.8968	19.8763	19.6561	19.1490	18.6367	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.2360	19.4090	19.7315	20.0668	20.2678	20.3384	20.3476	20.3481	20.3220	20.1077	19.6521	19.2036	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2360	19.4090	19.7315	20.0668	20.2678	20.3384	20.3476	20.3481	20.3220	20.1077	19.6521	19.2036	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9721	0.9570	0.9155	0.8241	0.6713	0.4528	0.3087	0.3205	0.5691	0.8316	0.9449	0.9769	(94)
Useful gains	596.2397	650.3930	690.1230	674.2694	556.6680	382.4000	248.8969	248.5281	416.0895	550.0746	573.6128	563.4838	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1110.0694	1088.1390	983.1764	813.9218	598.3256	387.6050	249.5422	249.2834	430.9855	669.8912	901.9525	1092.6922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	382.2893	294.1653	218.0317	100.5497	30.9933	0.0000	0.0000	0.0000	0.0000	89.1436	236.4046	393.7310	(98)
Space heating												1745.3086	(98)
Space heating per m2											(98) / (4) =	27.9294	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1870.6416	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	382.2893	294.1653	218.0317	100.5497	30.9933	0.0000	0.0000	0.0000	0.0000	89.1436	236.4046	393.7310	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	409.7420	315.2897	233.6888	107.7703	33.2189	0.0000	0.0000	0.0000	0.0000	95.5451	253.3811	422.0054	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2703	89.1717	88.8961	88.3217	87.4462	86.7000	86.7000	86.7000	86.7000	88.1827	88.9762	89.3131	(217)
Fuel for water heating, kWh/month													
	164.7178	144.5834	150.5315	133.3344	130.1523	114.6651	107.6272	121.5494	122.4208	138.6083	148.3569	159.8513	(219)
Water heating fuel used												1636.3984	(219)
Annual totals kWh/year													
Space heating fuel - main system												1870.6416	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3241.7446	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1870.6416	7.3800	138.0533	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1636.3984	7.3800	120.7662	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	286.1846	28.6600	82.0205	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			289.7859	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1870.6416	0.2160	404.0586	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.3984	0.2160	353.4620	(264)
Space and water heating			757.5206	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			619.8324	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1870.6416	1.2200	2282.1827	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.3984	1.2200	1996.4060	(264)
Space and water heating			4278.5887	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	286.1846	3.0700	878.5867	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3464.1322	(272)
Primary energy kWh/m2/year			55.4350	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£104	£104	£0
Mains gas	£366	£366	£0
Space heating	£267	£267	£0
Water heating	£121	£121	£0
Lighting	£82	£82	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£290	£290	£0
Total cost of uses	£290	£290	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	285.82 (P1)
Transmission heat loss coefficient	51.37 (37)
Summer heat loss coefficient	337.19 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.9800	87.1704	0.7200	0.7000	0.7650	90.1405
East	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
South	5.1000	118.5567	0.7200	0.7000	0.7650	209.8122
West	2.9800	125.2818	0.7200	0.7000	0.7650	129.5504
total:						460.3691

	Jun	Jul	Aug	
Solar gains	492	460	421	(P3)
Internal gains	361	346	353	
Total summer gains	853	806	774	(P5)
Summer gain/loss ratio	2.53	2.39	2.29	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.18	19.94	19.84	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 380 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 380	**Prop Type Ref**	
Property	11 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.67	**TER**	19.65
Environmental	91 B	**% DER<TER**	30.42		
CO_2 Emissions (t/year)	0.62	**DFEE**	46.81	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.11		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.65	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.67	$kgCO_2/m^2$	Pass
	-5.98 (-30.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.66	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.81	$kWh/m^2/yr$	
	-5.9 (-11.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.10 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	2.98 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	5.10 m², No overhang
Windows facing West	2.98 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.10 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 381 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 381	**Prop Type Ref**	
Property	15 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	87 B	**DER**	13.70	**TER**	18.78
Environmental	90 B	**% DER<TER**	27.06		
CO_2 Emissions (t/year)	0.77	**DFEE**	48.11	**TFEE**	53.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached Maisonette, total floor area 76 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.78 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.01 m², No overhang
Windows facing East: 6.78 m², No overhang
Windows facing South: 4.40 m², No overhang
Windows facing West: 2.98 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3347	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2845	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3628	0.3556	0.3485	0.3130	0.3059	0.2703	0.2703	0.2632	0.2845	0.3059	0.3201	0.3343	(22b)
Effective ac	0.5658	0.5632	0.5607	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.7248	33.5725	33.4233	32.7221	32.5909	31.9803	31.9803	31.8672	32.2155	32.5909	32.8563	33.1338	(38)
Heat transfer coeff	95.7607	95.6084	95.4592	94.7580	94.6268	94.0162	94.0162	93.9031	94.2514	94.6268	94.8922	95.1697	(39)
Average = Sum(39)m / 12 =												94.7574	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2593	1.2573	1.2554	1.2462	1.2444	1.2364	1.2364	1.2349	1.2395	1.2444	1.2479	1.2516	(40)
HLP (average)												1.2462	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	361.7408	359.7185	346.7103	325.7258	304.4461	283.8895	270.4977	276.3212	287.0636	308.2555	332.6169	350.8640	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	508.0059	622.6252	736.5330	848.6449	918.9539	904.5812	864.6381	801.8558	723.6453	607.5634	510.4716	474.2286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1432	55.2311	55.3174	55.7267	55.8040	56.1665	56.1665	56.2341	56.0263	55.8040	55.6479	55.4857	
alpha	4.6762	4.6821	4.6878	4.7151	4.7203	4.7444	4.7444	4.7489	4.7351	4.7203	4.7099	4.6990	
util living area													
	0.9968	0.9914	0.9750	0.9234	0.8069	0.6296	0.4708	0.5251	0.7788	0.9581	0.9930	0.9977	(86)
MIT	19.6766	19.8830	20.1929	20.5595	20.8318	20.9608	20.9919	20.9868	20.8946	20.5119	20.0145	19.6349	(87)
Th 2	19.8728	19.8744	19.8760	19.8832	19.8846	19.8910	19.8910	19.8922	19.8885	19.8846	19.8819	19.8790	(88)
util rest of house													
	0.9957	0.9884	0.9664	0.8976	0.7481	0.5349	0.3561	0.4055	0.6932	0.9385	0.9901	0.9969	(89)
MIT 2	18.1250	18.4261	18.8731	19.3872	19.7299	19.8668	19.8883	19.8872	19.8103	19.3362	18.6245	18.0684	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	18.7423	19.0057	19.3981	19.8535	20.1682	20.3021	20.3273	20.3246	20.2417	19.8039	19.1775	18.6916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7423	19.0057	19.3981	19.8535	20.1682	20.3021	20.3273	20.3246	20.2417	19.8039	19.1775	18.6916	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9854	0.9618	0.8968	0.7643	0.5714	0.4020	0.4533	0.7229	0.9367	0.9876	0.9956	(94)
Useful gains	505.0233	613.5245	708.4063	761.0299	702.4017	516.8862	347.5430	363.5128	523.1250	569.0890	504.1332	472.1614	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1383.0015	1348.6256	1231.2427	1037.9339	801.3202	536.0851	350.4298	368.5347	578.8602	870.9329	1146.0570	1379.1566	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	653.2158	493.9879	388.9903	199.3709	73.5954	0.0000	0.0000	0.0000	0.0000	224.5719	462.1851	674.8044	(98)
Space heating												3170.7217	(98)
Space heating per m2											(98) / (4) =	41.6981	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3398.4155	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	653.2158	493.9879	388.9903	199.3709	73.5954	0.0000	0.0000	0.0000	0.0000	224.5719	462.1851	674.8044	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	700.1241	529.4619	416.9242	213.6879	78.8803	0.0000	0.0000	0.0000	0.0000	240.6987	495.3753	723.2630	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5684	89.4785	89.2908	88.8579	88.0097	86.7000	86.7000	86.7000	86.7000	88.9279	89.4202	89.6040	(217)
Fuel for water heating, kWh/month													
	178.6028	156.7218	162.9289	143.9722	140.4022	124.3722	116.6223	131.8729	132.8691	149.3199	160.5114	173.3046	(219)
Water heating fuel used												1771.5002	(219)
Annual totals kWh/year													
Space heating fuel - main system												3398.4155	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5024.9415	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3398.4155	0.2160	734.0578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1771.5002	0.2160	382.6441	(264)
Space and water heating			1116.7018	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1041.4602	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.7000	ZC1
Total Floor Area	TFA	76.0400	
Assumed number of occupants	N	2.3834	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4405	ZC2
CO2 emissions from cooking, equation (L16)		2.3172	ZC3
Total CO2 emissions		32.4578	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.4578	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4161	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4509	0.4421	0.4333	0.3890	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5564	0.5564	0.5535	0.5625	0.5723	0.5792	0.5863	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	90.5300	18.2900	72.2400	0.1800	13.0032			(29a)
Roof	70.5500		70.5500	0.1300	9.1715			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8699			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1406	(36)
Total fabric heat loss					(33) + (36) =		57.0105	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.8632	35.6279	35.3972	34.3138	34.1111	33.1674	33.1674	32.9927	33.5309	34.1111	34.5211	34.9499	(38)
Heat transfer coeff	92.8737	92.6384	92.4077	91.3243	91.1216	90.1779	90.1779	90.0032	90.5414	91.1216	91.5316	91.9604	(39)
Average = Sum(39)m / 12 =												91.3233	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2214	1.2183	1.2153	1.2010	1.1983	1.1859	1.1859	1.1836	1.1907	1.1983	1.2037	1.2094	(40)
HLP (average)												1.2010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9014	44.3036	47.1995	43.8857	43.4976	40.3032	41.6466	43.4976	43.8857	47.1995	47.4682	50.9014	(61)
Total heat required for water heating calculated for each month													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(64)
								Total per year (kWh/year) = Sum(64)m =				1973.4301	(64)
Heat gains from water heating, kWh/month													
	61.9785	54.1530	56.2516	49.7255	48.0599	42.1640	40.1461	44.9951	45.4997	52.0392	55.7914	60.4244	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	83.3044	80.5849	75.6070	69.0632	64.5966	58.5612	53.9598	60.4773	63.1940	69.9452	77.4881	81.2156	(72)
Total internal gains													
	374.8657	372.2284	358.6083	337.0136	315.1201	293.9515	280.5656	287.0008	298.3596	320.1618	345.1315	363.9922	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.6300	0.7000	0.7700	6.5319	(74)
East	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(76)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
West	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(80)

Solar gains	127.9819	230.0434	341.0948	457.5542	537.6943	543.1052	519.8729	459.8428	382.0090	261.8944	155.6229	107.9440	(83)
Total gains	502.8476	602.2718	699.7031	794.5678	852.8145	837.0567	800.4385	746.8436	680.3686	582.0562	500.7544	471.9362	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8574	57.0018	57.1441	57.8220	57.9507	58.5571	58.5571	58.6708	58.3220	57.9507	57.6910	57.4221	
alpha	4.7905	4.8001	4.8096	4.8548	4.8634	4.9038	4.9038	4.9114	4.8881	4.8634	4.8461	4.8281	
util living area													
	0.9969	0.9923	0.9785	0.9337	0.8268	0.6506	0.4876	0.5403	0.7929	0.9618	0.9934	0.9977	(86)
MIT	19.7202	19.9096	20.2002	20.5557	20.8258	20.9600	20.9920	20.9871	20.8955	20.5251	20.0523	19.6876	(87)
Th 2	19.9029	19.9054	19.9078	19.9192	19.9213	19.9313	19.9313	19.9331	19.9274	19.9213	19.9170	19.9125	(88)
util rest of house													
	0.9959	0.9897	0.9711	0.9108	0.7716	0.5576	0.3734	0.4221	0.7108	0.9438	0.9907	0.9970	(89)
MIT 2	18.2095	18.4867	18.9076	19.4126	19.7580	19.9061	19.9285	19.9281	19.8484	19.3833	18.7041	18.1687	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	18.8105	19.0527	19.4218	19.8674	20.1828	20.3254	20.3516	20.3494	20.2649	19.8375	19.2404	18.7729	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8105	19.0527	19.4218	19.8674	20.1828	20.3254	20.3516	20.3494	20.2649	19.8375	19.2404	18.7729	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9869	0.9668	0.9095	0.7863	0.5933	0.4191	0.4694	0.7391	0.9420	0.9883	0.9958	(94)
Useful gains	500.0353	594.4046	676.5047	722.6667	670.5478	496.6649	335.4305	350.5396	502.8355	548.3196	494.9198	469.9505	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1347.6400	1311.0875	1194.0738	1001.5858	772.9639	516.3009	338.3103	355.4596	558.1806	841.7397	1111.2313	1340.1321	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	630.6179	481.6109	385.0714	200.8218	76.1976	0.0000	0.0000	0.0000	0.0000	218.3046	443.7442	647.4151	(98)
Space heating												3083.7836	(98)
Space heating per m2											(98) / (4) =	40.5548	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3301.6955	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	630.6179	481.6109	385.0714	200.8218	76.1976	0.0000	0.0000	0.0000	0.0000	218.3046	443.7442	647.4151	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000		(210)
Space heating fuel (main heating system)													
	675.1798	515.6434	412.2820	215.0126	81.5820	0.0000	0.0000	0.0000	0.0000	233.7308	475.1009	693.1640	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7522	87.4815	86.9063	85.6175	83.3653	80.3000	80.3000	80.3000	80.3000	85.7083	87.2388	87.8488	(217)
Fuel for water heating, kWh/month													
	226.8106	198.7380	208.1424	187.3909	186.3289	170.3726	163.2299	181.9631	183.9727	196.2705	205.8391	221.2406	(219)
Water heating fuel used												2330.2992	(219)
Annual totals kWh/year													
Space heating fuel - main system												3301.6955	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Total delivered energy for all uses												6039.7838	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3301.6955	0.2160	713.1662	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2330.2992	0.2160	503.3446	(264)
Space and water heating			1216.5109	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Total CO2, kg/m2/year			1428.1534	(272)
Emissions per m2 for space and water heating			15.9983	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2714	(272b)
Emissions per m2 for pumps and fans			0.5119	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9983 * 1.00) + 2.2714 + 0.5119, rounded to 2 d.p.			18.7800	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1295	34.9227	34.7199	33.7676	33.5895	32.7601	32.7601	32.6065	33.0796	33.5895	33.9499	34.3267	(38)
Heat transfer coeff	97.1654	96.9586	96.7558	95.8035	95.6254	94.7960	94.7960	94.6424	95.1155	95.6254	95.9858	96.3626	(39)
Average = Sum(39)m / 12 =												95.8027	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2778	1.2751	1.2724	1.2599	1.2576	1.2467	1.2467	1.2446	1.2509	1.2576	1.2623	1.2673	(40)
HLP (average)												1.2599	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.4776	27.5305	28.4090	24.7677	23.7652	20.5075	19.0032	21.8065	22.0669	25.7169	28.0720	30.4844	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	42.3086	40.9680	38.1841	34.3995	31.9424	28.4827	25.5420	29.3098	30.6485	34.5657	38.9889	40.9736	(72)
Total internal gains													
	330.8698	329.6115	318.1855	299.3499	279.4660	260.8730	249.1477	252.8333	262.8141	281.7823	303.6323	320.7502	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	477.1349	592.5183	708.0081	822.2690	893.9738	881.5647	843.2881	778.3679	699.3958	581.0902	481.4870	444.1148	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3460	54.4620	54.5761	55.1186	55.2213	55.7044	55.7044	55.7948	55.5173	55.2213	55.0139	54.7988	
alpha	4.6231	4.6308	4.6384	4.6746	4.6814	4.7136	4.7136	4.7197	4.7012	4.6814	4.6676	4.6533	
util living area													
	0.9975	0.9930	0.9788	0.9319	0.8218	0.6464	0.4854	0.5428	0.7974	0.9647	0.9945	0.9982	(86)
MIT	19.6159	19.8254	20.1423	20.5242	20.8127	20.9553	20.9906	20.9844	20.8804	20.4744	19.9647	19.5784	(87)
Th 2	19.8582	19.8604	19.8625	19.8724	19.8742	19.8829	19.8829	19.8845	19.8795	19.8742	19.8705	19.8666	(88)
util rest of house													
	0.9967	0.9906	0.9713	0.9081	0.7646	0.5503	0.3669	0.4194	0.7134	0.9476	0.9922	0.9976	(89)
MIT 2	18.6076	18.8175	19.1313	19.5037	19.7553	19.8638	19.8807	19.8804	19.8179	19.4670	18.9651	18.5768	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.0087	19.2185	19.5335	19.9097	20.1760	20.2980	20.3222	20.3196	20.2406	19.8677	19.3628	18.9752	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0087	19.2185	19.5335	19.9097	20.1760	20.2980	20.3222	20.3196	20.2406	19.8677	19.3628	18.9752	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9888	0.9686	0.9090	0.7814	0.5876	0.4144	0.4689	0.7432	0.9475	0.9908	0.9970	(94)
Useful gains	475.1374	585.8772	685.8101	747.4700	698.5070	518.0168	349.4493	364.9990	519.7685	550.5784	477.0727	442.7614	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1429.1806	1388.2999	1261.0671	1054.7667	810.5169	540.1501	352.8505	370.9616	584.0658	886.2306	1177.0515	1423.7812	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.8081	539.2281	427.9912	221.2536	83.3354	0.0000	0.0000	0.0000	0.0000	249.7252	503.9847	729.8787	(98)
Space heating												3465.2051	(98)
Space heating per m2											(98) / (4) =	45.5708	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	891.0822	701.4903	719.2822	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9044	0.9487	0.9297	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	805.8573	665.5012	668.6976	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1119.0332	1072.4749	998.0540	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	225.4866	302.7884	245.0412	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												773.3162 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	56.3717	75.6971	61.2603	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												193.3291 (107)
Space cooling per m2												2.5425 (108)
Energy for space heating												45.5708 (99)
Energy for space cooling												2.5425 (108)
Total												48.1133 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4161	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4509	0.4421	0.4333	0.3890	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5564	0.5564	0.5535	0.5625	0.5723	0.5792	0.5863	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	90.5300	18.2900	72.2400	0.1800	13.0032			(29a)
Roof	70.5500		70.5500	0.1300	9.1715			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.8699			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1406	(36)
Total fabric heat loss					(33) + (36) =		57.0105	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.8632	35.6279	35.3972	34.3138	34.1111	33.1674	33.1674	32.9927	33.5309	34.1111	34.5211	34.9499	(38)
Heat transfer coeff	92.8737	92.6384	92.4077	91.3243	91.1216	90.1779	90.1779	90.0032	90.5414	91.1216	91.5316	91.9604	(39)
Average = Sum(39)m / 12 =												91.3233	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2214	1.2183	1.2153	1.2010	1.1983	1.1859	1.1859	1.1836	1.1907	1.1983	1.2037	1.2094	(40)
HLP (average)												1.2010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.4776	27.5305	28.4090	24.7677	23.7652	20.5075	19.0032	21.8065	22.0669	25.7169	28.0720	30.4844	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	42.3086	40.9680	38.1841	34.3995	31.9424	28.4827	25.5420	29.3098	30.6485	34.5657	38.9889	40.9736	(72)
Total internal gains													
	330.8698	329.6115	318.1855	299.3499	279.4660	260.8730	249.1477	252.8333	262.8141	281.7823	303.6323	320.7502	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.6300	0.7000	0.7700	6.5319	(74)
East	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(76)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
West	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(80)

Solar gains	127.9819	230.0434	341.0948	457.5542	537.6943	543.1052	519.8729	459.8428	382.0090	261.8944	155.6229	107.9440	(83)
Total gains	458.8517	559.6549	659.2803	756.9041	817.1603	803.9782	769.0206	712.6761	644.8231	543.6767	459.2552	428.6942	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8574	57.0018	57.1441	57.8220	57.9507	58.5571	58.5571	58.6708	58.3220	57.9507	57.6910	57.4221	
alpha	4.7905	4.8001	4.8096	4.8548	4.8634	4.9038	4.9038	4.9114	4.8881	4.8634	4.8461	4.8281	
util living area													
	0.9979	0.9943	0.9830	0.9437	0.8442	0.6714	0.5060	0.5633	0.8168	0.9703	0.9954	0.9985	(86)
MIT	19.6673	19.8594	20.1555	20.5218	20.8070	20.9542	20.9906	20.9846	20.8798	20.4856	20.0030	19.6353	(87)
Th 2	19.9029	19.9054	19.9078	19.9192	19.9213	19.9313	19.9313	19.9331	19.9274	19.9213	19.9170	19.9125	(88)
util rest of house													
	0.9972	0.9924	0.9769	0.9234	0.7915	0.5777	0.3883	0.4415	0.7378	0.9557	0.9935	0.9980	(89)
MIT 2	18.6940	18.8872	19.1817	19.5430	19.7960	19.9113	19.9290	19.9290	19.8638	19.5175	19.0402	18.6698	(90)
Living area fraction										fLA = Living area / (4) =		0.3978	(91)
MIT	19.0812	19.2739	19.5691	19.9324	20.1982	20.3262	20.3514	20.3489	20.2680	19.9027	19.4232	19.0539	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0812	19.2739	19.5691	19.9324	20.1982	20.3262	20.3514	20.3489	20.2680	19.9027	19.4232	19.0539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9909	0.9745	0.9236	0.8064	0.6140	0.4355	0.4904	0.7655	0.9553	0.9923	0.9974	(94)
Useful gains	457.2455	554.5616	642.4943	699.1103	658.9580	493.6408	334.8847	349.4724	493.6151	519.3956	455.7384	427.6000	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1372.7853	1331.5770	1207.6832	1007.5246	774.3715	516.3734	338.2890	355.4152	558.4570	847.6726	1127.9625	1365.9675	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	681.1616	522.1544	420.5005	222.0583	85.8676	0.0000	0.0000	0.0000	0.0000	244.2381	484.0014	698.1455	(98)
Space heating												3358.1274	(98)
Space heating per m2											(98) / (4) =	44.1626	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	847.6724	667.3165	684.0240	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8999	0.9470	0.9279	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.8068	631.9531	634.7362	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1028.3477	985.6687	921.2713	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	191.1895	263.1644	213.1822	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												667.5361 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	47.7974	65.7911	53.2955	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												166.8840 (107)
Space cooling per m2												2.1947 (108)
Energy for space heating												44.1626 (99)
Energy for space cooling												2.1947 (108)
Total												46.3573 (109)
Target Fabric Energy Efficiency (TFEE)												53.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3347	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2845	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2987	0.2774	0.2845	0.2703	0.2703	0.2632	0.2561	0.2490	0.2418	0.2632	0.2490	0.2632	(22b)
Effective ac	0.5446	0.5385	0.5405	0.5365	0.5365	0.5346	0.5328	0.5310	0.5292	0.5346	0.5310	0.5346	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4628	32.0964	32.2155	31.9803	31.9803	31.8672	31.7571	31.6500	31.5460	31.8672	31.6500	31.8672	(38)
Heat transfer coeff	94.4987	94.1323	94.2514	94.0162	94.0162	93.9031	93.7930	93.6859	93.5819	93.9031	93.6859	93.9031	(39)
Average = Sum(39)m / 12 =												93.9475	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2379	1.2395	1.2364	1.2364	1.2349	1.2335	1.2321	1.2307	1.2349	1.2321	1.2349	(40)
HLP (average)												1.2355	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3834	(42)
Average daily hot water use (litres/day)	90.8065	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)										Total = Sum(45)m =		1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
RHI water heating demand												1567	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	13.4839	0.7200	0.7000	0.7700	9.4662	(74)
East	6.7800	25.1925	0.7200	0.7000	0.7700	59.6576	(76)
South	4.4000	56.7559	0.7200	0.7000	0.7700	87.2222	(78)
West	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(80)

Solar gains	182.5671	279.6277	418.8427	566.8584	634.5591	696.9477	661.6109	598.5540	495.9601	343.7098	221.3467	151.3226	(83)
Total gains	717.0835	810.0397	928.8410	1045.1277	1080.3440	1113.5137	1060.9859	1005.8347	921.3886	801.0748	714.2777	671.1631	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8797	56.0972	56.0263	56.1665	56.1665	56.2341	56.3001	56.3644	56.4271	56.2341	56.3644	56.2341	
alpha	4.7253	4.7398	4.7351	4.7444	4.7444	4.7489	4.7533	4.7576	4.7618	4.7489	4.7576	4.7489	
util living area													
	0.9847	0.9730	0.9352	0.8396	0.6837	0.4729	0.3433	0.3614	0.6101	0.8710	0.9667	0.9878	(86)
MIT	20.0097	20.1616	20.4521	20.7523	20.9265	20.9894	20.9981	20.9977	20.9666	20.7522	20.3468	19.9790	(87)
Th 2	19.8860	19.8898	19.8885	19.8910	19.8910	19.8922	19.8933	19.8944	19.8955	19.8922	19.8944	19.8922	(88)
util rest of house													
	0.9798	0.9647	0.9159	0.7969	0.6125	0.3846	0.2467	0.2600	0.5155	0.8242	0.9544	0.9838	(89)
MIT 2	18.6166	18.8359	19.2406	19.6345	19.8319	19.8869	19.8929	19.8939	19.8755	19.6477	19.1067	18.5773	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.1708	19.3633	19.7225	20.0792	20.2673	20.3255	20.3326	20.3330	20.3096	20.0871	19.6000	19.1349	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1708	19.3633	19.7225	20.0792	20.2673	20.3255	20.3326	20.3330	20.3096	20.0871	19.6000	19.1349	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9757	0.9598	0.9125	0.8048	0.6378	0.4196	0.2852	0.3004	0.5522	0.8335	0.9504	0.9802	(94)
Useful gains	699.6364	777.4509	847.5913	841.1703	688.9978	467.2672	302.6294	302.1840	508.8198	667.6676	678.8324	657.8835	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1348.5708	1323.8077	1199.1151	994.6144	730.2558	471.9123	303.1918	302.8858	524.9547	815.7458	1096.1279	1327.3122	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	482.8072	367.1517	261.5337	110.4798	30.6959	0.0000	0.0000	0.0000	0.0000	110.1702	300.4528	498.0549	(98)
Space heating												2161.3463	(98)
RHI space heating demand												2161	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3347	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2845	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3628	0.3556	0.3485	0.3130	0.3059	0.2703	0.2703	0.2632	0.2845	0.3059	0.3201	0.3343	(22b)
Effective ac	0.5658	0.5632	0.5607	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.7248	33.5725	33.4233	32.7221	32.5909	31.9803	31.9803	31.8672	32.2155	32.5909	32.8563	33.1338	(38)
Heat transfer coeff	95.7607	95.6084	95.4592	94.7580	94.6268	94.0162	94.0162	93.9031	94.2514	94.6268	94.8922	95.1697	(39)
Average = Sum(39)m / 12 =												94.7574	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2593	1.2573	1.2554	1.2462	1.2444	1.2364	1.2364	1.2349	1.2395	1.2444	1.2479	1.2516	(40)
HLP (average)												1.2462	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	680.7815	793.3187	899.8210	1001.1884	1060.2928	1037.2576	993.5154	932.8153	862.0102	756.6729	670.7857	643.2051	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1432	55.2311	55.3174	55.7267	55.8040	56.1665	56.1665	56.2341	56.0263	55.8040	55.6479	55.4857	
alpha	4.6762	4.6821	4.6878	4.7151	4.7203	4.7444	4.7444	4.7489	4.7351	4.7203	4.7099	4.6990	
util living area													
	0.9893	0.9777	0.9491	0.8759	0.7407	0.5609	0.4125	0.4566	0.6936	0.9140	0.9792	0.9917	(86)
MIT	19.8790	20.0749	20.3576	20.6727	20.8850	20.9757	20.9954	20.9926	20.9362	20.6449	20.1965	19.8346	(87)
Th 2	19.8728	19.8744	19.8760	19.8832	19.8846	19.8910	19.8910	19.8922	19.8885	19.8846	19.8819	19.8790	(88)
util rest of house													
	0.9859	0.9709	0.9337	0.8406	0.6769	0.4718	0.3106	0.3499	0.6042	0.8807	0.9716	0.9890	(89)
MIT 2	18.4183	18.7008	19.1009	19.5292	19.7836	19.8767	19.8895	19.8895	19.8445	19.5073	18.8845	18.3586	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	18.9994	19.2474	19.6008	19.9841	20.2217	20.3139	20.3294	20.3284	20.2788	19.9598	19.4064	18.9458	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9994	19.2474	19.6008	19.9841	20.2217	20.3139	20.3294	20.3284	20.2788	19.9598	19.4064	18.9458	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9660	0.9292	0.8442	0.6973	0.5066	0.3513	0.3925	0.6373	0.8833	0.9674	0.9860	(94)
Useful gains	668.8196	766.3600	836.0819	845.1847	739.3345	525.5152	349.0015	366.1488	549.3812	668.3665	648.8950	634.1876	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.6277	1371.7363	1250.5924	1050.3111	806.3857	537.1987	350.6265	368.8843	582.3589	885.6894	1167.7846	1403.3499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	549.6733	406.8129	308.3958	147.6910	49.8860	0.0000	0.0000	0.0000	0.0000	161.6882	373.6006	572.2568	(98)
Space heating												2570.0045	(98)
Space heating per m2											(98) / (4) =	33.7981	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2754.5600	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	549.6733	406.8129	308.3958	147.6910	49.8860	0.0000	0.0000	0.0000	0.0000	161.6882	373.6006	572.2568	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	589.1461	436.0267	330.5421	158.2969	53.4684	0.0000	0.0000	0.0000	0.0000	173.2993	400.4293	613.3513	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4626	89.3490	89.1140	88.5926	87.7056	86.7000	86.7000	86.7000	86.7000	88.6403	89.2712	89.5067	(217)
Fuel for water heating, kWh/month													
	178.8139	156.9490	163.2522	144.4033	140.8890	124.3722	116.6223	131.8729	132.8691	149.8044	160.7793	173.4928	(219)
Water heating fuel used												1774.1205	(219)
Annual totals kWh/year													
Space heating fuel - main system												2754.5600	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4383.7062	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2754.5600	3.4800	95.8587	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1774.1205	3.4800	61.7394	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	332.7891	13.1900	43.8949	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			258.4760	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8969	(257)
SAP value		87.4883	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2754.5600	0.2160	594.9850	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1774.1205	0.2160	383.2100	(264)
Space and water heating			978.1950	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			902.9534	(272)
CO2 emissions per m2			11.8700	(273)
EI value			90.0037	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8820 = 3.945, stars = 4
Water heating environmental impact	0.216 / 0.8820 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		4.4800	
Infiltration rate		0.3347	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2845	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2987	0.2774	0.2845	0.2703	0.2703	0.2632	0.2561	0.2490	0.2418	0.2632	0.2490	0.2632	(22b)
Effective ac	0.5446	0.5385	0.5405	0.5365	0.5365	0.5346	0.5328	0.5310	0.5292	0.5346	0.5310	0.5346	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4628	32.0964	32.2155	31.9803	31.9803	31.8672	31.7571	31.6500	31.5460	31.8672	31.6500	31.8672	(38)
Heat transfer coeff	94.4987	94.1323	94.2514	94.0162	94.0162	93.9031	93.7930	93.6859	93.5819	93.9031	93.6859	93.9031	(39)
Average = Sum(39)m / 12 =												93.9475	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2427	1.2379	1.2395	1.2364	1.2364	1.2349	1.2335	1.2321	1.2307	1.2349	1.2321	1.2349	(40)
HLP (average)												1.2355	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	13.4839	0.7200	0.7000	0.7700	9.4662	(74)
East	6.7800	25.1925	0.7200	0.7000	0.7700	59.6576	(76)
South	4.4000	56.7559	0.7200	0.7000	0.7700	87.2222	(78)
West	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	182.5671	279.6277	418.8427	566.8584	634.5591	696.9477	661.6109	598.5540	495.9601	343.7098	221.3467	151.3226	(83)
Total gains	717.0835	810.0397	928.8410	1045.1277	1080.3440	1113.5137	1060.9859	1005.8347	921.3886	801.0748	714.2777	671.1631	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8797	56.0972	56.0263	56.1665	56.1665	56.2341	56.3001	56.3644	56.4271	56.2341	56.3644	56.2341	
alpha	4.7253	4.7398	4.7351	4.7444	4.7444	4.7489	4.7533	4.7576	4.7618	4.7489	4.7576	4.7489	
util living area													
	0.9847	0.9730	0.9352	0.8396	0.6837	0.4729	0.3433	0.3614	0.6101	0.8710	0.9667	0.9878	(86)
MIT	20.0097	20.1616	20.4521	20.7523	20.9265	20.9894	20.9981	20.9977	20.9666	20.7522	20.3468	19.9790	(87)
Th 2	19.8860	19.8898	19.8885	19.8910	19.8910	19.8922	19.8933	19.8944	19.8955	19.8922	19.8944	19.8922	(88)
util rest of house													
	0.9798	0.9647	0.9159	0.7969	0.6125	0.3846	0.2467	0.2600	0.5155	0.8242	0.9544	0.9838	(89)
MIT 2	18.6166	18.8359	19.2406	19.6345	19.8319	19.8869	19.8929	19.8939	19.8755	19.6477	19.1067	18.5773	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.1708	19.3633	19.7225	20.0792	20.2673	20.3255	20.3326	20.3330	20.3096	20.0871	19.6000	19.1349	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1708	19.3633	19.7225	20.0792	20.2673	20.3255	20.3326	20.3330	20.3096	20.0871	19.6000	19.1349	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9757	0.9598	0.9125	0.8048	0.6378	0.4196	0.2852	0.3004	0.5522	0.8335	0.9504	0.9802	(94)
Useful gains	699.6364	777.4509	847.5913	841.1703	688.9978	467.2672	302.6294	302.1840	508.8198	667.6676	678.8324	657.8835	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1348.5708	1323.8077	1199.1151	994.6144	730.2558	471.9123	303.1918	302.8858	524.9547	815.7458	1096.1279	1327.3122	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	482.8072	367.1517	261.5337	110.4798	30.6959	0.0000	0.0000	0.0000	0.0000	110.1702	300.4528	498.0549	(98)
Space heating												2161.3463	(98)
Space heating per m2											(98) / (4) =	28.4238	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2316.5555	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	482.8072	367.1517	261.5337	110.4798	30.6959	0.0000	0.0000	0.0000	0.0000	110.1702	300.4528	498.0549	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	517.4782	393.5174	280.3148	118.4135	32.9002	0.0000	0.0000	0.0000	0.0000	118.0817	322.0287	533.8209	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3764	89.2755	88.9794	88.3319	87.3933	86.7000	86.7000	86.7000	86.7000	88.2962	89.1039	89.4175	(217)
Fuel for water heating, kWh/month													
	178.9864	157.0782	163.4991	144.8295	141.3925	124.3722	116.6223	131.8729	132.8691	150.3882	161.0811	173.6659	(219)
Water heating fuel used												1776.6575	(219)
Annual totals kWh/year													
Space heating fuel - main system												2316.5555	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3874.5222	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2316.5555	7.3800	170.9618	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1776.6575	7.3800	131.1173	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	332.7891	28.6600	95.3774	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			346.4024	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2316.5555	0.2160	500.3760	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1776.6575	0.2160	383.7580	(264)
Space and water heating			884.1340	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			770.6335	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2316.5555	1.2200	2826.1977	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1776.6575	1.2200	2167.5221	(264)
Space and water heating			4993.7198	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	332.7891	3.0700	1021.6627	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4322.3393	(272)
Primary energy kWh/m2/year			56.8430	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£117	£117	£0
Mains gas	£409	£409	£0
Space heating	£299	£299	£0
Water heating	£131	£131	£0
Lighting	£95	£95	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£346	£346	£0
Total cost of uses	£345	£345	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	476.85 (P1)
Transmission heat loss coefficient	62.04 (37)
Summer heat loss coefficient	538.88 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.0100	87.1704	0.7200	0.7000	0.7650	60.7995
East	6.7800	125.2818	0.7200	0.7000	0.7650	294.7488
South	4.4000	118.5567	0.7200	0.7000	0.7650	181.0144
West	2.9800	125.2818	0.7200	0.7000	0.7650	129.5504
total:						666.1131

	Jun	Jul	Aug	
Solar gains	713	666	601	(P3)
Internal gains	414	396	404	
Total summer gains	1127	1062	1005	(P5)
Summer gain/loss ratio	2.09	1.97	1.86	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.74	19.52	19.41	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 381 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 381	**Prop Type Ref**	
Property	15 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	87 B	**DER**	13.70	**TER**	18.78
Environmental	90 B	**% DER<TER**	27.06		
CO_2 Emissions (t/year)	0.77	**DFEE**	48.11	**TFEE**	53.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.78	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.70	$kgCO_2/m^2$	Pass
	-5.08 (-27.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.31	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.11	$kWh/m^2/yr$	
	-5.2 (-9.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	2.01 m², No overhang		
Windows facing East	6.78 m², No overhang		
Windows facing South	4.40 m², No overhang		
Windows facing West	2.98 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.48 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 382 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 382 EPC	**Prop Type Ref**	
Property	25 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	12.69	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.09		
CO_2 Emissions (t/year)	0.86	**DFEE**	45.39	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.69 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.78 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing South: 7.79 m², No overhang
Windows facing West: 1.53 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1244	(8)
Pressure test				Yes	
Measured/design AP50				4.7800	
Infiltration rate				0.3634	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3939	0.3862	0.3784	0.3398	0.3321	0.2935	0.2935	0.2858	0.3089	0.3321	0.3475	0.3630	(22b)
Effective ac	0.5776	0.5746	0.5716	0.5577	0.5551	0.5431	0.5431	0.5408	0.5477	0.5551	0.5604	0.5659	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.9489	45.7093	45.4744	44.3711	44.1647	43.2038	43.2038	43.0258	43.5739	44.1647	44.5823	45.0188	(38)
Heat transfer coeff	109.4931	109.2534	109.0186	107.9153	107.7089	106.7480	106.7480	106.5700	107.1181	107.7089	108.1265	108.5630	(39)
Average = Sum(39)m / 12 =												107.9143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1741	1.1715	1.1690	1.1571	1.1549	1.1446	1.1446	1.1427	1.1486	1.1549	1.1594	1.1641	(40)
HLP (average)												1.1571	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1488	59.2786	59.4063	60.0136	60.1286	60.6699	60.6699	60.7712	60.4603	60.1286	59.8964	59.6556	
alpha	4.9433	4.9519	4.9604	5.0009	5.0086	5.0447	5.0447	5.0514	5.0307	5.0086	4.9931	4.9770	
util living area													
	0.9980	0.9950	0.9875	0.9653	0.9037	0.7644	0.5931	0.6378	0.8562	0.9744	0.9955	0.9985	(86)
MIT	19.7292	19.8992	20.1476	20.4600	20.7406	20.9254	20.9835	20.9763	20.8589	20.4923	20.0481	19.6977	(87)
Th 2	19.9408	19.9429	19.9449	19.9544	19.9562	19.9646	19.9646	19.9661	19.9613	19.9562	19.9526	19.9488	(88)
util rest of house													
	0.9973	0.9932	0.9830	0.9516	0.8640	0.6745	0.4644	0.5100	0.7860	0.9617	0.9937	0.9980	(89)
MIT 2	18.2493	18.4986	18.8605	19.3137	19.6939	19.9126	19.9583	19.9561	19.8463	19.3664	18.7236	18.2090	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6321	18.8608	19.1934	19.6102	19.9646	20.1745	20.2234	20.2199	20.1082	19.6576	19.0661	18.5940	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6321	18.8608	19.1934	19.6102	19.9646	20.1745	20.2234	20.2199	20.1082	19.6576	19.0661	18.5940	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9786	0.9459	0.8644	0.6945	0.4979	0.5431	0.7975	0.9569	0.9914	0.9970	(94)
Useful gains	559.9951	658.7467	724.7289	753.3906	711.5360	553.3890	380.5378	397.4809	557.9584	604.4482	553.7451	526.5871	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1569.2625	1525.2676	1383.8133	1155.7893	890.1689	595.0675	386.7920	407.0908	643.5885	975.5852	1293.8571	1562.6591	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	750.8949	582.3020	490.3587	289.7271	132.9029	0.0000	0.0000	0.0000	0.0000	276.1260	532.8807	770.8375	(98)
Space heating												3826.0298	(98)
Space heating per m2											(98) / (4) =	41.0254	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4100.7822	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	750.8949	582.3020	490.3587	289.7271	132.9029	0.0000	0.0000	0.0000	0.0000	276.1260	532.8807	770.8375	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	804.8177	624.1179	525.5721	310.5328	142.4469	0.0000	0.0000	0.0000	0.0000	295.9549	571.1476	826.1924	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6098	89.5389	89.4064	89.1142	88.4701	86.7000	86.7000	86.7000	86.7000	89.0454	89.4697	89.6405	(217)
Fuel for water heating, kWh/month													
	190.8395	167.4102	173.8831	153.3221	149.1072	132.6794	124.3201	140.7076	141.8108	159.2707	171.4375	185.1603	(219)
Water heating fuel used												1889.9485	(219)
Annual totals kWh/year													
Space heating fuel - main system												4100.7822	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5777.5508	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4100.7822	0.2160	885.7690	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1889.9485	0.2160	408.2289	(264)
Space and water heating			1293.9978	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1183.3575	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6900	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.2167	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.2167	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.7800	
Infiltration rate			0.3634	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3939	0.3862	0.3784	0.3398	0.3321	0.2935	0.2935	0.2858	0.3089	0.3321	0.3475	0.3630	(22b)
Effective ac	0.5776	0.5746	0.5716	0.5577	0.5551	0.5431	0.5431	0.5408	0.5477	0.5551	0.5604	0.5659	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.9489	45.7093	45.4744	44.3711	44.1647	43.2038	43.2038	43.0258	43.5739	44.1647	44.5823	45.0188	(38)
Heat transfer coeff	109.4931	109.2534	109.0186	107.9153	107.7089	106.7480	106.7480	106.5700	107.1181	107.7089	108.1265	108.5630	(39)
Average = Sum(39)m / 12 =												107.9143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1741	1.1715	1.1690	1.1571	1.1549	1.1446	1.1446	1.1427	1.1486	1.1549	1.1594	1.1641	(40)
HLP (average)												1.1571	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206 (72)

Total internal gains

	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1488	59.2786	59.4063	60.0136	60.1286	60.6699	60.6699	60.7712	60.4603	60.1286	59.8964	59.6556	
alpha	4.9433	4.9519	4.9604	5.0009	5.0086	5.0447	5.0447	5.0514	5.0307	5.0086	4.9931	4.9770	
util living area	0.9984	0.9959	0.9895	0.9697	0.9130	0.7793	0.6084	0.6558	0.8701	0.9786	0.9965	0.9989	(86)
MIT	19.6968	19.8680	20.1191	20.4363	20.7241	20.9183	20.9815	20.9733	20.8463	20.4674	20.0179	19.6660	(87)
Th 2	19.9408	19.9429	19.9449	19.9544	19.9562	19.9646	19.9646	19.9661	19.9613	19.9562	19.9526	19.9488	(88)
util rest of house	0.9979	0.9945	0.9856	0.9575	0.8758	0.6906	0.4776	0.5264	0.8032	0.9677	0.9950	0.9985	(89)
MIT 2	18.7536	18.9259	19.1767	19.4948	19.7636	19.9251	19.9597	19.9582	19.8743	19.5301	19.0836	18.7293	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9976	19.1695	19.4204	19.7383	20.0120	20.1820	20.2240	20.2207	20.1257	19.7726	19.3253	18.9715	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9976	19.1695	19.4204	19.7383	20.0120	20.1820	20.2240	20.2207	20.1257	19.7726	19.3253	18.9715	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9931	0.9831	0.9543	0.8781	0.7111	0.5119	0.5602	0.8156	0.9652	0.9938	0.9980	(94)
Useful gains	528.1400	628.7415	698.4492	733.5224	699.6960	549.4477	379.7790	396.1586	549.7523	582.7439	524.6754	495.3279	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1609.2808	1558.9966	1408.5649	1169.6222	895.2783	595.8668	386.8507	407.1762	645.4578	987.9658	1321.8750	1603.6422	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	804.3687	625.1314	528.3261	313.9918	145.5132	0.0000	0.0000	0.0000	0.0000	301.4851	573.9837	824.5858	(98)
Space heating												4117.3859	(98)
Space heating per m2											(98) / (4) =	44.1495	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1003.4309	789.9349	809.9321	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8351	0.9064	0.8860	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	837.9950	715.9607	717.6078	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	120.0937	186.5673	156.6081	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                463.2691 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   30.0234   46.6418   39.1520    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                115.8173 (107)
Space cooling per m2                                                                                           1.2419 (108)
Energy for space heating                                                                                      44.1495 (99)
Energy for space cooling                                                                                       1.2419 (108)
Total                                                                                                         45.3914 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                        45.4 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.7800	
Infiltration rate			0.3634	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3244	0.3012	0.3089	0.2935	0.2935	0.2858	0.2780	0.2703	0.2626	0.2858	0.2703	0.2858	(22b)
Effective ac	0.5526	0.5454	0.5477	0.5431	0.5431	0.5408	0.5387	0.5365	0.5345	0.5408	0.5365	0.5408	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.9630	43.3865	43.5739	43.2038	43.2038	43.0258	42.8526	42.6842	42.5205	43.0258	42.6842	43.0258	(38)
Heat transfer coeff	107.5072	106.9307	107.1181	106.7480	106.7480	106.5700	106.3968	106.2284	106.0647	106.5700	106.2284	106.5700	(39)
Average = Sum(39)m / 12 =												106.6400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1528	1.1466	1.1486	1.1446	1.1446	1.1427	1.1409	1.1391	1.1373	1.1427	1.1391	1.1427	(40)
HLP (average)												1.1435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2414	60.5663	60.4603	60.6699	60.6699	60.7712	60.8701	60.9667	61.0608	60.7712	60.9667	60.7712	
alpha	5.0161	5.0378	5.0307	5.0447	5.0447	5.0514	5.0580	5.0644	5.0707	5.0514	5.0644	5.0514	
util living area													
	0.9889	0.9819	0.9611	0.9071	0.7935	0.5856	0.4289	0.4395	0.6910	0.9056	0.9754	0.9911	(86)
MIT	20.0503	20.1717	20.4062	20.6774	20.8818	20.9799	20.9966	20.9962	20.9544	20.7342	20.3672	20.0303	(87)
Th 2	19.9580	19.9630	19.9613	19.9646	19.9646	19.9661	19.9676	19.9691	19.9705	19.9661	19.9691	19.9661	(88)
util rest of house													
	0.9853	0.9762	0.9485	0.8769	0.7300	0.4883	0.3173	0.3255	0.5979	0.8680	0.9661	0.9882	(89)
MIT 2	18.7279	18.9060	19.2381	19.6107	19.8614	19.9553	19.9667	19.9680	19.9411	19.6930	19.1934	18.7053	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9709	0.9422	0.8743	0.7408	0.5130	0.3463	0.3552	0.6203	0.8679	0.9606	0.9846	(94)
Useful gains	781.1515	847.1611	892.1997	874.7329	737.6764	514.7210	332.3072	331.7574	559.2501	727.8548	752.9044	738.5548	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1523.3671	1489.9030	1343.2864	1108.7435	813.9866	524.3515	333.3442	332.9128	583.6880	912.4855	1231.9267	1497.0925	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	552.2083	431.9226	335.6085	168.4876	56.7748	0.0000	0.0000	0.0000	0.0000	137.3652	344.8961	564.3520	(98)
Space heating												2591.6153	(98)
RHI space heating demand												2592	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.7800	
Infiltration rate		0.3634	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3939	0.3862	0.3784	0.3398	0.3321	0.2935	0.2935	0.2858	0.3089	0.3321	0.3475	0.3630	(22b)
Effective ac	0.5776	0.5746	0.5716	0.5577	0.5551	0.5431	0.5431	0.5408	0.5477	0.5551	0.5604	0.5659	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.9489	45.7093	45.4744	44.3711	44.1647	43.2038	43.2038	43.0258	43.5739	44.1647	44.5823	45.0188	(38)
Heat transfer coeff	109.4931	109.2534	109.0186	107.9153	107.7089	106.7480	106.7480	106.5700	107.1181	107.7089	108.1265	108.5630	(39)
Average = Sum(39)m / 12 =												107.9143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1741	1.1715	1.1690	1.1571	1.1549	1.1446	1.1446	1.1427	1.1486	1.1549	1.1594	1.1641	(40)
HLP (average)												1.1571	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1488	59.2786	59.4063	60.0136	60.1286	60.6699	60.6699	60.7712	60.4603	60.1286	59.8964	59.6556	
alpha	4.9433	4.9519	4.9604	5.0009	5.0086	5.0447	5.0447	5.0514	5.0307	5.0086	4.9931	4.9770	
util living area													
	0.9923	0.9849	0.9692	0.9297	0.8405	0.6756	0.5063	0.5428	0.7661	0.9381	0.9847	0.9939	(86)
MIT	19.9246	20.0870	20.3168	20.5952	20.8251	20.9573	20.9918	20.9884	20.9180	20.6313	20.2252	19.8902	(87)
Th 2	19.9408	19.9429	19.9449	19.9544	19.9562	19.9646	19.9646	19.9661	19.9613	19.9562	19.9526	19.9488	(88)
util rest of house													
	0.9898	0.9801	0.9592	0.9061	0.7883	0.5841	0.3918	0.4275	0.6833	0.9124	0.9790	0.9920	(89)
MIT 2	18.5333	18.7694	19.0997	19.4940	19.7899	19.9370	19.9616	19.9615	19.9006	19.5514	18.9783	18.4892	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8931	19.1102	19.4145	19.7789	20.0577	20.2009	20.2280	20.2271	20.1637	19.8307	19.3008	18.8516	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8931	19.1102	19.4145	19.7789	20.0577	20.2009	20.2280	20.2271	20.1637	19.8307	19.3008	18.8516	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9864	0.9751	0.9529	0.9014	0.7939	0.6061	0.4216	0.4574	0.7010	0.9086	0.9742	0.9891	(94)
Useful gains	751.4854	840.4376	884.8228	875.8126	782.0176	574.9250	384.3019	403.3517	601.7944	729.9931	724.4642	715.5313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1597.8440	1552.5083	1407.9210	1173.9945	900.1952	597.8811	387.2863	407.8535	649.5335	994.2270	1319.2299	1590.6200	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	629.6908	478.5115	389.1850	214.6910	87.9242	0.0000	0.0000	0.0000	0.0000	196.5900	428.2313	651.0660	(98)
Space heating												3075.8898	(98)
Space heating per m2											(98) / (4) =	32.9819	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3296.7736	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.6908	478.5115	389.1850	214.6910	87.9242	0.0000	0.0000	0.0000	0.0000	196.5900	428.2313	651.0660	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	674.9098	512.8741	417.1329	230.1082	94.2382	0.0000	0.0000	0.0000	0.0000	210.7074	458.9832	697.8199	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5062	89.4144	89.2423	88.8650	88.1048	86.7000	86.7000	86.7000	86.7000	88.7555	89.3219	89.5447	(217)
Fuel for water heating, kWh/month													
	191.0603	167.6433	174.2028	153.7521	149.7254	132.6794	124.3201	140.7076	141.8108	159.7908	171.7211	185.3586	(219)
Water heating fuel used												1892.7722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3296.7736	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4976.3659	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3296.7736	3.4800	114.7277	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1892.7722	3.4800	65.8685	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			272.4778	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8277	(257)
SAP value		88.4533	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3296.7736	0.2160	712.1031	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1892.7722	0.2160	408.8388	(264)
Space and water heating			1120.9419	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			1010.3015	(272)
CO2 emissions per m2			10.8300	(273)
EI value			90.2083	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8830 = 3.941, stars = 4
Water heating environmental impact	0.216 / 0.8830 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.7800	
Infiltration rate		0.3634	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3244	0.3012	0.3089	0.2935	0.2935	0.2858	0.2780	0.2703	0.2626	0.2858	0.2703	0.2858	(22b)
Effective ac	0.5526	0.5454	0.5477	0.5431	0.5431	0.5408	0.5387	0.5365	0.5345	0.5408	0.5365	0.5408	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.9630	43.3865	43.5739	43.2038	43.2038	43.0258	42.8526	42.6842	42.5205	43.0258	42.6842	43.0258	(38)
Heat transfer coeff	107.5072	106.9307	107.1181	106.7480	106.7480	106.5700	106.3968	106.2284	106.0647	106.5700	106.2284	106.5700	(39)
Average = Sum(39)m / 12 =												106.6400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1528	1.1466	1.1486	1.1446	1.1446	1.1427	1.1409	1.1391	1.1373	1.1427	1.1391	1.1427	(40)
HLP (average)												1.1435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2414	60.5663	60.4603	60.6699	60.6699	60.7712	60.8701	60.9667	61.0608	60.7712	60.9667	60.7712	
alpha	5.0161	5.0378	5.0307	5.0447	5.0447	5.0514	5.0580	5.0644	5.0707	5.0514	5.0644	5.0514	
util living area													
	0.9889	0.9819	0.9611	0.9071	0.7935	0.5856	0.4289	0.4395	0.6910	0.9056	0.9754	0.9911	(86)
MIT	20.0503	20.1717	20.4062	20.6774	20.8818	20.9799	20.9966	20.9962	20.9544	20.7342	20.3672	20.0303	(87)
Th 2	19.9580	19.9630	19.9613	19.9646	19.9646	19.9661	19.9676	19.9691	19.9705	19.9661	19.9691	19.9661	(88)
util rest of house													
	0.9853	0.9762	0.9485	0.8769	0.7300	0.4883	0.3173	0.3255	0.5979	0.8680	0.9661	0.9882	(89)
MIT 2	18.7279	18.9060	19.2381	19.6107	19.8614	19.9553	19.9667	19.9680	19.9411	19.6930	19.1934	18.7053	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9709	0.9422	0.8743	0.7408	0.5130	0.3463	0.3552	0.6203	0.8679	0.9606	0.9846	(94)
Useful gains	781.1515	847.1611	892.1997	874.7329	737.6764	514.7210	332.3072	331.7574	559.2501	727.8548	752.9044	738.5548	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1523.3671	1489.9030	1343.2864	1108.7435	813.9866	524.3515	333.3442	332.9128	583.6880	912.4855	1231.9267	1497.0925	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	552.2083	431.9226	335.6085	168.4876	56.7748	0.0000	0.0000	0.0000	0.0000	137.3652	344.8961	564.3520	(98)
Space heating												2591.6153	(98)
Space heating per m2											(98) / (4) =	27.7891	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2777.7227	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	552.2083	431.9226	335.6085	168.4876	56.7748	0.0000	0.0000	0.0000	0.0000	137.3652	344.8961	564.3520	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	591.8632	462.9395	359.7090	180.5870	60.8519	0.0000	0.0000	0.0000	0.0000	147.2296	369.6636	604.8789	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4220	89.3442	89.1284	88.6516	87.7526	86.7000	86.7000	86.7000	86.7000	88.4347	89.1604	89.4558	(217)
Fuel for water heating, kWh/month													
	191.2402	167.7749	174.4254	154.1221	150.3263	132.6794	124.3201	140.7076	141.8108	160.3706	172.0322	185.5426	(219)
Water heating fuel used												1895.3522	(219)
Annual totals kWh/year													
Space heating fuel - main system												2777.7227	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4376.5451	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2777.7227	7.3800	204.9959	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.3522	7.3800	139.8770	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			366.8875	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2777.7227	0.2160	599.9881	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.3522	0.2160	409.3961	(264)
Space and water heating			1009.3842	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			855.4852	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2777.7227	1.2200	3388.8217	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.3522	1.2200	2312.3297	(264)
Space and water heating			5701.1514	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4790.8048	(272)
Primary energy kWh/m2/year			51.3704	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£452	£378	£74
Space heating	£333	£333	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£367	£308	£60
Total cost of uses	£367	£307	£60
Delivered energy	47 kWh/m²	37 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	40 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.7800	
Infiltration rate		0.3634	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3939	0.3862	0.3784	0.3398	0.3321	0.2935	0.2935	0.2858	0.3089	0.3321	0.3475	0.3630	(22b)
Effective ac	0.5776	0.5746	0.5716	0.5577	0.5551	0.5431	0.5431	0.5408	0.5477	0.5551	0.5604	0.5659	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.9489	45.7093	45.4744	44.3711	44.1647	43.2038	43.2038	43.0258	43.5739	44.1647	44.5823	45.0188	(38)
Heat transfer coeff	109.4931	109.2534	109.0186	107.9153	107.7089	106.7480	106.7480	106.5700	107.1181	107.7089	108.1265	108.5630	(39)
Average = Sum(39)m / 12 =												107.9143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1741	1.1715	1.1690	1.1571	1.1549	1.1446	1.1446	1.1427	1.1486	1.1549	1.1594	1.1641	(40)
HLP (average)												1.1571	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1815 (H8)
Utilisation factor												0.5710 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-862.7264 (H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435 (64)
								Total per year (kWh/year) = Sum(64)m =				818.2658 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1488	59.2786	59.4063	60.0136	60.1286	60.6699	60.6699	60.7712	60.4603	60.1286	59.8964	59.6556	
alpha	4.9433	4.9519	4.9604	5.0009	5.0086	5.0447	5.0447	5.0514	5.0307	5.0086	4.9931	4.9770	
util living area													
	0.9923	0.9849	0.9692	0.9297	0.8405	0.6756	0.5063	0.5428	0.7661	0.9381	0.9847	0.9939	(86)
MIT	19.9246	20.0870	20.3168	20.5952	20.8251	20.9573	20.9918	20.9884	20.9180	20.6313	20.2252	19.8902	(87)
Th 2	19.9408	19.9429	19.9449	19.9544	19.9562	19.9646	19.9646	19.9661	19.9613	19.9562	19.9526	19.9488	(88)
util rest of house													
	0.9898	0.9801	0.9592	0.9061	0.7883	0.5841	0.3918	0.4275	0.6833	0.9124	0.9790	0.9920	(89)
MIT 2	18.5333	18.7694	19.0997	19.4940	19.7899	19.9370	19.9616	19.9615	19.9006	19.5514	18.9783	18.4892	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8931	19.1102	19.4145	19.7789	20.0577	20.2009	20.2280	20.2271	20.1637	19.8307	19.3008	18.8516	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8931	19.1102	19.4145	19.7789	20.0577	20.2009	20.2280	20.2271	20.1637	19.8307	19.3008	18.8516	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9864	0.9751	0.9529	0.9014	0.7939	0.6061	0.4216	0.4574	0.7010	0.9086	0.9742	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4854	840.4376	884.8228	875.8126	782.0176	574.9250	384.3019	403.3517	601.7944	729.9931	724.4642	715.5313 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1597.8440	1552.5083	1407.9210	1173.9945	900.1952	597.8811	387.2863	407.8535	649.5335	994.2270	1319.2299	1590.6200 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	629.6908	478.5115	389.1850	214.6910	87.9242	0.0000	0.0000	0.0000	0.0000	196.5900	428.2313	651.0660 (98)
Space heating												3075.8898 (98)
Space heating per m2											(98) / (4) =	32.9819 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3296.7736 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.6908	478.5115	389.1850	214.6910	87.9242	0.0000	0.0000	0.0000	0.0000	196.5900	428.2313	651.0660	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	674.9098	512.8741	417.1329	230.1082	94.2382	0.0000	0.0000	0.0000	0.0000	210.7074	458.9832	697.8199	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5998	89.6140	89.6369	89.6986	89.7818	86.7000	86.7000	86.7000	86.7000	89.1513	89.4674	89.6220	(217)
Fuel for water heating, kWh/month													
	162.9396	120.6847	94.1164	46.0927	15.8114	0.0000	0.0000	25.6169	51.6716	99.2196	138.2744	161.8391	(219)
Water heating fuel used												916.2664	(219)
Annual totals kWh/year													
Space heating fuel - main system												3296.7736	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4049.8601	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3296.7736	3.4800	114.7277	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.2664	3.4800	31.8861	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			245.0904	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7445 (257)
SAP value		89.6139
SAP rating (Section 12)		90 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3296.7736	0.2160	712.1031	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.2664	0.2160	197.9135	(264)
Space and water heating			910.0166	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			825.3263 (272)
CO2 emissions per m2			8.8500 (273)
EI value			92.0010
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.7800	
Infiltration rate		0.3634	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3089	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3244	0.3012	0.3089	0.2935	0.2935	0.2858	0.2780	0.2703	0.2626	0.2858	0.2703	0.2858	(22b)
Effective ac	0.5526	0.5454	0.5477	0.5431	0.5431	0.5408	0.5387	0.5365	0.5345	0.5408	0.5365	0.5408	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.9630	43.3865	43.5739	43.2038	43.2038	43.0258	42.8526	42.6842	42.5205	43.0258	42.6842	43.0258	(38)
Heat transfer coeff	107.5072	106.9307	107.1181	106.7480	106.7480	106.5700	106.3968	106.2284	106.0647	106.5700	106.2284	106.5700	(39)
Average = Sum(39)m / 12 =												106.6400	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1528	1.1466	1.1486	1.1446	1.1446	1.1427	1.1409	1.1391	1.1373	1.1427	1.1391	1.1427	(40)
HLP (average)												1.1435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3223	(H8)
Utilisation factor												0.5306	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-897.1283	(H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656	(63)
								Solar input (sum of months) = Sum(63)m =				-897.1283	(63)
Output from w/h													
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
								Total per year (kWh/year) = Sum(64)m =				793.5279	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2414	60.5663	60.4603	60.6699	60.6699	60.7712	60.8701	60.9667	61.0608	60.7712	60.9667	60.7712	
alpha	5.0161	5.0378	5.0307	5.0447	5.0447	5.0514	5.0580	5.0644	5.0707	5.0514	5.0644	5.0514	
util living area													
	0.9889	0.9819	0.9611	0.9071	0.7935	0.5856	0.4289	0.4395	0.6910	0.9056	0.9754	0.9911	(86)
MIT	20.0503	20.1717	20.4062	20.6774	20.8818	20.9799	20.9966	20.9962	20.9544	20.7342	20.3672	20.0303	(87)
Th 2	19.9580	19.9630	19.9613	19.9646	19.9646	19.9661	19.9676	19.9691	19.9705	19.9661	19.9691	19.9661	(88)
util rest of house													
	0.9853	0.9762	0.9485	0.8769	0.7300	0.4883	0.3173	0.3255	0.5979	0.8680	0.9661	0.9882	(89)
MIT 2	18.7279	18.9060	19.2381	19.6107	19.8614	19.9553	19.9667	19.9680	19.9411	19.6930	19.1934	18.7053	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0699	19.2334	19.5402	19.8866	20.1253	20.2203	20.2330	20.2339	20.2031	19.9623	19.4970	19.0480	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9709	0.9422	0.8743	0.7408	0.5130	0.3463	0.3552	0.6203	0.8679	0.9606	0.9846	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.1515	847.1611	892.1997	874.7329	737.6764	514.7210	332.3072	331.7574	559.2501	727.8548	752.9044	738.5548	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1523.3671	1489.9030	1343.2864	1108.7435	813.9866	524.3515	333.3442	332.9128	583.6880	912.4855	1231.9267	1497.0925	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	552.2083	431.9226	335.6085	168.4876	56.7748	0.0000	0.0000	0.0000	0.0000	137.3652	344.8961	564.3520	(98)
Space heating												2591.6153	(98)
Space heating per m2											(98) / (4) =	27.7891	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2777.7227 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	552.2083	431.9226	335.6085	168.4876	56.7748	0.0000	0.0000	0.0000	0.0000	137.3652	344.8961	564.3520	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	591.8632	462.9395	359.7090	180.5870	60.8519	0.0000	0.0000	0.0000	0.0000	147.2296	369.6636	604.8789	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5406	89.5546	89.5560	89.5845	89.3855	86.7000	86.7000	86.7000	86.7000	88.8952	89.3497	89.5528	(217)
Fuel for water heating, kWh/month	158.3018	120.9118	93.7248	44.7914	20.7681	0.0000	0.0000	18.3443	46.0088	94.9411	132.9272	158.4686	(219)
Water heating fuel used												889.1879	(219)

Annual totals kWh/year	
Space heating fuel - main system	2777.7227 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	411.3521 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) = -782.8819	-782.8819 (233)
Total delivered energy for all uses	3420.3808 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2777.7227	7.3800	204.9959	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.1879	7.3800	65.6221	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			306.9626	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2777.7227	0.2160	599.9881	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.1879	0.2160	192.0646	(264)
Space and water heating			792.0527	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			664.1037	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2777.7227	1.2200	3388.8217	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.1879	1.2200	1084.8092	(264)
Space and water heating			4473.6309	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3716.7844	(272)
Primary energy kWh/m2/year			39.8540	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
West	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 382 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 382 EPC	**Prop Type Ref**	
Property	25 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	12.69	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.09		
CO_2 Emissions (t/year)	0.86	**DFEE**	45.39	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.00		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.69	$kgCO_2/m^2$	Pass
	-4.72 (-27.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.39	$kWh/m^2/yr$	
	-4.5 (-9.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.78 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	4.09 m², No overhang 7.79 m², No overhang 1.53 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.78 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 383 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 383 EPC	**Prop Type Ref**	
Property	26 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.57	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.78		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.86	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.57 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.9 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.16 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing East: 1.53 m², No overhang
Windows facing South: 7.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3324	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3603	0.3532	0.3462	0.3108	0.3038	0.2684	0.2684	0.2614	0.2826	0.3038	0.3179	0.3320	(22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5461	0.5360	0.5360	0.5342	0.5399	0.5461	0.5505	0.5551	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9410	44.7405	44.5440	43.6209	43.4482	42.6442	42.6442	42.4954	42.9539	43.4482	43.7976	44.1629	(38)
Heat transfer coeff	108.4852	108.2847	108.0882	107.1651	106.9924	106.1884	106.1884	106.0396	106.4981	106.9924	107.3418	107.7071	(39)
Average = Sum(39)m / 12 =												107.1643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1633	1.1611	1.1590	1.1491	1.1472	1.1386	1.1386	1.1370	1.1419	1.1472	1.1510	1.1549	(40)
HLP (average)												1.1491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6983	59.8089	59.9176	60.4337	60.5313	60.9896	60.9896	61.0752	60.8122	60.5313	60.3343	60.1297	
alpha	4.9799	4.9873	4.9945	5.0289	5.0354	5.0660	5.0660	5.0717	5.0541	5.0354	5.0223	5.0086	
util living area													
	0.9980	0.9949	0.9874	0.9649	0.9025	0.7624	0.5906	0.6355	0.8546	0.9742	0.9955	0.9985	(86)
MIT	19.7436	19.9128	20.1595	20.4680	20.7459	20.9272	20.9840	20.9771	20.8619	20.4989	20.0576	19.7100	(87)
Th 2	19.9495	19.9512	19.9529	19.9609	19.9624	19.9694	19.9694	19.9707	19.9667	19.9624	19.9594	19.9562	(88)
util rest of house													
	0.9973	0.9932	0.9828	0.9511	0.8626	0.6725	0.4628	0.5084	0.7843	0.9614	0.9936	0.9980	(89)
MIT 2	18.2765	18.5243	18.8836	19.3298	19.7057	19.9188	19.9633	19.9610	19.8543	19.3804	18.7423	18.2322	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6560	18.8834	19.2135	19.6242	19.9747	20.1796	20.2273	20.2238	20.1149	19.6697	19.0825	18.6144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6560	18.8834	19.2135	19.6242	19.9747	20.1796	20.2273	20.2238	20.1149	19.6697	19.0825	18.6144	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9784	0.9455	0.8631	0.6926	0.4961	0.5413	0.7960	0.9566	0.9914	0.9970	(94)
Useful gains	560.0044	658.7378	724.6338	753.0330	710.4891	551.8989	379.1482	396.1652	556.8670	604.2569	553.7414	526.5951	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1557.4091	1514.1895	1374.1844	1149.2613	885.3326	592.4890	385.1799	405.4708	640.5771	970.3872	1286.2195	1552.5329	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	742.0691	574.8635	483.2656	285.2844	130.0836	0.0000	0.0000	0.0000	0.0000	272.4009	527.3842	763.2977	(98)
Space heating												3778.6492	(98)
Space heating per m2											(98) / (4) =	40.5174	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4049.9991	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	742.0691	574.8635	483.2656	285.2844	130.0836	0.0000	0.0000	0.0000	0.0000	272.4009	527.3842	763.2977	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	795.3581	616.1453	517.9696	305.7710	139.4251	0.0000	0.0000	0.0000	0.0000	291.9624	565.2564	818.1112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6032	89.5311	89.3965	89.1019	88.4508	86.7000	86.7000	86.7000	86.7000	89.0342	89.4630	89.6352	(217)
Fuel for water heating, kWh/month													
	190.8536	167.4247	173.9022	153.3433	149.1397	132.6794	124.3201	140.7076	141.8108	159.2906	171.4502	185.1713	(219)
Water heating fuel used												1890.0935	(219)
Annual totals kWh/year													
Space heating fuel - main system												4049.9991	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5726.9127	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4049.9991	0.2160	874.7998	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.0935	0.2160	408.2602	(264)
Space and water heating			1283.0600	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1172.4196	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5700	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.0967	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0967	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.1600	
Infiltration rate			0.3324	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3603	0.3532	0.3462	0.3108	0.3038	0.2684	0.2684	0.2614	0.2826	0.3038	0.3179	0.3320	(22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5461	0.5360	0.5360	0.5342	0.5399	0.5461	0.5505	0.5551	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9410	44.7405	44.5440	43.6209	43.4482	42.6442	42.6442	42.4954	42.9539	43.4482	43.7976	44.1629	(38)
Heat transfer coeff	108.4852	108.2847	108.0882	107.1651	106.9924	106.1884	106.1884	106.0396	106.4981	106.9924	107.3418	107.7071	(39)
Average = Sum(39)m / 12 =												107.1643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1633	1.1611	1.1590	1.1491	1.1472	1.1386	1.1386	1.1370	1.1419	1.1472	1.1510	1.1549	(40)
HLP (average)												1.1491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6983	59.8089	59.9176	60.4337	60.5313	60.9896	60.9896	61.0752	60.8122	60.5313	60.3343	60.1297	
alpha	4.9799	4.9873	4.9945	5.0289	5.0354	5.0660	5.0660	5.0717	5.0541	5.0354	5.0223	5.0086	
util living area													
	0.9985	0.9959	0.9894	0.9693	0.9119	0.7774	0.6060	0.6534	0.8687	0.9784	0.9965	0.9989	(86)
MIT	19.7112	19.8816	20.1310	20.4444	20.7295	20.9203	20.9821	20.9741	20.8494	20.4741	20.0274	19.6782	(87)
Th 2	19.9495	19.9512	19.9529	19.9609	19.9624	19.9694	19.9694	19.9707	19.9667	19.9624	19.9594	19.9562	(88)
util rest of house													
	0.9979	0.9945	0.9855	0.9570	0.8744	0.6887	0.4760	0.5247	0.8016	0.9674	0.9950	0.9985	(89)
MIT 2	18.7749	18.9460	19.1949	19.5080	19.7738	19.9310	19.9647	19.9631	19.8815	19.5417	19.0985	18.7474	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0170	19.1880	19.4370	19.7502	20.0210	20.1868	20.2278	20.2245	20.1319	19.7828	19.3387	18.9881	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0170	19.1880	19.4370	19.7502	20.0210	20.1868	20.2278	20.2245	20.1319	19.7828	19.3387	18.9881	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9931	0.9830	0.9539	0.8769	0.7093	0.5101	0.5584	0.8141	0.9649	0.9938	0.9980	(94)
Useful gains	528.1476	628.7374	698.3776	733.2204	698.7435	548.0205	378.4103	394.8742	548.7506	582.5944	524.6749	495.3340	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1596.5806	1547.1718	1398.3409	1162.7584	890.2789	593.2586	385.2355	405.5519	642.3819	982.4920	1313.7294	1592.7872	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	794.9142	617.1879	520.7726	309.2674	142.5024	0.0000	0.0000	0.0000	0.0000	297.5238	568.1192	816.5052	(98)
Space heating												4066.7927	(98)
Space heating per m2											(98) / (4) =	43.6070	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	998.1713	785.7944	805.9006	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8379	0.9084	0.8882	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	836.3618	713.8478	715.8196	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.2696	188.1393	157.9385	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  467.3474 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   30.3174   47.0348   39.4846    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  116.8368 (107)
Space cooling per m2                                                                                             1.2528 (108)
Energy for space heating                                                                                        43.6070 (99)
Energy for space cooling                                                                                         1.2528 (108)
Total                                                                                                           44.8598 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                           44.9 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3324	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2967	0.2755	0.2826	0.2684	0.2684	0.2614	0.2543	0.2473	0.2402	0.2614	0.2473	0.2614	(22b)
Effective ac	0.5440	0.5380	0.5399	0.5360	0.5360	0.5342	0.5323	0.5306	0.5288	0.5342	0.5306	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2795	42.7971	42.9539	42.6442	42.6442	42.4954	42.3504	42.2095	42.0725	42.4954	42.2095	42.4954	(38)
Heat transfer coeff	106.8237	106.3413	106.4981	106.1884	106.1884	106.0396	105.8946	105.7537	105.6167	106.0396	105.7537	106.0396	(39)
Average = Sum(39)m / 12 =												106.0981	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1454	1.1403	1.1419	1.1386	1.1386	1.1370	1.1355	1.1340	1.1325	1.1370	1.1340	1.1370	(40)
HLP (average)												1.1377	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6269	60.9019	60.8122	60.9896	60.9896	61.0752	61.1588	61.2403	61.3197	61.0752	61.2403	61.0752	
alpha	5.0418	5.0601	5.0541	5.0660	5.0660	5.0717	5.0773	5.0827	5.0880	5.0717	5.0827	5.0717	
util living area													
	0.9888	0.9817	0.9607	0.9062	0.7916	0.5832	0.4270	0.4377	0.6891	0.9047	0.9752	0.9910	(86)
MIT	20.0600	20.1799	20.4138	20.6826	20.8846	20.9805	20.9967	20.9963	20.9555	20.7383	20.3728	20.0378	(87)
Th 2	19.9639	19.9681	19.9667	19.9694	19.9694	19.9707	19.9720	19.9732	19.9744	19.9707	19.9732	19.9707	(88)
util rest of house													
	0.9852	0.9760	0.9480	0.8758	0.7281	0.4866	0.3163	0.3246	0.5963	0.8669	0.9659	0.9881	(89)
MIT 2	18.7463	18.9217	19.2530	19.6214	19.8688	19.9602	19.9711	19.9722	19.9457	19.7020	19.2044	18.7195	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9417	0.8733	0.7390	0.5112	0.3451	0.3540	0.6186	0.8669	0.9604	0.9845	(94)
Useful gains	781.0875	847.0285	891.7981	873.7714	735.9074	512.8501	331.1245	330.6434	557.7763	727.0651	752.7539	738.5220	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1515.4109	1483.1515	1336.8955	1103.9200	810.3753	522.1506	332.1200	331.7555	581.6135	908.7619	1227.4350	1490.9676	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.3366	427.4746	331.1524	165.7069	55.4041	0.0000	0.0000	0.0000	0.0000	135.1824	341.7703	559.8195	(98)
Space heating												2562.8469	(98)
RHI space heating demand												2563	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3324	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3603	0.3532	0.3462	0.3108	0.3038	0.2684	0.2684	0.2614	0.2826	0.3038	0.3179	0.3320	(22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5461	0.5360	0.5360	0.5342	0.5399	0.5461	0.5505	0.5551	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9410	44.7405	44.5440	43.6209	43.4482	42.6442	42.6442	42.4954	42.9539	43.4482	43.7976	44.1629	(38)
Heat transfer coeff	108.4852	108.2847	108.0882	107.1651	106.9924	106.1884	106.1884	106.0396	106.4981	106.9924	107.3418	107.7071	(39)
Average = Sum(39)m / 12 =												107.1643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1633	1.1611	1.1590	1.1491	1.1472	1.1386	1.1386	1.1370	1.1419	1.1472	1.1510	1.1549	(40)
HLP (average)												1.1491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6983	59.8089	59.9176	60.4337	60.5313	60.9896	60.9896	61.0752	60.8122	60.5313	60.3343	60.1297	
alpha	4.9799	4.9873	4.9945	5.0289	5.0354	5.0660	5.0660	5.0717	5.0541	5.0354	5.0223	5.0086	
util living area													
	0.9922	0.9847	0.9688	0.9288	0.8385	0.6733	0.5039	0.5405	0.7639	0.9373	0.9846	0.9939	(86)
MIT	19.9393	20.1008	20.3288	20.6029	20.8296	20.9586	20.9921	20.9888	20.9203	20.6376	20.2349	19.9028	(87)
Th 2	19.9495	19.9512	19.9529	19.9609	19.9624	19.9694	19.9694	19.9707	19.9667	19.9624	19.9594	19.9562	(88)
util rest of house													
	0.9897	0.9799	0.9587	0.9050	0.7862	0.5821	0.3904	0.4260	0.6812	0.9114	0.9788	0.9919	(89)
MIT 2	18.5609	18.7954	19.1227	19.5095	19.8006	19.9427	19.9666	19.9663	19.9077	19.5648	18.9972	18.5129	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9174	19.1330	19.4346	19.7923	20.0667	20.2054	20.2318	20.2307	20.1696	19.8423	19.3173	18.8723	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9174	19.1330	19.4346	19.7923	20.0667	20.2054	20.2318	20.2307	20.1696	19.8423	19.3173	18.8723	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9524	0.9004	0.7920	0.6041	0.4199	0.4557	0.6989	0.9077	0.9741	0.9891	(94)
Useful gains	751.4450	840.2841	884.3959	874.8762	780.1439	572.9899	382.7920	401.8716	600.0214	729.3286	724.3495	715.5129	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1585.7754	1541.2175	1398.0774	1167.2725	895.1785	595.2317	385.6567	406.2096	646.3977	988.8542	1311.4298	1580.3154	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	620.7418	471.0272	382.1790	210.5253	85.5858	0.0000	0.0000	0.0000	0.0000	193.0871	422.6978	643.4130	(98)
Space heating												3029.2571	(98)
Space heating per m2											(98) / (4) =	32.4818	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3246.7921	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.7418	471.0272	382.1790	210.5253	85.5858	0.0000	0.0000	0.0000	0.0000	193.0871	422.6978	643.4130	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	665.3181	504.8524	409.6238	225.6434	91.7318	0.0000	0.0000	0.0000	0.0000	206.9529	453.0523	689.6174	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4973	89.4038	89.2287	88.8480	88.0818	86.7000	86.7000	86.7000	86.7000	88.7397	89.3126	89.5376	(217)
Fuel for water heating, kWh/month													
	191.0792	167.6631	174.2294	153.7815	149.7645	132.6794	124.3201	140.7076	141.8108	159.8194	171.7390	185.3732	(219)
Water heating fuel used												1892.9671	(219)
Annual totals kWh/year													
Space heating fuel - main system												3246.7921	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4926.5794	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3246.7921	3.4800	112.9884	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1892.9671	3.4800	65.8753	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			270.7452	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8225	(257)
SAP value		88.5267	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3246.7921	0.2160	701.3071	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1892.9671	0.2160	408.8809	(264)
Space and water heating			1110.1880	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			999.5476	(272)
CO2 emissions per m2			10.7200	(273)
EI value			90.3125	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8829 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8829 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3324	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2967	0.2755	0.2826	0.2684	0.2684	0.2614	0.2543	0.2473	0.2402	0.2614	0.2473	0.2614	(22b)
Effective ac	0.5440	0.5380	0.5399	0.5360	0.5360	0.5342	0.5323	0.5306	0.5288	0.5342	0.5306	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2795	42.7971	42.9539	42.6442	42.6442	42.4954	42.3504	42.2095	42.0725	42.4954	42.2095	42.4954	(38)
Heat transfer coeff	106.8237	106.3413	106.4981	106.1884	106.1884	106.0396	105.8946	105.7537	105.6167	106.0396	105.7537	106.0396	(39)
Average = Sum(39)m / 12 =												106.0981	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1454	1.1403	1.1419	1.1386	1.1386	1.1370	1.1355	1.1340	1.1325	1.1370	1.1340	1.1370	(40)
HLP (average)												1.1377	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6269	60.9019	60.8122	60.9896	60.9896	61.0752	61.1588	61.2403	61.3197	61.0752	61.2403	61.0752	
alpha	5.0418	5.0601	5.0541	5.0660	5.0660	5.0717	5.0773	5.0827	5.0880	5.0717	5.0827	5.0717	
util living area													
	0.9888	0.9817	0.9607	0.9062	0.7916	0.5832	0.4270	0.4377	0.6891	0.9047	0.9752	0.9910	(86)
MIT	20.0600	20.1799	20.4138	20.6826	20.8846	20.9805	20.9967	20.9963	20.9555	20.7383	20.3728	20.0378	(87)
Th 2	19.9639	19.9681	19.9667	19.9694	19.9694	19.9707	19.9720	19.9732	19.9744	19.9707	19.9732	19.9707	(88)
util rest of house													
	0.9852	0.9760	0.9480	0.8758	0.7281	0.4866	0.3163	0.3246	0.5963	0.8669	0.9659	0.9881	(89)
MIT 2	18.7463	18.9217	19.2530	19.6214	19.8688	19.9602	19.9711	19.9722	19.9457	19.7020	19.2044	18.7195	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9417	0.8733	0.7390	0.5112	0.3451	0.3540	0.6186	0.8669	0.9604	0.9845	(94)
Useful gains	781.0875	847.0285	891.7981	873.7714	735.9074	512.8501	331.1245	330.6434	557.7763	727.0651	752.7539	738.5220	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1515.4109	1483.1515	1336.8955	1103.9200	810.3753	522.1506	332.1200	331.7555	581.6135	908.7619	1227.4350	1490.9676	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.3366	427.4746	331.1524	165.7069	55.4041	0.0000	0.0000	0.0000	0.0000	135.1824	341.7703	559.8195	(98)
Space heating												2562.8469	(98)
Space heating per m2											(98) / (4) =	27.4807	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2746.8884	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	546.3366	427.4746	331.1524	165.7069	55.4041	0.0000	0.0000	0.0000	0.0000	135.1824	341.7703	559.8195	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	585.5698	458.1721	354.9329	177.6066	59.3827	0.0000	0.0000	0.0000	0.0000	144.8900	366.3133	600.0209	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4149	89.3369	89.1178	88.6368	87.7345	86.7000	86.7000	86.7000	86.7000	88.4203	89.1533	89.4506	(217)
Fuel for water heating, kWh/month													
	191.2554	167.7886	174.4461	154.1480	150.3573	132.6794	124.3201	140.7076	141.8108	160.3967	172.0459	185.5535	(219)
Water heating fuel used												1895.5094	(219)
Annual totals kWh/year													
Space heating fuel - main system												2746.8884	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4345.8680	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2746.8884	7.3800	202.7204	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.5094	7.3800	139.8886	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			364.6235	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2746.8884	0.2160	593.3279	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5094	0.2160	409.4300	(264)
Space and water heating			1002.7579	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			848.8590	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2746.8884	1.2200	3351.2039	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5094	1.2200	2312.5214	(264)
Space and water heating			5663.7253	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4753.3788	(272)
Primary energy kWh/m2/year			50.9691	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£450	£375	£74
Space heating	£331	£331	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£365	£305	£60
Total cost of uses	£365	£305	£60
Delivered energy	47 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	39 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.1600	
Infiltration rate		0.3324	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3603	0.3532	0.3462	0.3108	0.3038	0.2684	0.2684	0.2614	0.2826	0.3038	0.3179	0.3320	(22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5461	0.5360	0.5360	0.5342	0.5399	0.5461	0.5505	0.5551	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9410	44.7405	44.5440	43.6209	43.4482	42.6442	42.6442	42.4954	42.9539	43.4482	43.7976	44.1629	(38)
Heat transfer coeff	108.4852	108.2847	108.0882	107.1651	106.9924	106.1884	106.1884	106.0396	106.4981	106.9924	107.3418	107.7071	(39)
Average = Sum(39)m / 12 =												107.1643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1633	1.1611	1.1590	1.1491	1.1472	1.1386	1.1386	1.1370	1.1419	1.1472	1.1510	1.1549	(40)
HLP (average)												1.1491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1815	(H8)
Utilisation factor												0.5710	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-862.7264	(H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352	(63)
								Solar input (sum of months) = Sum(63)m =				-862.7264	(63)
Output from w/h													
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
								Total per year (kWh/year) = Sum(64)m =				818.2658	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6983	59.8089	59.9176	60.4337	60.5313	60.9896	60.9896	61.0752	60.8122	60.5313	60.3343	60.1297	
alpha	4.9799	4.9873	4.9945	5.0289	5.0354	5.0660	5.0660	5.0717	5.0541	5.0354	5.0223	5.0086	
util living area													
	0.9922	0.9847	0.9688	0.9288	0.8385	0.6733	0.5039	0.5405	0.7639	0.9373	0.9846	0.9939	(86)
MIT	19.9393	20.1008	20.3288	20.6029	20.8296	20.9586	20.9921	20.9888	20.9203	20.6376	20.2349	19.9028	(87)
Th 2	19.9495	19.9512	19.9529	19.9609	19.9624	19.9694	19.9694	19.9707	19.9667	19.9624	19.9594	19.9562	(88)
util rest of house													
	0.9897	0.9799	0.9587	0.9050	0.7862	0.5821	0.3904	0.4260	0.6812	0.9114	0.9788	0.9919	(89)
MIT 2	18.5609	18.7954	19.1227	19.5095	19.8006	19.9427	19.9666	19.9663	19.9077	19.5648	18.9972	18.5129	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9174	19.1330	19.4346	19.7923	20.0667	20.2054	20.2318	20.2307	20.1696	19.8423	19.3173	18.8723	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9174	19.1330	19.4346	19.7923	20.0667	20.2054	20.2318	20.2307	20.1696	19.8423	19.3173	18.8723	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9524	0.9004	0.7920	0.6041	0.4199	0.4557	0.6989	0.9077	0.9741	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4450	840.2841	884.3959	874.8762	780.1439	572.9899	382.7920	401.8716	600.0214	729.3286	724.3495	715.5129	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1585.7754	1541.2175	1398.0774	1167.2725	895.1785	595.2317	385.6567	406.2096	646.3977	988.8542	1311.4298	1580.3154	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	620.7418	471.0272	382.1790	210.5253	85.5858	0.0000	0.0000	0.0000	0.0000	193.0871	422.6978	643.4130	(98)

Space heating 3029.2571 (98)
Space heating per m2 (98) / (4) = 32.4818 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3246.7921 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	620.7418	471.0272	382.1790	210.5253	85.5858	0.0000	0.0000	0.0000	0.0000	193.0871	422.6978	643.4130	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	665.3181	504.8524	409.6238	225.6434	91.7318	0.0000	0.0000	0.0000	0.0000	206.9529	453.0523	689.6174	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5917	89.6052	89.6270	89.6887	89.7697	86.7000	86.7000	86.7000	86.7000	89.1372	89.4590	89.6155	(217)
Fuel for water heating, kWh/month	162.9543	120.6966	94.1268	46.0977	15.8135	0.0000	0.0000	25.6169	51.6716	99.2353	138.2873	161.8509	(219)

Water heating fuel used 916.3509 (219)
Annual totals kWh/year
Space heating fuel - main system 3246.7921 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 411.3521 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) = -699.5320 -699.5320 (233)
Total delivered energy for all uses 3999.9632 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3246.7921	3.4800	112.9884	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.3509	3.4800	31.8890	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			243.3540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7392 (257)
SAP value 89.6875
SAP rating (Section 12) 90 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3246.7921	0.2160	701.3071	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.3509	0.2160	197.9318	(264)
Space and water heating			899.2389	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			814.5485 (272)
CO2 emissions per m2			8.7300 (273)
EI value			92.1055
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.1600	
Infiltration rate			0.3324	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2826	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2967	0.2755	0.2826	0.2684	0.2684	0.2614	0.2543	0.2473	0.2402	0.2614	0.2473	0.2614	(22b)
Effective ac	0.5440	0.5380	0.5399	0.5360	0.5360	0.5342	0.5323	0.5306	0.5288	0.5342	0.5306	0.5342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2795	42.7971	42.9539	42.6442	42.6442	42.4954	42.3504	42.2095	42.0725	42.4954	42.2095	42.4954	(38)
Heat transfer coeff	106.8237	106.3413	106.4981	106.1884	106.1884	106.0396	105.8946	105.7537	105.6167	106.0396	105.7537	106.0396	(39)
Average = Sum(39)m / 12 =												106.0981	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1454	1.1403	1.1419	1.1386	1.1386	1.1370	1.1355	1.1340	1.1325	1.1370	1.1340	1.1370	(40)
HLP (average)												1.1377	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3223 (H8)
Utilisation factor												0.5306 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-897.1283 (H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656 (63)
								Solar input (sum of months) = Sum(63)m =				-897.1283 (63)
Output from w/h												
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132 (64)
								Total per year (kWh/year) = Sum(64)m =				793.5279 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6269	60.9019	60.8122	60.9896	60.9896	61.0752	61.1588	61.2403	61.3197	61.0752	61.2403	61.0752	
alpha	5.0418	5.0601	5.0541	5.0660	5.0660	5.0717	5.0773	5.0827	5.0880	5.0717	5.0827	5.0717	
util living area													
	0.9888	0.9817	0.9607	0.9062	0.7916	0.5832	0.4270	0.4377	0.6891	0.9047	0.9752	0.9910	(86)
MIT	20.0600	20.1799	20.4138	20.6826	20.8846	20.9805	20.9967	20.9963	20.9555	20.7383	20.3728	20.0378	(87)
Th 2	19.9639	19.9681	19.9667	19.9694	19.9694	19.9707	19.9720	19.9732	19.9744	19.9707	19.9732	19.9707	(88)
util rest of house													
	0.9852	0.9760	0.9480	0.8758	0.7281	0.4866	0.3163	0.3246	0.5963	0.8669	0.9659	0.9881	(89)
MIT 2	18.7463	18.9217	19.2530	19.6214	19.8688	19.9602	19.9711	19.9722	19.9457	19.7020	19.2044	18.7195	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0861	19.2471	19.5532	19.8959	20.1315	20.2241	20.2363	20.2371	20.2068	19.9700	19.5065	19.0605	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9417	0.8733	0.7390	0.5112	0.3451	0.3540	0.6186	0.8669	0.9604	0.9845	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.0875	847.0285	891.7981	873.7714	735.9074	512.8501	331.1245	330.6434	557.7763	727.0651	752.7539	738.5220	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1515.4109	1483.1515	1336.8955	1103.9200	810.3753	522.1506	332.1200	331.7555	581.6135	908.7619	1227.4350	1490.9676	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	546.3366	427.4746	331.1524	165.7069	55.4041	0.0000	0.0000	0.0000	0.0000	135.1824	341.7703	559.8195	(98)
Space heating												2562.8469	(98)
Space heating per m2											(98) / (4) =	27.4807	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2746.8884	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	546.3366	427.4746	331.1524	165.7069	55.4041	0.0000	0.0000	0.0000	0.0000	135.1824	341.7703	559.8195	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	585.5698	458.1721	354.9329	177.6066	59.3827	0.0000	0.0000	0.0000	0.0000	144.8900	366.3133	600.0209	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5342	89.5485	89.5481	89.5749	89.3687	86.7000	86.7000	86.7000	86.7000	88.8815	89.3433	89.5480	(217)
Fuel for water heating, kWh/month													
	158.3132	120.9201	93.7331	44.7962	20.7720	0.0000	0.0000	18.3443	46.0088	94.9558	132.9367	158.4771	(219)
Water heating fuel used												889.2572	(219)
Annual totals kWh/year													
Space heating fuel - main system												2746.8884	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												3389.6158	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2746.8884	7.3800	202.7204	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.2572	7.3800	65.6272	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			304.6921	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2746.8884	0.2160	593.3279	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2572	0.2160	192.0796	(264)
Space and water heating			785.4075	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			657.4585	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2746.8884	1.2200	3351.2039	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2572	1.2200	1084.8938	(264)
Space and water heating			4436.0976	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3679.2511	(272)
Primary energy kWh/m2/year			39.4515	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
East	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 383 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 383 EPC	**Prop Type Ref**	
Property	26 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.57	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.78		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.86	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.57	$kgCO_2/m^2$	Pass
	-4.84 (-27.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.86	$kWh/m^2/yr$	
	-5.0 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	4.09 m², No overhang 1.53 m², No overhang 7.79 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.16 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 384 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 384	**Prop Type Ref**	
Property	27 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.57	**TER**	18.78
Environmental	90 B	**% DER<TER**	27.75		
CO_2 Emissions (t/year)	0.77	**DFEE**	47.47	**TFEE**	53.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.95		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 76 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.78 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.57 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.5 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.70 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.01 m², No overhang
Windows facing East: 2.98 m², No overhang
Windows facing South: 4.40 m², No overhang
Windows facing West: 6.78 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Air permeability 3.7 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.2957	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2514	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3205	0.3142	0.3079	0.2765	0.2702	0.2388	0.2388	0.2325	0.2514	0.2702	0.2828	0.2954	(22b)
Effective ac	0.5514	0.5494	0.5474	0.5382	0.5365	0.5285	0.5285	0.5270	0.5316	0.5365	0.5400	0.5436	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.8642	32.7453	32.6288	32.0815	31.9791	31.5024	31.5024	31.4142	31.6860	31.9791	32.1862	32.4028	(38)
Heat transfer coeff	94.9001	94.7812	94.6647	94.1174	94.0150	93.5383	93.5383	93.4501	93.7219	94.0150	94.2221	94.4387	(39)
Average = Sum(39)m / 12 =												94.1169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2480	1.2465	1.2449	1.2377	1.2364	1.2301	1.2301	1.2290	1.2325	1.2364	1.2391	1.2420	(40)
HLP (average)												1.2377	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	361.7408	359.7185	346.7103	325.7258	304.4461	283.8895	270.4977	276.3212	287.0636	308.2555	332.6169	350.8640	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	508.0059	622.6252	736.5330	848.6449	918.9539	904.5812	864.6381	801.8558	723.6453	607.5634	510.4716	474.2286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6433	55.7131	55.7817	56.1061	56.1672	56.4534	56.4534	56.5067	56.3428	56.1672	56.0437	55.9152	
alpha	4.7096	4.7142	4.7188	4.7404	4.7445	4.7636	4.7636	4.7671	4.7562	4.7445	4.7362	4.7277	
util living area													
	0.9968	0.9913	0.9747	0.9225	0.8048	0.6273	0.4686	0.5230	0.7768	0.9576	0.9929	0.9977	(86)
MIT	19.6914	19.8970	20.2051	20.5673	20.8361	20.9620	20.9922	20.9872	20.8971	20.5186	20.0243	19.6475	(87)
Th 2	19.8818	19.8830	19.8842	19.8899	19.8910	19.8960	19.8960	19.8969	19.8941	19.8910	19.8888	19.8866	(88)
util rest of house													
	0.9957	0.9884	0.9661	0.8965	0.7460	0.5331	0.3549	0.4042	0.6913	0.9379	0.9901	0.9969	(89)
MIT 2	18.1527	18.4524	18.8965	19.4029	19.7404	19.8726	19.8934	19.8921	19.8178	19.3502	18.6435	18.0920	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	18.7648	19.0271	19.4171	19.8661	20.1763	20.3060	20.3305	20.3278	20.2472	19.8150	19.1928	18.7108	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7648	19.0271	19.4171	19.8661	20.1763	20.3060	20.3305	20.3278	20.2472	19.8150	19.1928	18.7108	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9853	0.9615	0.8958	0.7624	0.5694	0.4004	0.4517	0.7210	0.9362	0.9876	0.9957	(94)
Useful gains	505.0309	613.4972	708.1916	760.2525	700.5938	515.1098	346.1707	362.1967	521.7826	568.8096	504.1228	472.1691	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1372.7132	1338.9833	1222.7927	1032.1004	796.8957	533.7252	348.9469	367.0486	576.1258	866.3480	1139.4100	1370.3790	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	645.5556	487.5267	382.8632	195.7305	71.6486	0.0000	0.0000	0.0000	0.0000	221.3686	457.4068	668.2681	(98)
Space heating												3130.3681	(98)
Space heating per m2											(98) / (4) =	41.1674	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3355.1641	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	645.5556	487.5267	382.8632	195.7305	71.6486	0.0000	0.0000	0.0000	0.0000	221.3686	457.4068	668.2681	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	691.9139	522.5366	410.3572	209.7862	76.7937	0.0000	0.0000	0.0000	0.0000	237.2653	490.2538	716.2574	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5615	89.4701	89.2792	88.8419	87.9874	86.7000	86.7000	86.7000	86.7000	88.9157	89.4133	89.5985	(217)
Fuel for water heating, kWh/month													
	178.6165	156.7365	162.9500	143.9980	140.4377	124.3722	116.6223	131.8729	132.8691	149.3404	160.5238	173.3152	(219)
Water heating fuel used												1771.6547	(219)
Annual totals kWh/year													
Space heating fuel - main system												3355.1641	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4981.8445	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3355.1641	0.2160	724.7154	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1771.6547	0.2160	382.6774	(264)
Space and water heating			1107.3929	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1032.1512	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5700	ZC1
Total Floor Area	TFA	76.0400	
Assumed number of occupants	N	2.3834	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4405	ZC2
CO2 emissions from cooking, equation (L16)		2.3172	ZC3
Total CO2 emissions		32.3278	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.3278	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4161	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4509	0.4421	0.4333	0.3890	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5564	0.5564	0.5535	0.5625	0.5723	0.5792	0.5863	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	90.5300	18.2900	72.2400	0.1800	13.0032			(29a)
Roof	70.5500		70.5500	0.1300	9.1715			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8699			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1406	(36)
Total fabric heat loss					(33) + (36) =		57.0105	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.8632	35.6279	35.3972	34.3138	34.1111	33.1674	33.1674	32.9927	33.5309	34.1111	34.5211	34.9499	(38)
Heat transfer coeff	92.8737	92.6384	92.4077	91.3243	91.1216	90.1779	90.1779	90.0032	90.5414	91.1216	91.5316	91.9604	(39)
Average = Sum(39)m / 12 =												91.3233	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2214	1.2183	1.2153	1.2010	1.1983	1.1859	1.1859	1.1836	1.1907	1.1983	1.2037	1.2094	(40)
HLP (average)												1.2010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9014	44.3036	47.1995	43.8857	43.4976	40.3032	41.6466	43.4976	43.8857	47.1995	47.4682	50.9014	(61)
Total heat required for water heating calculated for each month													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(64)
								Total per year (kWh/year) = Sum(64)m =				1973.4301	(64)
Heat gains from water heating, kWh/month													
	61.9785	54.1530	56.2516	49.7255	48.0599	42.1640	40.1461	44.9951	45.4997	52.0392	55.7914	60.4244	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	83.3044	80.5849	75.6070	69.0632	64.5966	58.5612	53.9598	60.4773	63.1940	69.9452	77.4881	81.2156	(72)
Total internal gains													
	374.8657	372.2284	358.6083	337.0136	315.1201	293.9515	280.5656	287.0008	298.3596	320.1618	345.1315	363.9922	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.6300	0.7000	0.7700	6.5319	(74)
East	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(76)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
West	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(80)

Solar gains	127.9819	230.0434	341.0948	457.5542	537.6943	543.1052	519.8729	459.8428	382.0090	261.8944	155.6229	107.9440	(83)
Total gains	502.8476	602.2718	699.7031	794.5678	852.8145	837.0567	800.4385	746.8436	680.3686	582.0562	500.7544	471.9362	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8574	57.0018	57.1441	57.8220	57.9507	58.5571	58.5571	58.6708	58.3220	57.9507	57.6910	57.4221	
alpha	4.7905	4.8001	4.8096	4.8548	4.8634	4.9038	4.9038	4.9114	4.8881	4.8634	4.8461	4.8281	
util living area													
	0.9969	0.9923	0.9785	0.9337	0.8268	0.6506	0.4876	0.5403	0.7929	0.9618	0.9934	0.9977	(86)
MIT	19.7202	19.9096	20.2002	20.5557	20.8258	20.9600	20.9920	20.9871	20.8955	20.5251	20.0523	19.6876	(87)
Th 2	19.9029	19.9054	19.9078	19.9192	19.9213	19.9313	19.9313	19.9331	19.9274	19.9213	19.9170	19.9125	(88)
util rest of house													
	0.9959	0.9897	0.9711	0.9108	0.7716	0.5576	0.3734	0.4221	0.7108	0.9438	0.9907	0.9970	(89)
MIT 2	18.2095	18.4867	18.9076	19.4126	19.7580	19.9061	19.9285	19.9281	19.8484	19.3833	18.7041	18.1687	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	18.8105	19.0527	19.4218	19.8674	20.1828	20.3254	20.3516	20.3494	20.2649	19.8375	19.2404	18.7729	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8105	19.0527	19.4218	19.8674	20.1828	20.3254	20.3516	20.3494	20.2649	19.8375	19.2404	18.7729	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9869	0.9668	0.9095	0.7863	0.5933	0.4191	0.4694	0.7391	0.9420	0.9883	0.9958	(94)
Useful gains	500.0353	594.4046	676.5047	722.6667	670.5478	496.6649	335.4305	350.5396	502.8355	548.3196	494.9198	469.9505	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1347.6400	1311.0875	1194.0738	1001.5858	772.9639	516.3009	338.3103	355.4596	558.1806	841.7397	1111.2313	1340.1321	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	630.6179	481.6109	385.0714	200.8218	76.1976	0.0000	0.0000	0.0000	0.0000	218.3046	443.7442	647.4151	(98)
Space heating												3083.7836	(98)
Space heating per m2											(98) / (4) =	40.5548	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3301.6955	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	630.6179	481.6109	385.0714	200.8218	76.1976	0.0000	0.0000	0.0000	0.0000	218.3046	443.7442	647.4151	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	675.1798	515.6434	412.2820	215.0126	81.5820	0.0000	0.0000	0.0000	0.0000	233.7308	475.1009	693.1640	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.0312	173.8589	180.8889	160.4394	155.3336	136.8092	131.0736	146.1163	147.7300	168.2201	179.5716	194.3572	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7522	87.4815	86.9063	85.6175	83.3653	80.3000	80.3000	80.3000	80.3000	85.7083	87.2388	87.8488	(217)
Fuel for water heating, kWh/month													
	226.8106	198.7380	208.1424	187.3909	186.3289	170.3726	163.2299	181.9631	183.9727	196.2705	205.8391	221.2406	(219)
Water heating fuel used												2330.2992	(219)
Annual totals kWh/year													
Space heating fuel - main system												3301.6955	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Total delivered energy for all uses												6039.7838	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3301.6955	0.2160	713.1662	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2330.2992	0.2160	503.3446	(264)
Space and water heating			1216.5109	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Total CO2, kg/m2/year			1428.1534	(272)
Emissions per m2 for space and water heating			15.9983	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2714	(272b)
Emissions per m2 for pumps and fans			0.5119	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9983 * 1.00) + 2.2714 + 0.5119, rounded to 2 d.p.			18.7800	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.3511	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2984	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3805	0.3730	0.3656	0.3283	0.3208	0.2835	0.2835	0.2760	0.2984	0.3208	0.3357	0.3507	(22b)
Effective ac	0.5724	0.5696	0.5668	0.5539	0.5515	0.5402	0.5402	0.5381	0.5445	0.5515	0.5564	0.5615	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.1177	33.9501	33.7859	33.0145	32.8702	32.1983	32.1983	32.0739	32.4571	32.8702	33.1622	33.4674	(38)
Heat transfer coeff	96.1536	95.9860	95.8218	95.0504	94.9061	94.2342	94.2342	94.1098	94.4930	94.9061	95.1981	95.5033	(39)
Average = Sum(39)m / 12 =												95.0497	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2645	1.2623	1.2601	1.2500	1.2481	1.2393	1.2393	1.2376	1.2427	1.2481	1.2519	1.2560	(40)
HLP (average)												1.2500	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3834	(42)
Average daily hot water use (litres/day)	90.8065	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)										Total = Sum(45)m =		1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.4776	27.5305	28.4090	24.7677	23.7652	20.5075	19.0032	21.8065	22.0669	25.7169	28.0720	30.4844	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	42.3086	40.9680	38.1841	34.3995	31.9424	28.4827	25.5420	29.3098	30.6485	34.5657	38.9889	40.9736	(72)
Total internal gains													
	330.8698	329.6115	318.1855	299.3499	279.4660	260.8730	249.1477	252.8333	262.8141	281.7823	303.6323	320.7502	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	477.1349	592.5183	708.0081	822.2690	893.9738	881.5647	843.2881	778.3679	699.3958	581.0902	481.4870	444.1148	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9179	55.0138	55.1081	55.5553	55.6398	56.0365	56.0365	56.1106	55.8830	55.6398	55.4692	55.2919	
alpha	4.6612	4.6676	4.6739	4.7037	4.7093	4.7358	4.7358	4.7407	4.7255	4.7093	4.6979	4.6861	
util living area													
	0.9975	0.9929	0.9785	0.9310	0.8195	0.6437	0.4829	0.5403	0.7952	0.9643	0.9945	0.9982	(86)
MIT	19.6331	19.8417	20.1566	20.5335	20.8180	20.9567	20.9910	20.9850	20.8836	20.4823	19.9761	19.5931	(87)
Th 2	19.8687	19.8705	19.8722	19.8802	19.8817	19.8887	19.8887	19.8900	19.8860	19.8817	19.8787	19.8755	(88)
util rest of house													
	0.9967	0.9905	0.9710	0.9070	0.7622	0.5482	0.3655	0.4179	0.7112	0.9471	0.9922	0.9976	(89)
MIT 2	18.6330	18.8416	19.1532	19.5189	19.7663	19.8703	19.8866	19.8861	19.8261	19.4806	18.9828	18.5984	(90)
Living area fraction										fLA = Living area / (4) =		0.3978	(91)
MIT	19.0308	19.2395	19.5523	19.9225	20.1847	20.3025	20.3260	20.3233	20.2468	19.8791	19.3780	18.9941	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0308	19.2395	19.5523	19.9225	20.1847	20.3025	20.3260	20.3233	20.2468	19.8791	19.3780	18.9941	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9888	0.9684	0.9081	0.7792	0.5853	0.4125	0.4670	0.7411	0.9471	0.9908	0.9970	(94)
Useful gains	475.1464	585.8600	685.6201	746.6845	696.5491	515.9985	347.8586	363.4843	518.3174	550.3236	477.0684	442.7692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1416.4221	1376.3886	1250.6973	1047.6968	805.2492	537.3734	351.1121	369.2190	580.8290	880.6440	1168.8390	1412.8825	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.3091	531.2352	420.4174	216.7288	80.8728	0.0000	0.0000	0.0000	0.0000	245.7583	498.0748	721.7643	(98)
Space heating												3415.1608	(98)
Space heating per m2											(98) / (4) =	44.9127	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	885.8019	697.3334	715.2347	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9067	0.9502	0.9315	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	803.1353	662.6330	666.2355	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1119.0332	1072.4749	998.0540	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	227.4465	304.9223	246.8730	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											779.2418	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	56.8616	76.2306	61.7183	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											194.8105	(107)
Space cooling per m2											2.5619	(108)
Energy for space heating											44.9127	(99)
Energy for space cooling											2.5619	(108)
Total											47.4746	(109)
Dwelling Fabric Energy Efficiency (DFEE)											47.5	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1661	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4161	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3537	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4509	0.4421	0.4333	0.3890	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156	(22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5564	0.5564	0.5535	0.5625	0.5723	0.5792	0.5863	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	90.5300	18.2900	72.2400	0.1800	13.0032			(29a)
Roof	70.5500		70.5500	0.1300	9.1715			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8699			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1406	(36)
Total fabric heat loss					(33) + (36) =		57.0105	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.8632	35.6279	35.3972	34.3138	34.1111	33.1674	33.1674	32.9927	33.5309	34.1111	34.5211	34.9499	(38)
Heat transfer coeff	92.8737	92.6384	92.4077	91.3243	91.1216	90.1779	90.1779	90.0032	90.5414	91.1216	91.5316	91.9604	(39)
Average = Sum(39)m / 12 =												91.3233	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2214	1.2183	1.2153	1.2010	1.1983	1.1859	1.1859	1.1836	1.1907	1.1983	1.2037	1.2094	(40)
HLP (average)												1.2010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.4776	27.5305	28.4090	24.7677	23.7652	20.5075	19.0032	21.8065	22.0669	25.7169	28.0720	30.4844	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	119.1716	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.8439	16.7370	13.6114	10.3047	7.7029	6.5031	7.0268	9.1338	12.2593	15.5660	18.1678	19.3676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.9658	213.1550	207.6384	195.8941	181.0691	167.1357	157.8274	155.6382	161.1548	172.8991	187.7241	201.6575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	34.9172	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	42.3086	40.9680	38.1841	34.3995	31.9424	28.4827	25.5420	29.3098	30.6485	34.5657	38.9889	40.9736	(72)
Total internal gains													
	330.8698	329.6115	318.1855	299.3499	279.4660	260.8730	249.1477	252.8333	262.8141	281.7823	303.6323	320.7502	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.6300	0.7000	0.7700	6.5319	(74)
East	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(76)
South	4.4000	46.7521	0.6300	0.7000	0.7700	62.8674	(78)
West	6.7800	19.6403	0.6300	0.7000	0.7700	40.6957	(80)

Solar gains	127.9819	230.0434	341.0948	457.5542	537.6943	543.1052	519.8729	459.8428	382.0090	261.8944	155.6229	107.9440	(83)
Total gains	458.8517	559.6549	659.2803	756.9041	817.1603	803.9782	769.0206	712.6761	644.8231	543.6767	459.2552	428.6942	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8574	57.0018	57.1441	57.8220	57.9507	58.5571	58.5571	58.6708	58.3220	57.9507	57.6910	57.4221	
alpha	4.7905	4.8001	4.8096	4.8548	4.8634	4.9038	4.9038	4.9114	4.8881	4.8634	4.8461	4.8281	
util living area													
	0.9979	0.9943	0.9830	0.9437	0.8442	0.6714	0.5060	0.5633	0.8168	0.9703	0.9954	0.9985	(86)
MIT	19.6673	19.8594	20.1555	20.5218	20.8070	20.9542	20.9906	20.9846	20.8798	20.4856	20.0030	19.6353	(87)
Th 2	19.9029	19.9054	19.9078	19.9192	19.9213	19.9313	19.9313	19.9331	19.9274	19.9213	19.9170	19.9125	(88)
util rest of house													
	0.9972	0.9924	0.9769	0.9234	0.7915	0.5777	0.3883	0.4415	0.7378	0.9557	0.9935	0.9980	(89)
MIT 2	18.6940	18.8872	19.1817	19.5430	19.7960	19.9113	19.9290	19.9290	19.8638	19.5175	19.0402	18.6698	(90)
Living area fraction										fLA = Living area / (4) =		0.3978	(91)
MIT	19.0812	19.2739	19.5691	19.9324	20.1982	20.3262	20.3514	20.3489	20.2680	19.9027	19.4232	19.0539	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0812	19.2739	19.5691	19.9324	20.1982	20.3262	20.3514	20.3489	20.2680	19.9027	19.4232	19.0539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9909	0.9745	0.9236	0.8064	0.6140	0.4355	0.4904	0.7655	0.9553	0.9923	0.9974	(94)
Useful gains	457.2455	554.5616	642.4943	699.1103	658.9580	493.6408	334.8847	349.4724	493.6151	519.3956	455.7384	427.6000	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1372.7853	1331.5770	1207.6832	1007.5246	774.3715	516.3734	338.2890	355.4152	558.4570	847.6726	1127.9625	1365.9675	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	681.1616	522.1544	420.5005	222.0583	85.8676	0.0000	0.0000	0.0000	0.0000	244.2381	484.0014	698.1455	(98)
Space heating												3358.1274	(98)
Space heating per m2											(98) / (4) =	44.1626	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	847.6724	667.3165	684.0240	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8999	0.9470	0.9279	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.8068	631.9531	634.7362	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1028.3477	985.6687	921.2713	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	191.1895	263.1644	213.1822	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                667.5361 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   47.7974   65.7911   53.2955    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                166.8840 (107)
Space cooling per m2                                                                                           2.1947 (108)
Energy for space heating                                                                                      44.1626 (99)
Energy for space cooling                                                                                       2.1947 (108)
Total                                                                                                         46.3573 (109)
Target Fabric Energy Efficiency (TFEE)                                                                        53.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.2957	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2514	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2639	0.2451	0.2514	0.2388	0.2388	0.2325	0.2262	0.2199	0.2137	0.2325	0.2199	0.2325	(22b)
Effective ac	0.5348	0.5300	0.5316	0.5285	0.5285	0.5270	0.5256	0.5242	0.5228	0.5270	0.5242	0.5270	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.8791	31.5931	31.6860	31.5024	31.5024	31.4142	31.3282	31.2447	31.1635	31.4142	31.2447	31.4142	(38)
Heat transfer coeff	93.9150	93.6290	93.7219	93.5383	93.5383	93.4501	93.3641	93.2806	93.1994	93.4501	93.2806	93.4501	(39)
Average = Sum(39)m / 12 =												93.4848	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2351	1.2313	1.2325	1.2301	1.2301	1.2290	1.2278	1.2267	1.2257	1.2290	1.2267	1.2290	(40)
HLP (average)												1.2294	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)											Total = Sum(45)m =	1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
RHI water heating demand												1567	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	13.4839	0.7200	0.7000	0.7700	9.4662	(74)
East	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(76)
South	4.4000	56.7559	0.7200	0.7000	0.7700	87.2222	(78)
West	6.7800	25.1925	0.7200	0.7000	0.7700	59.6576	(80)

Solar gains	182.5671	279.6277	418.8427	566.8584	634.5591	696.9477	661.6109	598.5540	495.9601	343.7098	221.3467	151.3226	(83)
Total gains	717.0835	810.0397	928.8410	1045.1277	1080.3440	1113.5137	1060.9859	1005.8347	921.3886	801.0748	714.2777	671.1631	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2270	56.3987	56.3428	56.4534	56.4534	56.5067	56.5587	56.6094	56.6587	56.5067	56.6094	56.5067	
alpha	4.7485	4.7599	4.7562	4.7636	4.7636	4.7671	4.7706	4.7740	4.7772	4.7671	4.7740	4.7671	
util living area													
	0.9846	0.9728	0.9345	0.8382	0.6815	0.4708	0.3418	0.3599	0.6082	0.8699	0.9665	0.9878	(86)
MIT	20.0197	20.1700	20.4597	20.7569	20.9285	20.9898	20.9982	20.9978	20.9674	20.7561	20.3524	19.9867	(87)
Th 2	19.8920	19.8950	19.8941	19.8960	19.8960	19.8969	19.8978	19.8987	19.8995	19.8969	19.8987	19.8969	(88)
util rest of house													
	0.9797	0.9645	0.9152	0.7954	0.6105	0.3833	0.2460	0.2592	0.5141	0.8229	0.9542	0.9838	(89)
MIT 2	18.6353	18.8518	19.2553	19.6444	19.8385	19.8919	19.8974	19.8981	19.8800	19.6565	19.1178	18.5918	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.1860	19.3762	19.7344	20.0870	20.2721	20.3286	20.3353	20.3356	20.3126	20.0940	19.6090	19.1467	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1860	19.3762	19.7344	20.0870	20.2721	20.3286	20.3353	20.3356	20.3126	20.0940	19.6090	19.1467	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9596	0.9119	0.8035	0.6358	0.4180	0.2842	0.2994	0.5507	0.8324	0.9501	0.9802	(94)
Useful gains	699.5615	777.2798	847.0007	839.7570	686.8668	465.4506	301.5219	301.1425	507.3665	666.7978	678.6683	657.8464	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1341.6738	1317.9378	1193.4949	990.2882	726.9897	469.9265	302.0614	301.8177	523.0919	812.4508	1092.2192	1322.0101	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	477.7316	363.3222	257.7916	108.3825	29.8515	0.0000	0.0000	0.0000	0.0000	108.3658	297.7566	494.1378	(98)
Space heating												2137.3396	(98)
RHI space heating demand												2137	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.2957	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2514	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3205	0.3142	0.3079	0.2765	0.2702	0.2388	0.2388	0.2325	0.2514	0.2702	0.2828	0.2954	(22b)
Effective ac	0.5514	0.5494	0.5474	0.5382	0.5365	0.5285	0.5285	0.5270	0.5316	0.5365	0.5400	0.5436	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.8642	32.7453	32.6288	32.0815	31.9791	31.5024	31.5024	31.4142	31.6860	31.9791	32.1862	32.4028	(38)
Heat transfer coeff	94.9001	94.7812	94.6647	94.1174	94.0150	93.5383	93.5383	93.4501	93.7219	94.0150	94.2221	94.4387	(39)
Average = Sum(39)m / 12 =												94.1169	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2480	1.2465	1.2449	1.2377	1.2364	1.2301	1.2301	1.2290	1.2325	1.2364	1.2391	1.2420	(40)
HLP (average)												1.2377	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)										Total = Sum(45)m =		1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	10.6334	0.7200	0.7000	0.7700	7.4650	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	4.4000	46.7521	0.7200	0.7000	0.7700	71.8484	(78)
West	6.7800	19.6403	0.7200	0.7000	0.7700	46.5094	(80)

Solar gains	146.2650	262.9068	389.8226	522.9191	614.5078	620.6916	594.1405	525.5347	436.5817	299.3079	177.8547	123.3646	(83)
Total gains	680.7815	793.3187	899.8210	1001.1884	1060.2928	1037.2576	993.5154	932.8153	862.0102	756.6729	670.7857	643.2051	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6433	55.7131	55.7817	56.1061	56.1672	56.4534	56.4534	56.5067	56.3428	56.1672	56.0437	55.9152	
alpha	4.7096	4.7142	4.7188	4.7404	4.7445	4.7636	4.7636	4.7671	4.7562	4.7445	4.7362	4.7277	
util living area													
	0.9892	0.9775	0.9484	0.8744	0.7381	0.5586	0.4106	0.4546	0.6911	0.9130	0.9790	0.9916	(86)
MIT	19.8941	20.0890	20.3696	20.6798	20.8885	20.9765	20.9956	20.9929	20.9381	20.6512	20.2064	19.8475	(87)
Th 2	19.8818	19.8830	19.8842	19.8899	19.8910	19.8960	19.8960	19.8969	19.8941	19.8910	19.8888	19.8866	(88)
util rest of house													
	0.9858	0.9706	0.9329	0.8390	0.6744	0.4701	0.3095	0.3488	0.6021	0.8795	0.9713	0.9889	(89)
MIT 2	18.4465	18.7273	19.1239	19.5438	19.7931	19.8821	19.8945	19.8943	19.8513	19.5206	18.9037	18.3826	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.0224	19.2690	19.6194	19.9958	20.2288	20.3175	20.3325	20.3314	20.2836	19.9703	19.4219	18.9654	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0224	19.2690	19.6194	19.9958	20.2288	20.3175	20.3325	20.3314	20.2836	19.9703	19.4219	18.9654	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9658	0.9285	0.8427	0.6950	0.5047	0.3498	0.3910	0.6352	0.8823	0.9672	0.9859	(94)
Useful gains	668.7692	766.1584	835.4428	843.7376	736.8635	523.5179	347.5783	364.7526	547.5501	667.6133	648.7657	634.1644	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1397.1583	1361.9113	1241.9480	1044.3041	801.8397	534.8060	349.1361	367.3865	579.5421	880.9526	1160.9997	1394.4228	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	541.9215	400.3460	302.4398	144.4079	48.3423	0.0000	0.0000	0.0000	0.0000	158.7244	368.8085	565.6323	(98)
Space heating												2530.6227	(98)
Space heating per m2											(98) / (4) =	33.2802	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2712.3501	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	541.9215	400.3460	302.4398	144.4079	48.3423	0.0000	0.0000	0.0000	0.0000	158.7244	368.8085	565.6323	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	580.8376	429.0954	324.1585	154.7780	51.8139	0.0000	0.0000	0.0000	0.0000	170.1226	395.2931	606.2511	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4535	89.3377	89.0984	88.5724	87.6830	86.7000	86.7000	86.7000	86.7000	88.6238	89.2617	89.4995	(217)
Fuel for water heating, kWh/month													
	178.8322	156.9688	163.2807	144.4362	140.9253	124.3722	116.6223	131.8729	132.8691	149.8323	160.7964	173.5069	(219)
Water heating fuel used												1774.3155	(219)
Annual totals kWh/year													
Space heating fuel - main system												2712.3501	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4341.6913	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2712.3501	3.4800	94.3898	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1774.3155	3.4800	61.7462	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	332.7891	13.1900	43.8949	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			257.0139	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8918	(257)
SAP value		87.5591	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2712.3501	0.2160	585.8676	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1774.3155	0.2160	383.2521	(264)
Space and water heating			969.1198	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			893.8781	(272)
CO2 emissions per m2			11.7600	(273)
EI value			90.1041	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact	0.216 / 0.8819 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	5.4900 (1b)	x	2.8300 (2b)	=	15.5367	(1b) - (3b)
First floor	70.5500 (1c)	x	2.3400 (2c)	=	165.0870	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	180.6237	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1107	(8)
Pressure test		Yes	
Measured/design AP50		3.7000	
Infiltration rate		0.2957	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2514	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2639	0.2451	0.2514	0.2388	0.2388	0.2325	0.2262	0.2199	0.2137	0.2325	0.2199	0.2325	(22b)
Effective ac	0.5348	0.5300	0.5316	0.5285	0.5285	0.5270	0.5256	0.5242	0.5228	0.5270	0.5242	0.5270	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			16.1700	1.2357	19.9819			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1900	1.0431			(28a)
External Wall	90.5300	18.2900	72.2400	0.2700	19.5048			(29a)
Roof	70.5500		70.5500	0.1600	11.2880			(30)
Total net area of external elements Aum(A, m2)			166.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.9978			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0381	(36)
Total fabric heat loss					(33) + (36) =		62.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.8791	31.5931	31.6860	31.5024	31.5024	31.4142	31.3282	31.2447	31.1635	31.4142	31.2447	31.4142	(38)
Heat transfer coeff	93.9150	93.6290	93.7219	93.5383	93.5383	93.4501	93.3641	93.2806	93.1994	93.4501	93.2806	93.4501	(39)
Average = Sum(39)m / 12 =												93.4848	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2351	1.2313	1.2325	1.2301	1.2301	1.2290	1.2278	1.2267	1.2257	1.2290	1.2267	1.2290	(40)
HLP (average)												1.2294	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3834	(42)
Average daily hot water use (litres/day)												90.8065	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	99.8872	96.2549	92.6227	88.9904	85.3581	81.7259	81.7259	85.3581	88.9904	92.6227	96.2549	99.8872	(44)
Energy conte	148.1298	129.5553	133.6894	116.5537	111.8360	96.5060	89.4270	102.6188	103.8444	121.0206	132.1035	143.4558	(45)
Energy content (annual)										Total = Sum(45)m =		1428.7402	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2195	19.4333	20.0534	17.4831	16.7754	14.4759	13.4140	15.3928	15.5767	18.1531	19.8155	21.5184	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8418	10.6770	11.7911	11.3769	11.7315	11.3247	11.6845	11.7150	11.3532	11.7665	11.4261	11.8320	(61)
Total heat required for water heating calculated for each month													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
								Total per year (kWh/year) = Sum(64)m =				1567.2606	(64)
Heat gains from water heating, kWh/month													
	52.2136	45.7464	47.3995	41.5983	40.1184	34.9194	32.6556	37.0495	37.3665	43.1810	46.7809	50.6571	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	143.0060	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.1097	41.8425	34.0286	25.7618	19.2573	16.2578	17.5671	22.8344	30.6483	38.9150	45.4196	48.4191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	314.8744	318.1418	309.9080	292.3793	270.2525	249.4563	235.5632	232.2958	240.5296	258.0583	280.1852	300.9813	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	51.6840	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	-95.3373	(71)
Water heating gains (Table 5)													
	70.1796	68.0750	63.7090	57.7755	53.9225	48.4992	43.8920	49.7977	51.8980	58.0389	64.9735	68.0874	(72)
Total internal gains													
	534.5164	530.4119	509.9983	478.2693	445.7849	416.5660	399.3750	407.2806	425.4285	457.3650	492.9310	519.8405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0100	13.4839	0.7200	0.7000	0.7700	9.4662	(74)
East	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(76)
South	4.4000	56.7559	0.7200	0.7000	0.7700	87.2222	(78)
West	6.7800	25.1925	0.7200	0.7000	0.7700	59.6576	(80)

Solar gains	182.5671	279.6277	418.8427	566.8584	634.5591	696.9477	661.6109	598.5540	495.9601	343.7098	221.3467	151.3226	(83)
Total gains	717.0835	810.0397	928.8410	1045.1277	1080.3440	1113.5137	1060.9859	1005.8347	921.3886	801.0748	714.2777	671.1631	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2270	56.3987	56.3428	56.4534	56.4534	56.5067	56.5587	56.6094	56.6587	56.5067	56.6094	56.5067	
alpha	4.7485	4.7599	4.7562	4.7636	4.7636	4.7671	4.7706	4.7740	4.7772	4.7671	4.7740	4.7671	
util living area													
	0.9846	0.9728	0.9345	0.8382	0.6815	0.4708	0.3418	0.3599	0.6082	0.8699	0.9665	0.9878	(86)
MIT	20.0197	20.1700	20.4597	20.7569	20.9285	20.9898	20.9982	20.9978	20.9674	20.7561	20.3524	19.9867	(87)
Th 2	19.8920	19.8950	19.8941	19.8960	19.8960	19.8969	19.8978	19.8987	19.8995	19.8969	19.8987	19.8969	(88)
util rest of house													
	0.9797	0.9645	0.9152	0.7954	0.6105	0.3833	0.2460	0.2592	0.5141	0.8229	0.9542	0.9838	(89)
MIT 2	18.6353	18.8518	19.2553	19.6444	19.8385	19.8919	19.8974	19.8981	19.8800	19.6565	19.1178	18.5918	(90)
Living area fraction									fLA = Living area / (4) =			0.3978	(91)
MIT	19.1860	19.3762	19.7344	20.0870	20.2721	20.3286	20.3353	20.3356	20.3126	20.0940	19.6090	19.1467	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1860	19.3762	19.7344	20.0870	20.2721	20.3286	20.3353	20.3356	20.3126	20.0940	19.6090	19.1467	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9756	0.9596	0.9119	0.8035	0.6358	0.4180	0.2842	0.2994	0.5507	0.8324	0.9501	0.9802	(94)
Useful gains	699.5615	777.2798	847.0007	839.7570	686.8668	465.4506	301.5219	301.1425	507.3665	666.7978	678.6683	657.8464	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1341.6738	1317.9378	1193.4949	990.2882	726.9897	469.9265	302.0614	301.8177	523.0919	812.4508	1092.2192	1322.0101	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	477.7316	363.3222	257.7916	108.3825	29.8515	0.0000	0.0000	0.0000	0.0000	108.3658	297.7566	494.1378	(98)
Space heating												2137.3396	(98)
Space heating per m2											(98) / (4) =	28.1081	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2290.8248	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	477.7316	363.3222	257.7916	108.3825	29.8515	0.0000	0.0000	0.0000	0.0000	108.3658	297.7566	494.1378	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	512.0381	389.4128	276.3040	116.1655	31.9951	0.0000	0.0000	0.0000	0.0000	116.1477	319.1389	529.6225	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	159.9716	140.2323	145.4805	127.9306	123.5676	107.8307	101.1115	114.3338	115.1975	132.7871	143.5296	155.2878	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3691	89.2678	88.9673	88.3148	87.3778	86.7000	86.7000	86.7000	86.7000	88.2816	89.0967	89.4123	(217)
Fuel for water heating, kWh/month													
	179.0010	157.0918	163.5213	144.8575	141.4176	124.3722	116.6223	131.8729	132.8691	150.4132	161.0941	173.6762	(219)
Water heating fuel used												1776.8091	(219)
Annual totals kWh/year													
Space heating fuel - main system												2290.8248	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												332.7891	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3848.9432	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2290.8248	7.3800	169.0629	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1776.8091	7.3800	131.1285	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	332.7891	28.6600	95.3774	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			344.5146	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2290.8248	0.2160	494.8182	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1776.8091	0.2160	383.7908	(264)
Space and water heating			878.6089	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	332.7891	0.5190	172.7176	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			765.1084	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2290.8248	1.2200	2794.8063	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1776.8091	1.2200	2167.7071	(264)
Space and water heating			4962.5134	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	332.7891	3.0700	1021.6627	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			4291.1329	(272)
Primary energy kWh/m2/year			56.4326	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£117	£117	£0
Mains gas	£407	£407	£0
Space heating	£298	£298	£0
Water heating	£131	£131	£0
Lighting	£95	£95	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£344	£344	£0
Total cost of uses	£344	£344	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	476.85 (P1)
Transmission heat loss coefficient	62.04 (37)
Summer heat loss coefficient	538.88 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.0100	87.1704	0.7200	0.7000	0.7650	60.7995
East	2.9800	125.2818	0.7200	0.7000	0.7650	129.5504
South	4.4000	118.5567	0.7200	0.7000	0.7650	181.0144
West	6.7800	125.2818	0.7200	0.7000	0.7650	294.7488
total:						666.1131

	Jun	Jul	Aug	
Solar gains	713	666	601	(P3)
Internal gains	414	396	404	
Total summer gains	1127	1062	1005	(P5)
Summer gain/loss ratio	2.09	1.97	1.86	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.74	19.52	19.41	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 384 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 384	**Prop Type Ref**	
Property	27 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.57	**TER**	18.78
Environmental	90 B	**% DER<TER**	27.75		
CO_2 Emissions (t/year)	0.77	**DFEE**	47.47	**TFEE**	53.31
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.95		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.78	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.57	$kgCO_2/m^2$	Pass
	-5.21 (-27.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.31	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.47	$kWh/m^2/yr$	
	-5.8 (-10.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.70 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	2.01 m², No overhang
Windows facing East	2.98 m², No overhang
Windows facing South	4.40 m², No overhang
Windows facing West	6.78 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.70 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Air permeability	3.7	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 385 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 385	**Prop Type Ref**	
Property	28 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.70	**TER**	19.65
Environmental	91 B	**% DER<TER**	30.26		
CO_2 Emissions (t/year)	0.62	**DFEE**	46.97	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 62 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.65 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.31 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.98 m², No overhang
Windows facing East: 2.98 m², No overhang
Windows facing South: 5.10 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3541	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.3247	27.1886	27.0551	26.4282	26.3109	25.7649	25.7649	25.6637	25.9752	26.3109	26.5482	26.7962	(38)
Heat transfer coeff	78.6997	78.5635	78.4301	77.8031	77.6858	77.1398	77.1398	77.0387	77.3501	77.6858	77.9231	78.1712	(39)
Average = Sum(39)m / 12 =												77.8026	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2572	1.2551	1.2450	1.2432	1.2344	1.2344	1.2328	1.2378	1.2432	1.2470	1.2509	(40)
HLP (average)												1.2450	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134	(64)
Heat gains from water heating, kWh/month													
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	316.5595	314.6858	303.3269	285.0916	266.7454	248.9284	237.2666	242.6107	251.9013	270.3259	291.4855	307.1939	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	436.2185	521.7427	594.5501	658.1117	694.8856	678.3036	649.4433	613.1429	571.4434	501.3677	435.4144	409.1969	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1410	55.2366	55.3306	55.7765	55.8607	56.2561	56.2561	56.3299	56.1031	55.8607	55.6906	55.5138	
alpha	4.6761	4.6824	4.6887	4.7184	4.7240	4.7504	4.7504	4.7553	4.7402	4.7240	4.7127	4.7009	
util living area													
	0.9961	0.9906	0.9766	0.9362	0.8410	0.6756	0.5109	0.5592	0.7964	0.9574	0.9918	0.9971	(86)
MIT	19.7037	19.8974	20.1792	20.5194	20.7959	20.9476	20.9887	20.9829	20.8837	20.5154	20.0382	19.6641	(87)
Th 2	19.8728	19.8745	19.8762	19.8841	19.8856	19.8926	19.8926	19.8938	19.8899	19.8856	19.8826	19.8795	(88)
util rest of house													
	0.9948	0.9875	0.9685	0.9136	0.7868	0.5792	0.3883	0.4340	0.7128	0.9375	0.9885	0.9962	(89)
MIT 2	18.1643	18.4469	18.8540	19.3359	19.6926	19.8592	19.8887	19.8872	19.8021	19.3417	18.6591	18.1113	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	18.7957	19.0418	19.3975	19.8213	20.1451	20.3056	20.3398	20.3366	20.2457	19.8231	19.2247	18.7481	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7957	19.0418	19.3975	19.8213	20.1451	20.3056	20.3398	20.3366	20.2457	19.8231	19.2247	18.7481	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9844	0.9641	0.9121	0.8008	0.6170	0.4389	0.4857	0.7423	0.9361	0.9858	0.9947	(94)
Useful gains	433.1986	513.5972	573.2275	600.2457	556.4396	418.5293	285.0631	297.7881	424.1769	469.3500	429.2440	407.0457	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1140.8056	1111.0290	1011.5544	849.7138	656.0672	440.1269	288.4913	303.2739	475.3736	716.5006	944.7959	1137.2448	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	526.4596	401.4742	326.1152	179.6170	74.1230	0.0000	0.0000	0.0000	0.0000	183.8801	371.1974	543.2681	(98)
Space heating												2606.1346	(98)
Space heating per m2											(98) / (4) =	41.7048	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2793.2847	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	526.4596	401.4742	326.1152	179.6170	74.1230	0.0000	0.0000	0.0000	0.0000	183.8801	371.1974	543.2681	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	564.2654	430.3046	349.5340	192.5156	79.4458	0.0000	0.0000	0.0000	0.0000	197.0848	397.8536	582.2810	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4887	89.3977	89.2221	88.8392	88.0850	86.7000	86.7000	86.7000	86.7000	88.8273	89.3270	89.5264	(217)
Fuel for water heating, kWh/month													
	164.3158	144.2179	149.9815	132.5577	129.2083	114.6651	107.6272	121.5494	122.4208	137.6025	147.7743	159.4705	(219)
Water heating fuel used												1631.3910	(219)
Annual totals kWh/year													
Space heating fuel - main system												2793.2847	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												4233.0968	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2793.2847	0.2160	603.3495	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1631.3910	0.2160	352.3805	(264)
Space and water heating			955.7299	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			856.3005	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.7000	ZC1
Total Floor Area	TFA	62.4900	
Assumed number of occupants	N	2.0511	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9913	ZC2
CO2 emissions from cooking, equation (L16)		2.6920	ZC3
Total CO2 emissions		33.3833	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3833	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3886	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3303	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4211	0.4128	0.4046	0.3633	0.3550	0.3138	0.3138	0.3055	0.3303	0.3550	0.3716	0.3881	(22b)
Effective ac	0.5887	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7700	1.3258	15.6042			(27)
Ground floor			62.4900	0.1300	8.1237			(28a)
External Wall	72.5500	13.8900	58.6600	0.1800	10.5588			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.8307			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0066	(36)
Total fabric heat loss					(33) + (36) =		47.8373	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0414	27.8774	27.7167	26.9616	26.8204	26.1628	26.1628	26.0410	26.4161	26.8204	27.1062	27.4049	(38)
Heat transfer coeff	75.8787	75.7147	75.5540	74.7989	74.6576	74.0000	74.0000	73.8782	74.2533	74.6576	74.9434	75.2422	(39)
Average = Sum(39)m / 12 =												74.7982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2143	1.2116	1.2091	1.1970	1.1947	1.1842	1.1842	1.1822	1.1882	1.1947	1.1993	1.2041	(40)
HLP (average)												1.1970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	46.4769	40.4526	43.0968	40.0710	39.7166	36.7999	38.0266	39.7166	40.0710	43.0968	43.3421	46.4769	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(64)
								Total per year (kWh/year) = Sum(64)m =				1801.8945	(64)
Heat gains from water heating, kWh/month													
	56.5912	49.4459	51.3621	45.4032	43.8824	38.4990	36.6565	41.0840	41.5447	47.5158	50.9419	55.1722	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	76.0634	73.5802	69.0350	63.0601	58.9817	53.4709	49.2695	55.2205	57.7010	63.8654	70.7526	74.1561	(72)
Total internal gains													
	328.2150	325.7793	313.8608	295.0674	276.1602	257.7835	246.1267	252.0301	261.8840	280.8667	302.5828	318.8522	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.6300	0.7000	0.7700	9.6841	(74)
East	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(76)
South	5.1000	46.7521	0.6300	0.7000	0.7700	72.8690	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	104.7017	181.1748	254.8203	326.3926	374.6227	375.7033	360.6546	324.2157	279.5993	202.1615	125.9379	89.2526	(83)
Total gains	432.9166	506.9540	568.6811	621.4600	650.7829	633.4868	606.7813	576.2458	541.4833	483.0283	428.5207	408.1047	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1911	57.3149	57.4369	58.0167	58.1264	58.6430	58.6430	58.7397	58.4429	58.1264	57.9048	57.6749	
alpha	4.8127	4.8210	4.8291	4.8678	4.8751	4.9095	4.9095	4.9160	4.8962	4.8751	4.8603	4.8450	
util living area													
	0.9962	0.9914	0.9793	0.9435	0.8555	0.6925	0.5246	0.5709	0.8066	0.9602	0.9921	0.9972	(86)
MIT	19.7583	19.9353	20.1991	20.5251	20.7949	20.9478	20.9891	20.9838	20.8872	20.5339	20.0816	19.7244	(87)
Th 2	19.9086	19.9107	19.9128	19.9224	19.9242	19.9327	19.9327	19.9342	19.9294	19.9242	19.9206	19.9167	(88)
util rest of house													
	0.9950	0.9886	0.9721	0.9232	0.8048	0.5984	0.4035	0.4480	0.7263	0.9416	0.9890	0.9962	(89)
MIT 2	18.2689	18.5277	18.9097	19.3752	19.7271	19.8987	19.9288	19.9278	19.8429	19.3974	18.7490	18.2253	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	18.8798	19.1050	19.4385	19.8468	20.1651	20.3290	20.3637	20.3609	20.2712	19.8635	19.2955	18.8401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8798	19.1050	19.4385	19.8468	20.1651	20.3290	20.3637	20.3609	20.2712	19.8635	19.2955	18.8401	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9857	0.9681	0.9215	0.8174	0.6352	0.4535	0.4987	0.7545	0.9403	0.9865	0.9949	(94)
Useful gains	430.0218	499.7292	550.5251	572.6600	531.9514	402.4217	275.1854	287.3800	408.5576	454.2114	422.7200	406.0069	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1106.2953	1075.5274	977.5584	818.8077	631.9831	423.9476	278.5126	292.6236	458.2333	691.5943	913.9758	1101.5549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	503.1475	386.9364	317.7128	177.2263	74.4236	0.0000	0.0000	0.0000	0.0000	176.6129	353.7042	517.4877	(98)
Space heating												2507.2513	(98)
Space heating per m2											(98) / (4) =	40.1224	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2684.4232	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	503.1475	386.9364	317.7128	177.2263	74.4236	0.0000	0.0000	0.0000	0.0000	176.6129	353.7042	517.4877	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	538.7018	414.2788	340.1636	189.7498	79.6827	0.0000	0.0000	0.0000	0.0000	189.0930	378.6983	554.0553	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7309	158.7466	165.1656	146.4936	141.8316	124.9174	119.6803	133.4155	134.8890	153.5980	163.9628	177.4632	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4803	87.2090	86.6713	85.5316	83.5110	80.3000	80.3000	80.3000	80.3000	85.4034	86.9366	87.5868	(217)
Fuel for water heating, kWh/month													
	207.7391	182.0302	190.5656	171.2741	169.8358	155.5633	149.0415	166.1464	167.9813	179.8500	188.6004	202.6140	(219)
Water heating fuel used												2131.2418	(219)
Annual totals kWh/year													
Space heating fuel - main system												2684.4232	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Total delivered energy for all uses												5176.8496	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2684.4232	0.2160	579.8354	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2131.2418	0.2160	460.3482	(264)
Space and water heating			1040.1836	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Total CO2, kg/m2/year			1227.6384	(272)
Emissions per m2 for space and water heating			16.6456	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3769	(272b)
Emissions per m2 for pumps and fans			0.6229	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6456 * 1.00) + 2.3769 + 0.6229, rounded to 2 d.p.			19.6500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3541	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.3247	27.1886	27.0551	26.4282	26.3109	25.7649	25.7649	25.6637	25.9752	26.3109	26.5482	26.7962	(38)
Heat transfer coeff	78.6997	78.5635	78.4301	77.8031	77.6858	77.1398	77.1398	77.0387	77.3501	77.6858	77.9231	78.1712	(39)
Average = Sum(39)m / 12 =												77.8026	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2572	1.2551	1.2450	1.2432	1.2344	1.2344	1.2328	1.2378	1.2432	1.2470	1.2509	(40)
HLP (average)												1.2450	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)											Total = Sum(45)m =	1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	28.7415	25.1375	25.9396	22.6148	21.6994	18.7250	17.3514	19.9110	20.1488	23.4815	25.6319	27.8346 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	38.6310	37.4070	34.8651	31.4094	29.1659	26.0069	23.3218	26.7621	27.9845	31.5612	35.5999	37.4121	(72)
Total internal gains													
	287.7826	286.6060	276.6908	260.4168	243.3444	227.3195	217.1789	220.5718	229.1674	245.5625	264.4300	279.1081	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	407.4416	493.6629	567.9140	633.4369	671.4846	656.6947	629.3556	591.1040	548.7095	476.6043	408.3590	381.1111	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1410	55.2366	55.3306	55.7765	55.8607	56.2561	56.2561	56.3299	56.1031	55.8607	55.6906	55.5138	
alpha	4.6761	4.6824	4.6887	4.7184	4.7240	4.7504	4.7504	4.7553	4.7402	4.7240	4.7127	4.7009	
util living area	0.9971	0.9925	0.9803	0.9437	0.8541	0.6921	0.5257	0.5773	0.8142	0.9644	0.9937	0.9979	(86)
MIT	19.6620	19.8577	20.1440	20.4923	20.7798	20.9420	20.9873	20.9805	20.8713	20.4853	19.9997	19.6232	(87)
Th 2	19.8728	19.8745	19.8762	19.8841	19.8856	19.8926	19.8926	19.8938	19.8899	19.8856	19.8826	19.8795	(88)
util rest of house	0.9961	0.9900	0.9734	0.9231	0.8021	0.5954	0.4003	0.4494	0.7330	0.9472	0.9911	0.9972	(89)
MIT 2	18.6649	18.8607	19.1443	19.4855	19.7418	19.8670	19.8895	19.8886	19.8223	19.4867	19.0093	18.6315	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.0739	19.2696	19.5543	19.8984	20.1676	20.3079	20.3398	20.3365	20.2526	19.8963	19.4155	19.0382	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0739	19.2696	19.5543	19.8984	20.1676	20.3079	20.3398	20.3365	20.2526	19.8963	19.4155	19.0382	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9882	0.9709	0.9235	0.8167	0.6337	0.4522	0.5024	0.7623	0.9474	0.9897	0.9964	(94)
Useful gains	405.4722	487.8340	551.3820	584.9505	548.4019	416.1589	284.6005	296.9449	418.3043	451.5270	404.1435	379.7417	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1162.6980	1128.9281	1023.8502	855.7133	657.8091	440.3055	288.4859	303.2604	475.9027	722.1880	959.6636	1159.9205	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	563.3760	430.8153	351.5163	194.9492	81.3990	0.0000	0.0000	0.0000	0.0000	201.3718	399.9745	580.4530	(98)
Space heating												2803.8549	(98)
Space heating per m2											(98) / (4) =	44.8689	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	725.1144	570.8347	585.4942	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8824	0.9355	0.9170	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	639.8718	534.0232	536.8768	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	844.1059	810.6448	767.1643	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	147.0486	205.8064	171.3339	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												524.1889	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   36.7621   51.4516   42.8335    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          131.0472 (107)
Space cooling per m2                                                                                                     2.0971 (108)
Energy for space heating                                                                                                44.8689 (99)
Energy for space cooling                                                                                                 2.0971 (108)
Total                                                                                                                   46.9659 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   47.0 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3886	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3303	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4211	0.4128	0.4046	0.3633	0.3550	0.3138	0.3138	0.3055	0.3303	0.3550	0.3716	0.3881	(22b)
Effective ac	0.5887	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7700	1.3258	15.6042			(27)
Ground floor			62.4900	0.1300	8.1237			(28a)
External Wall	72.5500	13.8900	58.6600	0.1800	10.5588			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8307			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0066	(36)
Total fabric heat loss					(33) + (36) =		47.8373	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0414	27.8774	27.7167	26.9616	26.8204	26.1628	26.1628	26.0410	26.4161	26.8204	27.1062	27.4049	(38)
Heat transfer coeff	75.8787	75.7147	75.5540	74.7989	74.6576	74.0000	74.0000	73.8782	74.2533	74.6576	74.9434	75.2422	(39)
Average = Sum(39)m / 12 =												74.7982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2143	1.2116	1.2091	1.1970	1.1947	1.1842	1.1842	1.1822	1.1882	1.1947	1.1993	1.2041	(40)
HLP (average)												1.1970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0511 (42)
Average daily hot water use (litres/day)		82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	28.7415	25.1375	25.9396	22.6148	21.6994	18.7250	17.3514	19.9110	20.1488	23.4815	25.6319	27.8346 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	102.5545	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2050	14.3931	11.7053	8.8616	6.6242	5.5924	6.0428	7.8546	10.5425	13.3861	15.6236	16.6553	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.1803	181.0396	176.3541	166.3794	153.7880	141.9539	134.0480	132.1887	136.8741	146.8489	159.4402	171.2743	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	33.2555	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	38.6310	37.4070	34.8651	31.4094	29.1659	26.0069	23.3218	26.7621	27.9845	31.5612	35.5999	37.4121	(72)
Total internal gains													
	287.7826	286.6060	276.6908	260.4168	243.3444	227.3195	217.1789	220.5718	229.1674	245.5625	264.4300	279.1081	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.6300	0.7000	0.7700	9.6841	(74)
East	2.9800	19.6403	0.6300	0.7000	0.7700	17.8869	(76)
South	5.1000	46.7521	0.6300	0.7000	0.7700	72.8690	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	104.7017	181.1748	254.8203	326.3926	374.6227	375.7033	360.6546	324.2157	279.5993	202.1615	125.9379	89.2526	(83)
Total gains	392.4842	467.7808	531.5111	586.8094	617.9671	603.0228	577.8335	544.7875	508.7668	447.7240	390.3679	368.3607	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1911	57.3149	57.4369	58.0167	58.1264	58.6430	58.6430	58.7397	58.4429	58.1264	57.9048	57.6749	
alpha	4.8127	4.8210	4.8291	4.8678	4.8751	4.9095	4.9095	4.9160	4.8962	4.8751	4.8603	4.8450	
util living area													
	0.9975	0.9939	0.9841	0.9537	0.8743	0.7177	0.5483	0.5992	0.8333	0.9699	0.9947	0.9982	(86)
MIT	19.6992	19.8793	20.1488	20.4853	20.7703	20.9390	20.9869	20.9800	20.8681	20.4899	20.0267	19.6660	(87)
Th 2	19.9086	19.9107	19.9128	19.9224	19.9242	19.9327	19.9327	19.9342	19.9294	19.9242	19.9206	19.9167	(88)
util rest of house													
	0.9967	0.9918	0.9784	0.9363	0.8271	0.6237	0.4230	0.4725	0.7571	0.9551	0.9925	0.9976	(89)
MIT 2	18.7304	18.9111	19.1792	19.5125	19.7709	19.9050	19.9294	19.9287	19.8583	19.5240	19.0665	18.7037	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.1277	19.3082	19.5769	19.9115	20.1808	20.3291	20.3631	20.3599	20.2724	19.9201	19.4603	19.0984	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1277	19.3082	19.5769	19.9115	20.1808	20.3291	20.3631	20.3599	20.2724	19.9201	19.4603	19.0984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9903	0.9762	0.9361	0.8397	0.6608	0.4749	0.5250	0.7843	0.9551	0.9913	0.9969	(94)
Useful gains	390.8727	463.2405	518.8691	549.2836	518.9097	398.4501	274.4104	286.0113	399.0388	427.6113	386.9594	367.2330	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1125.1084	1090.9121	988.0099	823.6481	633.1566	423.9534	278.4711	292.5493	458.3247	695.8200	926.3259	1120.9860	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.2714	421.7953	349.0408	197.5424	84.9997	0.0000	0.0000	0.0000	0.0000	199.5473	388.3439	560.7923	(98)
Space heating												2748.3329	(98)
Space heating per m2											(98) / (4) =	43.9804	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	695.6002	547.6002	561.4746	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8752	0.9319	0.9132	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	608.7885	510.2954	512.7581	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	781.3726	750.4242	713.0281	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.2605	178.6558	149.0009	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												451.9172	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0651   44.6640   37.2502    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          112.9793 (107)
Space cooling per m2                                                                                                     1.8080 (108)
Energy for space heating                                                                                                43.9804 (99)
Energy for space cooling                                                                                                 1.8080 (108)
Total                                                                                                                   45.7883 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   52.7 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3541	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3160	0.2934	0.3009	0.2859	0.2859	0.2784	0.2708	0.2633	0.2558	0.2784	0.2633	0.2784	(22b)
Effective ac	0.5499	0.5430	0.5453	0.5409	0.5409	0.5387	0.5367	0.5347	0.5327	0.5387	0.5347	0.5387	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1963	25.8687	25.9752	25.7649	25.7649	25.6637	25.5653	25.4696	25.3766	25.6637	25.4696	25.6637	(38)
Heat transfer coeff	77.5712	77.2436	77.3501	77.1398	77.1398	77.0387	76.9403	76.8446	76.7515	77.0387	76.8446	77.0387	(39)
Average = Sum(39)m / 12 =												77.0785	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2413	1.2361	1.2378	1.2344	1.2344	1.2328	1.2312	1.2297	1.2282	1.2328	1.2297	1.2328	(40)
HLP (average)												1.2335	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0511	(42)
Average daily hot water use (litres/day)	82.9134	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134 (64)
RHI water heating demand												1443 (64)
Heat gains from water heating, kWh/month												
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	13.4839	0.7200	0.7000	0.7700	14.0344	(74)
East	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(76)
South	5.1000	56.7559	0.7200	0.7000	0.7700	101.0985	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	147.6014	217.5441	309.4360	401.2451	440.1455	480.6652	457.3163	419.3601	359.3924	262.1262	176.9821	123.6808	(83)
Total gains	613.3344	679.6014	753.7948	818.1903	829.1866	844.5129	806.2838	775.4738	731.1362	661.4729	607.0462	576.8298	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9432	56.1805	56.1031	56.2561	56.2561	56.3299	56.4020	56.4722	56.5407	56.3299	56.4722	56.3299	
alpha	4.7295	4.7454	4.7402	4.7504	4.7504	4.7553	4.7601	4.7648	4.7694	4.7553	4.7648	4.7553	
util living area	0.9821	0.9708	0.9376	0.8577	0.7175	0.5086	0.3700	0.3839	0.6270	0.8689	0.9623	0.9854	(86)
MIT	20.0442	20.1818	20.4436	20.7257	20.9101	20.9857	20.9975	20.9971	20.9628	20.7560	20.3741	20.0166	(87)
Th 2	19.8871	19.8912	19.8899	19.8926	19.8926	19.8938	19.8951	19.8963	19.8975	19.8938	19.8963	19.8938	(88)
util rest of house	0.9764	0.9619	0.9189	0.8176	0.6467	0.4151	0.2664	0.2767	0.5314	0.8217	0.9487	0.9807	(89)
MIT 2	18.6666	18.8654	19.2305	19.6048	19.8188	19.8867	19.8945	19.8956	19.8749	19.6536	19.1458	18.6325	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.2316	19.4053	19.7280	20.0645	20.2664	20.3374	20.3468	20.3473	20.3211	20.1057	19.6496	19.2002	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2316	19.4053	19.7280	20.0645	20.2664	20.3374	20.3468	20.3473	20.3211	20.1057	19.6496	19.2002	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9722	0.9571	0.9157	0.8245	0.6719	0.4533	0.3090	0.3208	0.5696	0.8319	0.9450	0.9769	(94)
Useful gains	596.2633	650.4389	690.2555	674.5598	557.1244	382.8200	249.1608	248.7763	416.4253	550.2848	573.6598	563.4965	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1111.7210	1089.5433	984.5155	814.9449	599.0975	388.0784	249.8136	249.5398	431.4295	670.6792	902.8898	1093.9625	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	383.5005	295.0781	218.9295	101.0773	31.2280	0.0000	0.0000	0.0000	0.0000	89.5735	237.0456	394.6667	(98)
Space heating												1751.0992	(98)
RHI space heating demand												1751	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3541	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.3247	27.1886	27.0551	26.4282	26.3109	25.7649	25.7649	25.6637	25.9752	26.3109	26.5482	26.7962	(38)
Heat transfer coeff	78.6997	78.5635	78.4301	77.8031	77.6858	77.1398	77.1398	77.0387	77.3501	77.6858	77.9231	78.1712	(39)
Average = Sum(39)m / 12 =												77.8026	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2572	1.2551	1.2450	1.2432	1.2344	1.2344	1.2328	1.2378	1.2432	1.2470	1.2509	(40)
HLP (average)												1.2450	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0511	(42)
Average daily hot water use (litres/day)	82.9134	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682 (64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134 (64)
Heat gains from water heating, kWh/month												
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	10.6334	0.7200	0.7000	0.7700	11.0676	(74)
East	2.9800	19.6403	0.7200	0.7000	0.7700	20.4422	(76)
South	5.1000	46.7521	0.7200	0.7000	0.7700	83.2789	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	119.6591	207.0569	291.2232	373.0201	428.1402	429.3752	412.1767	370.5322	319.5421	231.0417	143.9290	102.0029	(83)
Total gains	585.3920	669.1142	735.5820	789.9653	817.1813	793.2229	761.1442	726.6458	691.2858	630.3885	573.9932	555.1520	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1410	55.2366	55.3306	55.7765	55.8607	56.2561	56.2561	56.3299	56.1031	55.8607	55.6906	55.5138	
alpha	4.6761	4.6824	4.6887	4.7184	4.7240	4.7504	4.7504	4.7553	4.7402	4.7240	4.7127	4.7009	
util living area													
	0.9872	0.9755	0.9500	0.8890	0.7709	0.5960	0.4405	0.4793	0.7053	0.9103	0.9758	0.9898	(86)
MIT	19.9149	20.0976	20.3535	20.6467	20.8633	20.9690	20.9939	20.9910	20.9317	20.6540	20.2276	19.8729	(87)
Th 2	19.8728	19.8745	19.8762	19.8841	19.8856	19.8926	19.8926	19.8938	19.8899	19.8856	19.8826	19.8795	(88)
util rest of house													
	0.9832	0.9680	0.9348	0.8559	0.7089	0.5038	0.3325	0.3683	0.6161	0.8759	0.9670	0.9866	(89)
MIT 2	18.4700	18.7329	19.0954	19.4980	19.7631	19.8738	19.8906	19.8906	19.8423	19.5194	18.9287	18.4141	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.0626	19.2926	19.6114	19.9691	20.2143	20.3230	20.3431	20.3419	20.2891	19.9848	19.4615	19.0124	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0626	19.2926	19.6114	19.9691	20.2143	20.3230	20.3431	20.3419	20.2891	19.9848	19.4615	19.0124	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9795	0.9631	0.9305	0.8588	0.7285	0.5408	0.3770	0.4141	0.6501	0.8795	0.9628	0.9833	(94)
Useful gains	573.3694	644.4488	684.4499	678.3851	595.2962	428.9392	286.9420	300.8711	449.3728	554.4189	552.6619	545.8905	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1161.8135	1130.7352	1028.3284	861.2122	661.4442	441.4706	288.7421	303.6794	478.7296	729.0649	963.2430	1157.9035	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	437.8024	326.7844	255.8456	131.6355	49.2141	0.0000	0.0000	0.0000	0.0000	129.9367	295.6184	455.3377	(98)
Space heating												2082.1748	(98)
Space heating per m2											(98) / (4) =	33.3201	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2231.6986	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	437.8024	326.7844	255.8456	131.6355	49.2141	0.0000	0.0000	0.0000	0.0000	129.9367	295.6184	455.3377	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	469.2416	350.2513	274.2182	141.0884	52.7482	0.0000	0.0000	0.0000	0.0000	139.2676	316.8472	488.0361	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3670	89.2515	89.0305	88.5636	87.7561	86.7000	86.7000	86.7000	86.7000	88.5184	89.1572	89.4138	(217)
Fuel for water heating, kWh/month													
	164.5395	144.4541	150.3044	132.9703	129.6925	114.6651	107.6272	121.5494	122.4208	138.0826	148.0558	159.6714	(219)
Water heating fuel used												1634.0330	(219)
Annual totals kWh/year													
Space heating fuel - main system												2231.6986	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												3674.1528	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2231.6986	3.4800	77.6631	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1634.0330	3.4800	56.8643	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	286.1846	13.1900	37.7477	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			229.2582	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8958	(257)
SAP value		87.5037	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2231.6986	0.2160	482.0469	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1634.0330	0.2160	352.9511	(264)
Space and water heating			834.9980	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			735.5686	(272)
CO2 emissions per m2			11.7700	(273)
EI value			90.8302	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.4900 (1b)	x	2.3100 (2b)	=	144.3519	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3519	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1386	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3541	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3160	0.2934	0.3009	0.2859	0.2859	0.2784	0.2708	0.2633	0.2558	0.2784	0.2633	0.2784	(22b)
Effective ac	0.5499	0.5430	0.5453	0.5409	0.5409	0.5387	0.5367	0.5347	0.5327	0.5387	0.5347	0.5387	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7700	1.2357	14.5447			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			62.4900	0.1900	11.8731			(28a)
External Wall	72.5500	13.8900	58.6600	0.2700	15.8382			(29a)
Total net area of external elements Aum(A, m2)			135.0400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.4360			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9390	(36)
Total fabric heat loss					(33) + (36) =		51.3750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1963	25.8687	25.9752	25.7649	25.7649	25.6637	25.5653	25.4696	25.3766	25.6637	25.4696	25.6637	(38)
Heat transfer coeff	77.5712	77.2436	77.3501	77.1398	77.1398	77.0387	76.9403	76.8446	76.7515	77.0387	76.8446	77.0387	(39)
Average = Sum(39)m / 12 =												77.0785	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2413	1.2361	1.2378	1.2344	1.2344	1.2328	1.2312	1.2297	1.2282	1.2328	1.2297	1.2328	(40)
HLP (average)												1.2335	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0511 (42)
Average daily hot water use (litres/day)												82.9134 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2047	87.8882	84.5717	81.2551	77.9386	74.6220	74.6220	77.9386	81.2551	84.5717	87.8882	91.2047	(44)
Energy conte	135.2540	118.2940	122.0688	106.4225	102.1150	88.1174	81.6538	93.6989	94.8180	110.5012	120.6207	130.9863	(45)
Energy content (annual)										Total = Sum(45)m =		1304.5505	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2881	17.7441	18.3103	15.9634	15.3172	13.2176	12.2481	14.0548	14.2227	16.5752	18.0931	19.6479	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7901	10.6335	11.7479	11.3407	11.6982	11.2972	11.6590	11.6844	11.3209	11.7273	11.3817	11.7819	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.6134	(64)
Heat gains from water heating, kWh/month													
	47.9195	41.9911	43.5248	38.2207	36.8778	32.1233	30.0646	34.0760	34.3572	39.6735	42.9518	46.4984	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	123.0654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.5124	35.9827	29.2631	22.1541	16.5604	13.9810	15.1070	19.6366	26.3562	33.4653	39.0589	41.6384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.4332	270.2083	263.2151	248.3274	229.5343	211.8715	200.0716	197.2965	204.2897	219.1774	237.9705	255.6334	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	49.3576	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	-82.0436	(71)
Water heating gains (Table 5)													
	64.4079	62.4868	58.5011	53.0843	49.5669	44.6158	40.4095	45.8011	47.7183	53.3246	59.6553	62.4979	(72)
Total internal gains													
	465.7329	462.0573	444.3588	416.9452	389.0411	363.8477	348.9675	356.1136	371.7437	399.3467	430.0642	453.1490	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.9800	13.4839	0.7200	0.7000	0.7700	14.0344	(74)
East	2.9800	25.1925	0.7200	0.7000	0.7700	26.2212	(76)
South	5.1000	56.7559	0.7200	0.7000	0.7700	101.0985	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	147.6014	217.5441	309.4360	401.2451	440.1455	480.6652	457.3163	419.3601	359.3924	262.1262	176.9821	123.6808	(83)
Total gains	613.3344	679.6014	753.7948	818.1903	829.1866	844.5129	806.2838	775.4738	731.1362	661.4729	607.0462	576.8298	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9432	56.1805	56.1031	56.2561	56.2561	56.3299	56.4020	56.4722	56.5407	56.3299	56.4722	56.3299	
alpha	4.7295	4.7454	4.7402	4.7504	4.7504	4.7553	4.7601	4.7648	4.7694	4.7553	4.7648	4.7553	
util living area	0.9821	0.9708	0.9376	0.8577	0.7175	0.5086	0.3700	0.3839	0.6270	0.8689	0.9623	0.9854	(86)
MIT	20.0442	20.1818	20.4436	20.7257	20.9101	20.9857	20.9975	20.9971	20.9628	20.7560	20.3741	20.0166	(87)
Th 2	19.8871	19.8912	19.8899	19.8926	19.8926	19.8938	19.8951	19.8963	19.8975	19.8938	19.8963	19.8938	(88)
util rest of house	0.9764	0.9619	0.9189	0.8176	0.6467	0.4151	0.2664	0.2767	0.5314	0.8217	0.9487	0.9807	(89)
MIT 2	18.6666	18.8654	19.2305	19.6048	19.8188	19.8867	19.8945	19.8956	19.8749	19.6536	19.1458	18.6325	(90)
Living area fraction									fLA = Living area / (4) =			0.4101	(91)
MIT	19.2316	19.4053	19.7280	20.0645	20.2664	20.3374	20.3468	20.3473	20.3211	20.1057	19.6496	19.2002	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2316	19.4053	19.7280	20.0645	20.2664	20.3374	20.3468	20.3473	20.3211	20.1057	19.6496	19.2002	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9722	0.9571	0.9157	0.8245	0.6719	0.4533	0.3090	0.3208	0.5696	0.8319	0.9450	0.9769	(94)
Useful gains	596.2633	650.4389	690.2555	674.5598	557.1244	382.8200	249.1608	248.7763	416.4253	550.2848	573.6598	563.4965	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1111.7210	1089.5433	984.5155	814.9449	599.0975	388.0784	249.8136	249.5398	431.4295	670.6792	902.8898	1093.9625	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	383.5005	295.0781	218.9295	101.0773	31.2280	0.0000	0.0000	0.0000	0.0000	89.5735	237.0456	394.6667	(98)
Space heating												1751.0992	(98)
Space heating per m2											(98) / (4) =	28.0221	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1876.8480	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	383.5005	295.0781	218.9295	101.0773	31.2280	0.0000	0.0000	0.0000	0.0000	89.5735	237.0456	394.6667	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	411.0402	316.2681	234.6511	108.3358	33.4705	0.0000	0.0000	0.0000	0.0000	96.0059	254.0682	423.0083	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0441	128.9275	133.8167	117.7632	113.8132	99.4146	93.3128	105.3833	106.1388	122.2285	132.0024	142.7682	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2726	89.1741	88.8997	88.3264	87.4506	86.7000	86.7000	86.7000	86.7000	88.1869	88.9785	89.3148	(217)
Fuel for water heating, kWh/month													
	164.7135	144.5795	150.5255	133.3273	130.1456	114.6651	107.6272	121.5494	122.4208	138.6017	148.3532	159.8483	(219)
Water heating fuel used												1636.3571	(219)
Annual totals kWh/year													
Space heating fuel - main system												1876.8480	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.1846	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												3247.9099	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1876.8480	7.3800	138.5114	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1636.3571	7.3800	120.7632	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	286.1846	28.6600	82.0205	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			290.2409	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1876.8480	0.2160	405.3992	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.3571	0.2160	353.4531	(264)
Space and water heating			758.8523	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.1846	0.5190	148.5298	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			621.1641	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1876.8480	1.2200	2289.7546	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.3571	1.2200	1996.3557	(264)
Space and water heating			4286.1103	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	286.1846	3.0700	878.5867	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			3471.6538	(272)
Primary energy kWh/m2/year			55.5553	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£104	£104	£0
Mains gas	£366	£366	£0
Space heating	£267	£267	£0
Water heating	£121	£121	£0
Lighting	£82	£82	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£290	£290	£0
Total cost of uses	£290	£290	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	285.82 (P1)
Transmission heat loss coefficient	51.37 (37)
Summer heat loss coefficient	337.19 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.9800	87.1704	0.7200	0.7000	0.7650	90.1405
East	2.9800	125.2818	0.7200	0.7000	0.7650	129.5504
South	5.1000	118.5567	0.7200	0.7000	0.7650	209.8122
West	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
total:						460.3691

	Jun	Jul	Aug	
Solar gains	492	460	421	(P3)
Internal gains	361	346	353	
Total summer gains	853	806	774	(P5)
Summer gain/loss ratio	2.53	2.39	2.29	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.18	19.94	19.84	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 385 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 385	**Prop Type Ref**	
Property	28 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.70	**TER**	19.65
Environmental	91 B	**% DER<TER**	30.26		
CO_2 Emissions (t/year)	0.62	**DFEE**	46.97	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.81		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.65	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.70	$kgCO_2/m^2$	Pass
	-5.95 (-30.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.66	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.97	$kWh/m^2/yr$	
	-5.7 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	2.98 m², No overhang
Windows facing East	2.98 m², No overhang
Windows facing South	5.10 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 386 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 386 EPC	**Prop Type Ref**	
Property	29 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.03	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.64		
CO_2 Emissions (t/year)	0.76	**DFEE**	45.89	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

End-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.22 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2200	
Infiltration rate		0.3555	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3853	0.3777	0.3702	0.3324	0.3248	0.2871	0.2871	0.2795	0.3022	0.3248	0.3399	0.3550	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5528	0.5412	0.5412	0.5391	0.5457	0.5528	0.5578	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3434	39.1459	38.9524	38.0433	37.8732	37.0815	37.0815	36.9348	37.3864	37.8732	38.2173	38.5770	(38)
Heat transfer coeff	99.6702	99.4727	99.2792	98.3701	98.2001	97.4083	97.4083	97.2617	97.7133	98.2001	98.5441	98.9038	(39)
Average = Sum(39)m / 12 =												98.3693	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2409	1.2385	1.2360	1.2247	1.2226	1.2128	1.2128	1.2109	1.2165	1.2226	1.2269	1.2314	(40)
HLP (average)												1.2247	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9623	56.0734	56.1827	56.7019	56.8001	57.2618	57.2618	57.3482	57.0831	56.8001	56.6018	56.3960	
alpha	4.7308	4.7382	4.7455	4.7801	4.7867	4.8175	4.8175	4.8232	4.8055	4.7867	4.7735	4.7597	
util living area													
	0.9968	0.9919	0.9801	0.9469	0.8658	0.7105	0.5417	0.5864	0.8141	0.9621	0.9930	0.9977	(86)
MIT	19.6993	19.8929	20.1649	20.4937	20.7717	20.9380	20.9865	20.9804	20.8761	20.5085	20.0348	19.6616	(87)
Th 2	19.8874	19.8894	19.8913	19.9003	19.9020	19.9098	19.9098	19.9113	19.9068	19.9020	19.8985	19.8950	(88)
util rest of house													
	0.9957	0.9892	0.9731	0.9274	0.8164	0.6150	0.4153	0.4590	0.7337	0.9441	0.9902	0.9969	(89)
MIT 2	18.1682	18.4511	18.8452	19.3153	19.6809	19.8690	19.9050	19.9035	19.8113	19.3456	18.6657	18.1185	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5527	18.8131	19.1766	19.6112	19.9548	20.1375	20.1766	20.1739	20.0787	19.6376	19.0095	18.5060	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5527	18.8131	19.1766	19.6112	19.9548	20.1375	20.1766	20.1739	20.0787	19.6376	19.0095	18.5060	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9671	0.9210	0.8191	0.6364	0.4472	0.4910	0.7480	0.9385	0.9869	0.9954	(94)
Useful gains	532.0585	635.2649	704.6962	730.8130	676.9102	510.3669	344.1542	360.4530	520.9244	580.7926	529.4779	498.8411	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1420.5673	1383.9781	1258.5224	1053.6625	810.6255	539.3951	348.3869	367.0547	584.1945	887.4956	1173.6115	1414.9191	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.0506	503.1353	412.0467	232.4516	99.4842	0.0000	0.0000	0.0000	0.0000	228.1871	463.7762	681.5620	(98)
Space heating												3281.6937	(98)
Space heating per m2											(98) / (4) =	40.8577	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3517.3565	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.0506	503.1353	412.0467	232.4516	99.4842	0.0000	0.0000	0.0000	0.0000	228.1871	463.7762	681.5620	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	708.5215	539.2661	441.6363	249.1443	106.6283	0.0000	0.0000	0.0000	0.0000	244.5735	497.0806	730.5059	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5633	89.4771	89.3176	88.9714	88.2518	86.7000	86.7000	86.7000	86.7000	88.9243	89.4088	89.5981	(217)
Fuel for water heating, kWh/month													
	182.3182	159.9742	166.2393	146.7280	142.8603	126.8692	118.9361	134.5284	135.5568	152.3803	163.8483	176.9032	(219)
Water heating fuel used												1807.1422	(219)
Annual totals kWh/year													
Space heating fuel - main system												3517.3565	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5124.7231	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3517.3565	0.2160	759.7490	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1422	0.2160	390.3427	(264)
Space and water heating			1150.0917	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1046.4082	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.4883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.4883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2200	
Infiltration rate		0.3555	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3853	0.3777	0.3702	0.3324	0.3248	0.2871	0.2871	0.2795	0.3022	0.3248	0.3399	0.3550	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5528	0.5412	0.5412	0.5391	0.5457	0.5528	0.5578	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3434	39.1459	38.9524	38.0433	37.8732	37.0815	37.0815	36.9348	37.3864	37.8732	38.2173	38.5770	(38)
Heat transfer coeff	99.6702	99.4727	99.2792	98.3701	98.2001	97.4083	97.4083	97.2617	97.7133	98.2001	98.5441	98.9038	(39)
Average = Sum(39)m / 12 =												98.3693	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2409	1.2385	1.2360	1.2247	1.2226	1.2128	1.2128	1.2109	1.2165	1.2226	1.2269	1.2314	(40)
HLP (average)												1.2247	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9623	56.0734	56.1827	56.7019	56.8001	57.2618	57.2618	57.3482	57.0831	56.8001	56.6018	56.3960	
alpha	4.7308	4.7382	4.7455	4.7801	4.7867	4.8175	4.8175	4.8232	4.8055	4.7867	4.7735	4.7597	
util living area													
	0.9976	0.9934	0.9830	0.9528	0.8766	0.7253	0.5557	0.6031	0.8292	0.9677	0.9945	0.9982	(86)
MIT	19.6637	19.8590	20.1345	20.4696	20.7564	20.9321	20.9849	20.9779	20.8647	20.4825	20.0019	19.6267	(87)
Th 2	19.8874	19.8894	19.8913	19.9003	19.9020	19.9098	19.9098	19.9113	19.9068	19.9020	19.8985	19.8950	(88)
util rest of house													
	0.9967	0.9912	0.9769	0.9350	0.8295	0.6301	0.4268	0.4735	0.7513	0.9520	0.9922	0.9976	(89)
MIT 2	18.6782	18.8739	19.1476	19.4789	19.7392	19.8790	19.9061	19.9052	19.8344	19.4981	19.0243	18.6473	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9257	19.1212	19.3954	19.7277	19.9946	20.1434	20.1770	20.1746	20.0931	19.7453	19.2698	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9257	19.1212	19.3954	19.7277	19.9946	20.1434	20.1770	20.1746	20.0931	19.7453	19.2698	18.8932	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9734	0.9316	0.8341	0.6522	0.4596	0.5063	0.7665	0.9491	0.9905	0.9968	(94)
Useful gains	501.7892	607.2578	681.0453	714.2138	668.0622	507.7506	343.6788	359.6026	514.9138	561.8209	502.1778	469.0419	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1457.7429	1414.6247	1280.2491	1065.1226	814.5338	539.9770	348.4313	367.1200	585.6064	898.0728	1199.2639	1453.2181	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	711.2296	542.5506	445.8076	252.6544	108.9748	0.0000	0.0000	0.0000	0.0000	250.1714	501.9020	732.2271	(98)
Space heating												3545.5174	(98)
Space heating per m2											(98) / (4) =	44.1424	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	915.6380	720.8214	739.1887	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8633	0.9239	0.9057	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.4398	665.9635	669.4706	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.5042	222.1099	187.9404	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                562.5544 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   38.1260   55.5275   46.9851    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                140.6386 (107)
Space cooling per m2                                                                                           1.7510 (108)
Energy for space heating                                                                                      44.1424 (99)
Energy for space cooling                                                                                       1.7510 (108)
Total                                                                                                         45.8934 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                      45.9 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2200	
Infiltration rate		0.3555	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3173	0.2946	0.3022	0.2871	0.2871	0.2795	0.2719	0.2644	0.2568	0.2795	0.2644	0.2795	(22b)
Effective ac	0.5503	0.5434	0.5457	0.5412	0.5412	0.5391	0.5370	0.5350	0.5330	0.5391	0.5350	0.5391	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7071	37.2320	37.3864	37.0815	37.0815	36.9348	36.7921	36.6533	36.5184	36.9348	36.6533	36.9348	(38)
Heat transfer coeff	98.0339	97.5588	97.7133	97.4083	97.4083	97.2617	97.1190	96.9802	96.8453	97.2617	96.9802	97.2617	(39)
Average = Sum(39)m / 12 =												97.3193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2205	1.2146	1.2165	1.2128	1.2128	1.2109	1.2092	1.2074	1.2057	1.2109	1.2074	1.2109	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8964	57.1735	57.0831	57.2618	57.2618	57.3482	57.4324	57.5146	57.5947	57.3482	57.5146	57.3482	
alpha	4.7931	4.8116	4.8055	4.8175	4.8175	4.8232	4.8288	4.8343	4.8396	4.8232	4.8343	4.8232	
util living area													
	0.9848	0.9748	0.9462	0.8773	0.7493	0.5405	0.3940	0.4052	0.6484	0.8806	0.9670	0.9878	(86)
MIT	20.0327	20.1697	20.4239	20.7022	20.8960	20.9827	20.9969	20.9966	20.9593	20.7471	20.3649	20.0065	(87)
Th 2	19.9036	19.9083	19.9068	19.9098	19.9098	19.9113	19.9127	19.9141	19.9154	19.9113	19.9141	19.9113	(88)
util rest of house													
	0.9800	0.9670	0.9296	0.8406	0.6805	0.4441	0.2857	0.2941	0.5529	0.8362	0.9549	0.9839	(89)
MIT 2	18.6624	18.8615	19.2179	19.5924	19.8224	19.9024	19.9119	19.9132	19.8903	19.6591	19.1471	18.6308	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9224	0.8391	0.6929	0.4680	0.3130	0.3222	0.5755	0.8372	0.9484	0.9792	(94)
Useful gains	732.7869	801.2152	847.4573	825.0754	682.4031	467.0676	298.7875	298.3458	510.2899	679.7626	707.6750	691.0010	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1382.9145	1355.0957	1223.4421	1010.2308	739.5275	474.0198	299.5514	299.2070	528.6539	829.8694	1120.4016	1359.3536	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	483.6949	372.2077	279.7327	133.3119	42.5005	0.0000	0.0000	0.0000	0.0000	111.6794	297.1631	497.2543	(98)
Space heating												2217.5446	(98)
RHI space heating demand												2218	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2200	
Infiltration rate			0.3555	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3853	0.3777	0.3702	0.3324	0.3248	0.2871	0.2871	0.2795	0.3022	0.3248	0.3399	0.3550	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5528	0.5412	0.5412	0.5391	0.5457	0.5528	0.5578	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3434	39.1459	38.9524	38.0433	37.8732	37.0815	37.0815	36.9348	37.3864	37.8732	38.2173	38.5770	(38)
Heat transfer coeff	99.6702	99.4727	99.2792	98.3701	98.2001	97.4083	97.4083	97.2617	97.7133	98.2001	98.5441	98.9038	(39)
Average = Sum(39)m / 12 =												98.3693	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2409	1.2385	1.2360	1.2247	1.2226	1.2128	1.2128	1.2109	1.2165	1.2226	1.2269	1.2314	(40)
HLP (average)												1.2247	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9623	56.0734	56.1827	56.7019	56.8001	57.2618	57.2618	57.3482	57.0831	56.8001	56.6018	56.3960	
alpha	4.7308	4.7382	4.7455	4.7801	4.7867	4.8175	4.8175	4.8232	4.8055	4.7867	4.7735	4.7597	
util living area													
	0.9894	0.9788	0.9569	0.9050	0.7998	0.6293	0.4674	0.5038	0.7259	0.9195	0.9793	0.9917	(86)
MIT	19.8999	20.0836	20.3329	20.6211	20.8445	20.9630	20.9927	20.9896	20.9260	20.6431	20.2152	19.8596	(87)
Th 2	19.8874	19.8894	19.8913	19.9003	19.9020	19.9098	19.9098	19.9113	19.9068	19.9020	19.8985	19.8950	(88)
util rest of house													
	0.9861	0.9723	0.9435	0.8753	0.7408	0.5359	0.3552	0.3898	0.6381	0.8878	0.9717	0.9890	(89)
MIT 2	18.4589	18.7244	19.0795	19.4803	19.7595	19.8869	19.9074	19.9074	19.8542	19.5200	18.9234	18.4061	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8207	19.0657	19.3943	19.7668	20.0319	20.1572	20.1799	20.1792	20.1234	19.8020	19.2478	18.7711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8207	19.0657	19.3943	19.7668	20.0319	20.1572	20.1799	20.1792	20.1234	19.8020	19.2478	18.7711	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9360	0.8711	0.7485	0.5581	0.3835	0.4185	0.6569	0.8844	0.9658	0.9852	(94)
Useful gains	702.4595	794.5939	841.2910	829.5383	728.5949	524.5474	346.5232	364.2228	552.1270	684.7693	679.6301	667.4561	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1447.2840	1409.1030	1280.1317	1068.9678	818.1968	541.3138	348.7135	367.5679	588.5621	903.6374	1197.0924	1441.1384	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	554.1494	412.9501	326.4975	172.3893	66.6639	0.0000	0.0000	0.0000	0.0000	162.8378	372.5729	575.6196	(98)
Space heating												2643.6805	(98)
Space heating per m2											(98) / (4) =	32.9143	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2833.5268	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	554.1494	412.9501	326.4975	172.3893	66.6639	0.0000	0.0000	0.0000	0.0000	162.8378	372.5729	575.6196	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	593.9437	442.6046	349.9438	184.7688	71.4511	0.0000	0.0000	0.0000	0.0000	174.5314	399.3278	616.9556	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4546	89.3451	89.1429	88.7126	87.9122	86.7000	86.7000	86.7000	86.7000	88.6285	89.2541	89.4977	(217)
Fuel for water heating, kWh/month													
	182.5399	160.2107	166.5650	147.1561	143.4120	126.8692	118.9361	134.5284	135.5568	152.8888	164.1324	177.1016	(219)
Water heating fuel used												1809.8969	(219)
Annual totals kWh/year													
Space heating fuel - main system												2833.5268	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4443.6481	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2833.5268	3.4800	98.6067	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8969	3.4800	62.9844	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.2407	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8554	(257)
SAP value		88.0669	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2833.5268	0.2160	612.0418	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8969	0.2160	390.9377	(264)
Space and water heating			1002.9795	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			899.2960	(272)
CO2 emissions per m2			11.2000	(273)
EI value			90.3842	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2200	
Infiltration rate			0.3555	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3173	0.2946	0.3022	0.2871	0.2871	0.2795	0.2719	0.2644	0.2568	0.2795	0.2644	0.2795	(22b)
Effective ac	0.5503	0.5434	0.5457	0.5412	0.5412	0.5391	0.5370	0.5350	0.5330	0.5391	0.5350	0.5391	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7071	37.2320	37.3864	37.0815	37.0815	36.9348	36.7921	36.6533	36.5184	36.9348	36.6533	36.9348	(38)
Heat transfer coeff	98.0339	97.5588	97.7133	97.4083	97.4083	97.2617	97.1190	96.9802	96.8453	97.2617	96.9802	97.2617	(39)
Average = Sum(39)m / 12 =												97.3193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2205	1.2146	1.2165	1.2128	1.2128	1.2109	1.2092	1.2074	1.2057	1.2109	1.2074	1.2109	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8964	57.1735	57.0831	57.2618	57.2618	57.3482	57.4324	57.5146	57.5947	57.3482	57.5146	57.3482	
alpha	4.7931	4.8116	4.8055	4.8175	4.8175	4.8232	4.8288	4.8343	4.8396	4.8232	4.8343	4.8232	
util living area													
	0.9848	0.9748	0.9462	0.8773	0.7493	0.5405	0.3940	0.4052	0.6484	0.8806	0.9670	0.9878	(86)
MIT	20.0327	20.1697	20.4239	20.7022	20.8960	20.9827	20.9969	20.9966	20.9593	20.7471	20.3649	20.0065	(87)
Th 2	19.9036	19.9083	19.9068	19.9098	19.9098	19.9113	19.9127	19.9141	19.9154	19.9113	19.9141	19.9113	(88)
util rest of house													
	0.9800	0.9670	0.9296	0.8406	0.6805	0.4441	0.2857	0.2941	0.5529	0.8362	0.9549	0.9839	(89)
MIT 2	18.6624	18.8615	19.2179	19.5924	19.8224	19.9024	19.9119	19.9132	19.8903	19.6591	19.1471	18.6308	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9224	0.8391	0.6929	0.4680	0.3130	0.3222	0.5755	0.8372	0.9484	0.9792	(94)
Useful gains	732.7869	801.2152	847.4573	825.0754	682.4031	467.0676	298.7875	298.3458	510.2899	679.7626	707.6750	691.0010	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1382.9145	1355.0957	1223.4421	1010.2308	739.5275	474.0198	299.5514	299.2070	528.6539	829.8694	1120.4016	1359.3536	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	483.6949	372.2077	279.7327	133.3119	42.5005	0.0000	0.0000	0.0000	0.0000	111.6794	297.1631	497.2543	(98)
Space heating												2217.5446	(98)
Space heating per m2											(98) / (4) =	27.6089	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2376.7895	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	483.6949	372.2077	279.7327	133.3119	42.5005	0.0000	0.0000	0.0000	0.0000	111.6794	297.1631	497.2543	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	518.4297	398.9364	299.8206	142.8852	45.5526	0.0000	0.0000	0.0000	0.0000	119.6993	318.5028	532.9628	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3635	89.2704	89.0183	88.4823	87.5803	86.7000	86.7000	86.7000	86.7000	88.2903	89.0787	89.4027	(217)
Fuel for water heating, kWh/month													
	182.7260	160.3446	166.7981	147.5392	143.9556	126.8692	118.9361	134.5284	135.5568	153.4745	164.4555	177.2897	(219)
Water heating fuel used												1812.4736	(219)
Annual totals kWh/year													
Space heating fuel - main system												2376.7895	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3914.3696	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2376.7895	7.3800	175.4071	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4736	7.3800	133.7606	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			337.3832	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2376.7895	0.2160	513.3865	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4736	0.2160	391.4943	(264)
Space and water heating			904.8808	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			762.2111	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2376.7895	1.2200	2899.6831	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4736	1.2200	2211.2178	(264)
Space and water heating			5110.9009	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4266.9781	(272)
Primary energy kWh/m2/year			53.1247	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£416	£344	£72
Space heating	£304	£304	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£337	£280	£58
Total cost of uses	£338	£280	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2200	
Infiltration rate		0.3555	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3853	0.3777	0.3702	0.3324	0.3248	0.2871	0.2871	0.2795	0.3022	0.3248	0.3399	0.3550	(22b)
Effective ac	0.5742	0.5713	0.5685	0.5552	0.5528	0.5412	0.5412	0.5391	0.5457	0.5528	0.5578	0.5630	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3434	39.1459	38.9524	38.0433	37.8732	37.0815	37.0815	36.9348	37.3864	37.8732	38.2173	38.5770	(38)
Heat transfer coeff	99.6702	99.4727	99.2792	98.3701	98.2001	97.4083	97.4083	97.2617	97.7133	98.2001	98.5441	98.9038	(39)
Average = Sum(39)m / 12 =												98.3693	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2409	1.2385	1.2360	1.2247	1.2226	1.2128	1.2128	1.2109	1.2165	1.2226	1.2269	1.2314	(40)
HLP (average)												1.2247	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9623	56.0734	56.1827	56.7019	56.8001	57.2618	57.2618	57.3482	57.0831	56.8001	56.6018	56.3960	
alpha	4.7308	4.7382	4.7455	4.7801	4.7867	4.8175	4.8175	4.8232	4.8055	4.7867	4.7735	4.7597	
util living area													
	0.9894	0.9788	0.9569	0.9050	0.7998	0.6293	0.4674	0.5038	0.7259	0.9195	0.9793	0.9917	(86)
MIT	19.8999	20.0836	20.3329	20.6211	20.8445	20.9630	20.9927	20.9896	20.9260	20.6431	20.2152	19.8596	(87)
Th 2	19.8874	19.8894	19.8913	19.9003	19.9020	19.9098	19.9098	19.9113	19.9068	19.9020	19.8985	19.8950	(88)
util rest of house													
	0.9861	0.9723	0.9435	0.8753	0.7408	0.5359	0.3552	0.3898	0.6381	0.8878	0.9717	0.9890	(89)
MIT 2	18.4589	18.7244	19.0795	19.4803	19.7595	19.8869	19.9074	19.9074	19.8542	19.5200	18.9234	18.4061	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.8207	19.0657	19.3943	19.7668	20.0319	20.1572	20.1799	20.1792	20.1234	19.8020	19.2478	18.7711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8207	19.0657	19.3943	19.7668	20.0319	20.1572	20.1799	20.1792	20.1234	19.8020	19.2478	18.7711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9360	0.8711	0.7485	0.5581	0.3835	0.4185	0.6569	0.8844	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4595	794.5939	841.2910	829.5383	728.5949	524.5474	346.5232	364.2228	552.1270	684.7693	679.6301	667.4561	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1447.2840	1409.1030	1280.1317	1068.9678	818.1968	541.3138	348.7135	367.5679	588.5621	903.6374	1197.0924	1441.1384	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	554.1494	412.9501	326.4975	172.3893	66.6639	0.0000	0.0000	0.0000	0.0000	162.8378	372.5729	575.6196	(98)
Space heating												2643.6805	(98)
Space heating per m2											(98) / (4) =	32.9143	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2833.5268	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	554.1494	412.9501	326.4975	172.3893	66.6639	0.0000	0.0000	0.0000	0.0000	162.8378	372.5729	575.6196	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	593.9437	442.6046	349.9438	184.7688	71.4511	0.0000	0.0000	0.0000	0.0000	174.5314	399.3278	616.9556	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5551	89.5618	89.5762	89.6381	89.7777	86.7000	86.7000	86.7000	86.7000	89.0489	89.4102	89.5807	(217)
Fuel for water heating, kWh/month	154.9941	114.2024	88.0747	41.5958	12.0982	0.0000	0.0000	21.8860	47.3352	93.5112	131.3630	154.0644	(219)
Water heating fuel used												859.1249	(219)
Annual totals kWh/year													
Space heating fuel - main system												2833.5268	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3542.8760	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2833.5268	3.4800	98.6067	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.1249	3.4800	29.8975	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			228.7489	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7666	(257)
SAP value		89.3055	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2833.5268	0.2160	612.0418	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.1249	0.2160	185.5710	(264)
Space and water heating			797.6128	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			719.8792 (272)
CO2 emissions per m2			8.9600 (273)
EI value			92.3026
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2200	
Infiltration rate		0.3555	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3022	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3173	0.2946	0.3022	0.2871	0.2871	0.2795	0.2719	0.2644	0.2568	0.2795	0.2644	0.2795	(22b)
Effective ac	0.5503	0.5434	0.5457	0.5412	0.5412	0.5391	0.5370	0.5350	0.5330	0.5391	0.5350	0.5391	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7071	37.2320	37.3864	37.0815	37.0815	36.9348	36.7921	36.6533	36.5184	36.9348	36.6533	36.9348	(38)
Heat transfer coeff	98.0339	97.5588	97.7133	97.4083	97.4083	97.2617	97.1190	96.9802	96.8453	97.2617	96.9802	97.2617	(39)
Average = Sum(39)m / 12 =												97.3193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2205	1.2146	1.2165	1.2128	1.2128	1.2109	1.2092	1.2074	1.2057	1.2109	1.2074	1.2109	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
								Total per year (kWh/year) = Sum(64)m =				743.7098	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8964	57.1735	57.0831	57.2618	57.2618	57.3482	57.4324	57.5146	57.5947	57.3482	57.5146	57.3482	
alpha	4.7931	4.8116	4.8055	4.8175	4.8175	4.8232	4.8288	4.8343	4.8396	4.8232	4.8343	4.8232	
util living area													
	0.9848	0.9748	0.9462	0.8773	0.7493	0.5405	0.3940	0.4052	0.6484	0.8806	0.9670	0.9878	(86)
MIT	20.0327	20.1697	20.4239	20.7022	20.8960	20.9827	20.9969	20.9966	20.9593	20.7471	20.3649	20.0065	(87)
Th 2	19.9036	19.9083	19.9068	19.9098	19.9098	19.9113	19.9127	19.9141	19.9154	19.9113	19.9141	19.9113	(88)
util rest of house													
	0.9800	0.9670	0.9296	0.8406	0.6805	0.4441	0.2857	0.2941	0.5529	0.8362	0.9549	0.9839	(89)
MIT 2	18.6624	18.8615	19.2179	19.5924	19.8224	19.9024	19.9119	19.9132	19.8903	19.6591	19.1471	18.6308	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0065	19.1900	19.5207	19.8711	20.0920	20.1737	20.1844	20.1852	20.1587	19.9323	19.4529	18.9763	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9224	0.8391	0.6929	0.4680	0.3130	0.3222	0.5755	0.8372	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.7869	801.2152	847.4573	825.0754	682.4031	467.0676	298.7875	298.3458	510.2899	679.7626	707.6750	691.0010	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1382.9145	1355.0957	1223.4421	1010.2308	739.5275	474.0198	299.5514	299.2070	528.6539	829.8694	1120.4016	1359.3536	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	483.6949	372.2077	279.7327	133.3119	42.5005	0.0000	0.0000	0.0000	0.0000	111.6794	297.1631	497.2543	(98)
Space heating												2217.5446	(98)
Space heating per m2											(98) / (4) =	27.6089	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2376.7895	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	483.6949	372.2077	279.7327	133.3119	42.5005	0.0000	0.0000	0.0000	0.0000	111.6794	297.1631	497.2543	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	518.4297	398.9364	299.8206	142.8852	45.5526	0.0000	0.0000	0.0000	0.0000	119.6993	318.5028	532.9628	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4906	89.4977	89.4851	89.5055	89.3175	86.7000	86.7000	86.7000	86.7000	88.7685	89.2808	89.5065	(217)
Fuel for water heating, kWh/month													
	150.5106	114.5019	87.8244	40.4965	17.1483	0.0000	0.0000	14.9625	41.9449	89.4358	126.1991	150.8118	(219)
Water heating fuel used												833.8358	(219)
Annual totals kWh/year													
Space heating fuel - main system												2376.7895	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2985.7319	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2376.7895	7.3800	175.4071	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8358	7.3800	61.5371	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			279.4897	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2376.7895	0.2160	513.3865	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8358	0.2160	180.1085	(264)
Space and water heating			693.4951	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			576.7754	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2376.7895	1.2200	2899.6831	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8358	1.2200	1017.2797	(264)
Space and water heating			3916.9629	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3226.5400	(272)
Primary energy kWh/m2/year			40.1711	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 386 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 386 EPC	**Prop Type Ref**	
Property	29 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.03	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.64		
CO_2 Emissions (t/year)	0.76	**DFEE**	45.89	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.61		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.03	$kgCO_2/m^2$	Pass
	-5.23 (-28.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.89	$kWh/m^2/yr$	
	-5.4 (-10.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.22 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	3.61 m², No overhang 7.97 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.22 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 387 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 387 EPC	**Prop Type Ref**	
Property	30 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	10.95	**TER**	16.79
Environmental	92 A	**% DER<TER**	34.77		
CO_2 Emissions (t/year)	0.61	**DFEE**	35.81	**TFEE**	42.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.40		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Mid-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.95 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.21 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3550	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3847	0.3772	0.3696	0.3319	0.3244	0.2867	0.2867	0.2791	0.3017	0.3244	0.3395	0.3545	(22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5390	0.5455	0.5526	0.5576	0.5629	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3291	39.1322	38.9392	38.0327	37.8631	37.0735	37.0735	36.9273	37.3776	37.8631	38.2062	38.5649	(38)
Heat transfer coeff	83.0398	82.8429	82.6499	81.7434	81.5738	80.7842	80.7842	80.6380	81.0884	81.5738	81.9169	82.2756	(39)
Average = Sum(39)m / 12 =												81.7426	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0339	1.0314	1.0290	1.0177	1.0156	1.0058	1.0058	1.0040	1.0096	1.0156	1.0199	1.0243	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	375.7219	373.5175	359.8284	337.8381	315.5431	294.1292	280.2885	286.3813	297.7540	319.9564	345.4020	364.4526	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331	(83)
Total gains	519.2729	612.2814	674.8714	714.6309	729.5164	702.7122	675.1186	653.0781	633.7199	580.3496	516.2063	488.0857	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1699	67.3296	67.4868	68.2352	68.3771	69.0454	69.0454	69.1706	68.7864	68.3771	68.0907	67.7938	
alpha	5.4780	5.4886	5.4991	5.5490	5.5585	5.6030	5.6030	5.6114	5.5858	5.5585	5.5394	5.5196	
util living area	0.9971	0.9924	0.9810	0.9481	0.8636	0.6956	0.5196	0.5575	0.7908	0.9583	0.9931	0.9979	(86)
MIT	19.9620	20.1322	20.3587	20.6267	20.8458	20.9661	20.9944	20.9918	20.9299	20.6497	20.2503	19.9288	(87)
Th 2	20.0552	20.0572	20.0592	20.0686	20.0703	20.0785	20.0785	20.0800	20.0754	20.0703	20.0668	20.0631	(88)
util rest of house	0.9962	0.9900	0.9746	0.9301	0.8181	0.6115	0.4144	0.4514	0.7161	0.9401	0.9905	0.9972	(89)
MIT 2	18.6712	18.9203	19.2485	19.6330	19.9194	20.0558	20.0764	20.0766	20.0214	19.6719	19.1004	18.6287	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9954	19.2246	19.5273	19.8825	20.1521	20.2844	20.3069	20.3064	20.2495	19.9175	19.3892	18.9552	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9954	19.2246	19.5273	19.8825	20.1521	20.2844	20.3069	20.3064	20.2495	19.9175	19.3892	18.9552	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9870	0.9700	0.9258	0.8226	0.6313	0.4410	0.4781	0.7315	0.9364	0.9878	0.9961	(94)
Useful gains	516.4954	604.3301	654.5990	661.6272	600.1084	443.5997	297.6993	312.2578	463.5558	543.4216	509.9073	486.1710	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1220.3005	1186.6945	1076.7069	897.7477	689.4679	459.2128	299.4600	315.0061	498.6567	760.0608	1006.6909	1213.9909	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	523.6310	391.3489	314.0482	170.0068	66.4835	0.0000	0.0000	0.0000	0.0000	161.1796	357.6842	541.4979	(98)
Space heating												2525.8801	(98)
Space heating per m2											(98) / (4) =	31.4477	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2707.2670	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	523.6310	391.3489	314.0482	170.0068	66.4835	0.0000	0.0000	0.0000	0.0000	161.1796	357.6842	541.4979	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	561.2336	419.4522	336.6005	182.2152	71.2577	0.0000	0.0000	0.0000	0.0000	172.7541	383.3700	580.3836	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4174	89.3069	89.1122	88.7003	87.9100	86.7000	86.7000	86.7000	86.7000	88.6194	89.2235	89.4589	(217)
Fuel for water heating, kWh/month													
	182.6158	160.2791	166.6225	147.1766	143.4156	126.8692	118.9361	134.5284	135.5568	152.9046	164.1885	177.1783	(219)
Water heating fuel used												1810.2715	(219)
Annual totals kWh/year													
Space heating fuel - main system												2707.2670	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4331.5211	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2707.2670	0.2160	584.7697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.2715	0.2160	391.0186	(264)
Space and water heating			975.7883	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			879.2453	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.9500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		10.9500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		29.4083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.4083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	44.8300	13.7000	31.1300	0.1800	5.6034			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9413			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8839 (36)
Total fabric heat loss	(33) + (36) =	42.8251 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	83.3454	83.1022	82.8639	81.7444	81.5350	80.5600	80.5600	80.3794	80.9355	81.5350	81.9587	82.4017	(39)
Average = Sum(39)m / 12 =												81.7434	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0346	1.0317	1.0177	1.0151	1.0030	1.0030	1.0007	1.0077	1.0151	1.0204	1.0259	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.8637	386.3915	372.0770	349.4630	326.5409	304.5014	290.6669	297.3849	309.3876	332.2137	358.2809	377.5977	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	125.6071	208.9184	275.6626	329.6938	362.2267	357.5101	345.4764	320.8596	293.9701	227.8440	149.4537	108.1790	(83)
Total gains	514.4707	595.3099	647.7396	679.1568	688.7675	662.0115	636.1433	618.2445	603.3577	560.0576	507.7346	485.7767	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9236	67.1195	67.3125	68.2343	68.4096	69.2376	69.2376	69.3931	68.9163	68.4096	68.0559	67.6901	
alpha	5.4616	5.4746	5.4875	5.5490	5.5606	5.6158	5.6158	5.6262	5.5944	5.5606	5.5371	5.5127	
util living area													
	0.9972	0.9934	0.9842	0.9575	0.8852	0.7265	0.5478	0.5843	0.8137	0.9638	0.9937	0.9980	(86)
MIT	19.9510	20.1083	20.3260	20.5940	20.8219	20.9584	20.9928	20.9898	20.9190	20.6306	20.2399	19.9239	(87)
Th 2	20.0521	20.0546	20.0570	20.0686	20.0707	20.0808	20.0808	20.0827	20.0770	20.0707	20.0664	20.0618	(88)
util rest of house													
	0.9963	0.9912	0.9788	0.9421	0.8437	0.6424	0.4383	0.4748	0.7416	0.9476	0.9912	0.9973	(89)
MIT 2	18.6529	18.8837	19.2004	19.5892	19.8927	20.0523	20.0781	20.0784	20.0131	19.6467	19.0851	18.6205	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9789	19.1913	19.4831	19.8415	20.1260	20.2798	20.3078	20.3072	20.2406	19.8938	19.3751	18.9478	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9789	19.1913	19.4831	19.8415	20.1260	20.2798	20.3078	20.3072	20.2406	19.8938	19.3751	18.9478	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9885	0.9745	0.9375	0.8465	0.6618	0.4660	0.5024	0.7557	0.9437	0.9886	0.9962	(94)
Useful gains	511.8326	588.4620	631.2000	636.6828	583.0386	438.1223	296.4119	310.6025	455.9660	528.5170	501.9656	483.9121	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1223.4171	1187.6353	1075.8285	894.4105	687.0173	457.5658	298.6975	314.0618	496.9912	757.7706	1006.0515	1215.2443	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	529.4189	402.6445	330.8036	185.5639	77.3601	0.0000	0.0000	0.0000	0.0000	170.5647	362.9419	544.1112	(98)
Space heating												2603.4087	(98)
Space heating per m2											(98) / (4) =	32.4130	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2787.3755	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	529.4189	402.6445	330.8036	185.5639	77.3601	0.0000	0.0000	0.0000	0.0000	170.5647	362.9419	544.1112	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	566.8296	431.0968	354.1794	198.6766	82.8267	0.0000	0.0000	0.0000	0.0000	182.6175	388.5888	582.5601	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3610	87.0470	86.4988	85.3624	83.3504	80.3000	80.3000	80.3000	80.3000	85.0304	86.7354	87.4688	(217)
Fuel for water heating, kWh/month													
	231.6825	204.1949	213.7980	192.1525	190.5282	174.1812	166.8789	186.0308	188.0853	202.2578	211.6621	225.9339	(219)
Water heating fuel used												2387.3861	(219)
Annual totals kWh/year													
Space heating fuel - main system												2787.3755	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Total delivered energy for all uses												5619.1866	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2787.3755	0.2160	602.0731	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2387.3861	0.2160	515.6754	(264)
Space and water heating			1117.7485	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Total CO2, kg/m2/year			1348.4051	(272)
Emissions per m2 for space and water heating			13.9162	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3871	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9162 * 1.00) + 2.3871 + 0.4846, rounded to 2 d.p.			16.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2100	
Infiltration rate			0.3550	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3847	0.3772	0.3696	0.3319	0.3244	0.2867	0.2867	0.2791	0.3017	0.3244	0.3395	0.3545	(22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5390	0.5455	0.5526	0.5576	0.5629	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3291	39.1322	38.9392	38.0327	37.8631	37.0735	37.0735	36.9273	37.3776	37.8631	38.2062	38.5649	(38)
Heat transfer coeff	83.0398	82.8429	82.6499	81.7434	81.5738	80.7842	80.7842	80.6380	81.0884	81.5738	81.9169	82.2756	(39)
Average = Sum(39)m / 12 =												81.7426	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0339	1.0314	1.0290	1.0177	1.0156	1.0058	1.0058	1.0040	1.0096	1.0156	1.0199	1.0243	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	344.3144	342.8890	330.8176	311.0244	290.1567	270.7505	258.6138	262.5206	273.1146	293.0433	315.9210	333.8192	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331	(83)
Total gains	487.8653	581.6528	645.8606	687.8173	704.1300	679.3335	653.4439	629.2174	609.0804	553.4364	486.7253	457.4523	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1699	67.3296	67.4868	68.2352	68.3771	69.0454	69.0454	69.1706	68.7864	68.3771	68.0907	67.7938	
alpha	5.4780	5.4886	5.4991	5.5490	5.5585	5.6030	5.6030	5.6114	5.5858	5.5585	5.5394	5.5196	
util living area													
	0.9979	0.9940	0.9843	0.9553	0.8773	0.7139	0.5356	0.5767	0.8100	0.9656	0.9948	0.9985	(86)
MIT	19.9250	20.0970	20.3272	20.6022	20.8311	20.9615	20.9935	20.9903	20.9206	20.6236	20.2162	19.8925	(87)
Th 2	20.0552	20.0572	20.0592	20.0686	20.0703	20.0785	20.0785	20.0800	20.0754	20.0703	20.0668	20.0631	(88)
util rest of house													
	0.9972	0.9921	0.9790	0.9393	0.8342	0.6296	0.4279	0.4679	0.7373	0.9500	0.9928	0.9980	(89)
MIT 2	19.0735	19.2462	19.4753	19.7488	19.9560	20.0607	20.0768	20.0772	20.0328	19.7745	19.3734	19.0476	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2873	19.4599	19.6892	19.9631	20.1757	20.2869	20.3070	20.3065	20.2557	19.9878	19.5850	19.2598	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2873	19.4599	19.6892	19.9631	20.1757	20.2869	20.3070	20.3065	20.2557	19.9878	19.5850	19.2598	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9905	0.9763	0.9371	0.8397	0.6498	0.4551	0.4954	0.7529	0.9483	0.9914	0.9974	(94)
Useful gains	486.1064	576.1050	630.5525	644.5423	591.2485	441.4373	297.4067	311.7394	458.5813	524.7963	482.5204	456.2711	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1244.5449	1206.1824	1090.0884	904.3338	691.3973	459.4120	299.4673	315.0143	499.1593	765.7959	1022.7337	1239.0524	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	564.2783	423.4120	341.8947	187.0499	74.5107	0.0000	0.0000	0.0000	0.0000	179.3037	388.9536	582.3893	(98)
Space heating												2741.7922	(98)
Space heating per m2											(98) / (4) =	34.1359	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	759.3719	597.8034	612.8490	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9059	0.9552	0.9444	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	687.9527	571.0126	578.7464	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	886.6584	854.5355	827.9425	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	143.0681	210.9411	185.4019	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												539.4111	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   35.7670   52.7353   46.3505    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          134.8528 (107)
Space cooling per m2                                                                                                     1.6789 (108)
Energy for space heating                                                                                                34.1359 (99)
Energy for space cooling                                                                                                 1.6789 (108)
Total                                                                                                                   35.8148 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   35.8 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	44.8300	13.7000	31.1300	0.1800	5.6034			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9413			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.8839	(36)
Total fabric heat loss (33) + (36) =	42.8251	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	83.3454	83.1022	82.8639	81.7444	81.5350	80.5600	80.5600	80.3794	80.9355	81.5350	81.9587	82.4017	(39)
Average = Sum(39)m / 12 =												81.7434	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0346	1.0317	1.0177	1.0151	1.0030	1.0030	1.0007	1.0077	1.0151	1.0204	1.0259	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	344.3144	342.8890	330.8176	311.0244	290.1567	270.7505	258.6138	262.5206	273.1146	293.0433	315.9210	333.8192	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	125.6071	208.9184	275.6626	329.6938	362.2267	357.5101	345.4764	320.8596	293.9701	227.8440	149.4537	108.1790	(83)
Total gains	469.9215	551.8073	606.4802	640.7182	652.3834	628.2606	604.0901	583.3803	567.0847	520.8872	465.3747	441.9981	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9236	67.1195	67.3125	68.2343	68.4096	69.2376	69.2376	69.3931	68.9163	68.4096	68.0559	67.6901	
alpha	5.4616	5.4746	5.4875	5.5490	5.5606	5.6158	5.6158	5.6262	5.5944	5.5606	5.5371	5.5127	
util living area													
	0.9982	0.9954	0.9882	0.9664	0.9035	0.7542	0.5743	0.6150	0.8418	0.9732	0.9958	0.9987	(86)
MIT	19.8985	20.0580	20.2804	20.5568	20.7976	20.9498	20.9909	20.9868	20.9027	20.5912	20.1907	19.8720	(87)
Th 2	20.0521	20.0546	20.0570	20.0686	20.0707	20.0808	20.0808	20.0827	20.0770	20.0707	20.0664	20.0618	(88)
util rest of house													
	0.9976	0.9938	0.9841	0.9536	0.8660	0.6709	0.4608	0.5019	0.7737	0.9606	0.9942	0.9983	(89)
MIT 2	19.0445	19.2054	19.4278	19.7068	19.9299	20.0568	20.0784	20.0788	20.0229	19.7449	19.3478	19.0260	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2590	19.4195	19.6419	19.9202	20.1478	20.2810	20.3076	20.3068	20.2439	19.9574	19.5595	19.2385	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2590	19.4195	19.6419	19.9202	20.1478	20.2810	20.3076	20.3068	20.2439	19.9574	19.5595	19.2385	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9925	0.9817	0.9512	0.8696	0.6904	0.4896	0.5305	0.7875	0.9586	0.9929	0.9978	(94)
Useful gains	468.4992	547.6490	595.4090	609.4301	567.3196	433.7493	295.7613	309.5090	446.6061	499.3338	462.0906	441.0293	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1246.7618	1206.6041	1088.9872	900.8440	688.7899	457.6629	298.6805	314.0299	497.2566	762.9564	1021.1613	1239.1961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	579.0274	442.8179	367.2221	209.8180	90.3739	0.0000	0.0000	0.0000	0.0000	196.1352	402.5309	593.8361	(98)
Space heating												2881.7615	(98)
Space heating per m2											(98) / (4) =	35.8785	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	757.2638	596.1439	610.8836	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8836	0.9421	0.9298	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.0964	561.6563	568.0091	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	826.9628	796.8493	774.3667	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	113.6638	174.9836	153.5301	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												442.1776	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   28.4160   43.7459   38.3825    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.5444 (107)
Space cooling per m2                                                                                                     1.3763 (108)
Energy for space heating                                                                                                35.8785 (99)
Energy for space cooling                                                                                                 1.3763 (108)
Total                                                                                                                   37.2548 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     42.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2100	
Infiltration rate			0.3550	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3168	0.2942	0.3017	0.2867	0.2867	0.2791	0.2716	0.2640	0.2565	0.2791	0.2640	0.2791	(22b)
Effective ac	0.5502	0.5433	0.5455	0.5411	0.5411	0.5390	0.5369	0.5349	0.5329	0.5390	0.5349	0.5390	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6974	37.2236	37.3776	37.0735	37.0735	36.9273	36.7850	36.6466	36.5121	36.9273	36.6466	36.9273	(38)
Heat transfer coeff	81.4081	80.9343	81.0884	80.7842	80.7842	80.6380	80.4957	80.3573	80.2228	80.6380	80.3573	80.6380	(39)
Average = Sum(39)m / 12 =												80.6955	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0135	1.0076	1.0096	1.0058	1.0058	1.0040	1.0022	1.0005	0.9988	1.0040	1.0005	1.0040	(40)
HLP (average)												1.0047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392	(83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.5163	68.9173	68.7864	69.0454	69.0454	69.1706	69.2929	69.4122	69.5286	69.1706	69.4122	69.1706	
alpha	5.5678	5.5945	5.5858	5.6030	5.6030	5.6114	5.6195	5.6275	5.6352	5.6114	5.6275	5.6114	
util living area													
	0.9824	0.9708	0.9386	0.8629	0.7246	0.5122	0.3689	0.3751	0.6036	0.8524	0.9592	0.9859	(86)
MIT	20.2908	20.4069	20.6070	20.8141	20.9450	20.9932	20.9991	20.9990	20.9837	20.8559	20.5662	20.2675	(87)
Th 2	20.0721	20.0770	20.0754	20.0785	20.0785	20.0800	20.0815	20.0829	20.0843	20.0800	20.0829	20.0800	(88)
util rest of house													
	0.9771	0.9624	0.9214	0.8272	0.6624	0.4326	0.2825	0.2875	0.5230	0.8070	0.9457	0.9815	(89)
MIT 2	19.1593	19.3279	19.6055	19.8808	20.0323	20.0764	20.0813	20.0827	20.0742	19.9384	19.5601	19.1325	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9726	0.9571	0.9167	0.8287	0.6754	0.4525	0.3042	0.3095	0.5427	0.8119	0.9408	0.9775	(94)
Useful gains	712.0456	765.6669	788.8163	743.5373	597.4017	401.0477	258.3069	257.9275	442.2661	623.1281	678.5152	674.6666	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1183.9515	1157.2709	1042.5505	857.5363	627.0051	403.7276	258.5323	258.1714	449.4550	707.0971	957.2758	1162.6014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	351.0980	263.1579	188.7782	82.0792	22.0249	0.0000	0.0000	0.0000	0.0000	62.4730	200.7076	363.0235	(98)
Space heating												1533.3423	(98)
RHI space heating demand												1533	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2100	
Infiltration rate			0.3550	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3847	0.3772	0.3696	0.3319	0.3244	0.2867	0.2867	0.2791	0.3017	0.3244	0.3395	0.3545	(22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5390	0.5455	0.5526	0.5576	0.5629	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3291	39.1322	38.9392	38.0327	37.8631	37.0735	37.0735	36.9273	37.3776	37.8631	38.2062	38.5649	(38)
Heat transfer coeff	83.0398	82.8429	82.6499	81.7434	81.5738	80.7842	80.7842	80.6380	81.0884	81.5738	81.9169	82.2756	(39)
Average = Sum(39)m / 12 =												81.7426	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0339	1.0314	1.0290	1.0177	1.0156	1.0058	1.0058	1.0040	1.0096	1.0156	1.0199	1.0243	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331 (83)
Total gains	700.6887	791.3139	845.8646	874.0829	877.0177	841.0555	809.5507	789.8934	778.5745	736.7455	684.5529	665.5902 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1699	67.3296	67.4868	68.2352	68.3771	69.0454	69.0454	69.1706	68.7864	68.3771	68.0907	67.7938	
alpha	5.4780	5.4886	5.4991	5.5490	5.5585	5.6030	5.6030	5.6114	5.5858	5.5585	5.5394	5.5196	
util living area	0.9881	0.9760	0.9517	0.8945	0.7800	0.5986	0.4366	0.4660	0.6826	0.9005	0.9753	0.9907	(86)
MIT	20.1705	20.3290	20.5296	20.7517	20.9107	20.9837	20.9976	20.9966	20.9663	20.7783	20.4359	20.1350	(87)
Th 2	20.0552	20.0572	20.0592	20.0686	20.0703	20.0785	20.0785	20.0800	20.0754	20.0703	20.0668	20.0631	(88)
util rest of house	0.9845	0.9691	0.9378	0.8651	0.7254	0.5193	0.3465	0.3747	0.6049	0.8669	0.9669	0.9879	(89)
MIT 2	18.9732	19.2017	19.4859	19.7935	19.9885	20.0683	20.0777	20.0787	20.0516	19.8353	19.3647	18.9281	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2739	19.4848	19.7480	20.0341	20.2200	20.2981	20.3087	20.3092	20.2813	20.0721	19.6337	19.2312	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2739	19.4848	19.7480	20.0341	20.2200	20.2981	20.3087	20.3092	20.2813	20.0721	19.6337	19.2312	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9639	0.9323	0.8639	0.7348	0.5387	0.3692	0.3977	0.6230	0.8670	0.9620	0.9846	(94)
Useful gains	687.1475	762.7238	788.6276	755.1144	644.4186	453.0699	298.8823	314.1335	485.0884	638.7258	658.5627	655.3504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1243.4255	1208.2453	1094.9438	910.1392	695.0126	460.3206	299.6028	315.2295	501.2313	772.6789	1026.7193	1236.6990	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	413.8708	299.3904	227.8993	111.6178	37.6420	0.0000	0.0000	0.0000	0.0000	99.6611	265.0728	432.5234	(98)
Space heating												1887.6776	(98)
Space heating per m2											(98) / (4) =	23.5020	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2023.2343	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	413.8708	299.3904	227.8993	111.6178	37.6420	0.0000	0.0000	0.0000	0.0000	99.6611	265.0728	432.5234	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	443.5915	320.8901	244.2650	119.6332	40.3451	0.0000	0.0000	0.0000	0.0000	106.8179	284.1080	463.5835	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2515	89.1033	88.8447	88.3230	87.5021	86.7000	86.7000	86.7000	86.7000	88.1900	88.9848	89.3055	(217)
Fuel for water heating, kWh/month													
	182.9552	160.6454	167.1241	147.8052	144.0843	126.8692	118.9361	134.5284	135.5568	153.6490	164.6290	177.4826	(219)
Water heating fuel used												1814.2654	(219)
Annual totals kWh/year													
Space heating fuel - main system												2023.2343	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3651.4823	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2023.2343	3.4800	70.4086	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.2654	3.4800	63.1364	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	369.4250	13.1900	48.7272	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.0093	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7675	(257)
SAP value		89.2933	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2023.2343	0.2160	437.0186	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.2654	0.2160	391.8813	(264)
Space and water heating			828.8999	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			732.3569	(272)
CO2 emissions per m2			9.1200	(273)
EI value			92.1692	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8803 = 3.953, stars = 4
Water heating environmental impact	0.216 / 0.8803 = 0.2454, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2100	
Infiltration rate			0.3550	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3168	0.2942	0.3017	0.2867	0.2867	0.2791	0.2716	0.2640	0.2565	0.2791	0.2640	0.2791	(22b)
Effective ac	0.5502	0.5433	0.5455	0.5411	0.5411	0.5390	0.5369	0.5349	0.5329	0.5390	0.5349	0.5390	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6974	37.2236	37.3776	37.0735	37.0735	36.9273	36.7850	36.6466	36.5121	36.9273	36.6466	36.9273	(38)
Heat transfer coeff	81.4081	80.9343	81.0884	80.7842	80.7842	80.6380	80.4957	80.3573	80.2228	80.6380	80.3573	80.6380	(39)
Average = Sum(39)m / 12 =												80.6955	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0135	1.0076	1.0096	1.0058	1.0058	1.0040	1.0022	1.0005	0.9988	1.0040	1.0005	1.0040	(40)
HLP (average)												1.0047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392	(83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.5163	68.9173	68.7864	69.0454	69.0454	69.1706	69.2929	69.4122	69.5286	69.1706	69.4122	69.1706	
alpha	5.5678	5.5945	5.5858	5.6030	5.6030	5.6114	5.6195	5.6275	5.6352	5.6114	5.6275	5.6114	
util living area	0.9824	0.9708	0.9386	0.8629	0.7246	0.5122	0.3689	0.3751	0.6036	0.8524	0.9592	0.9859	(86)
MIT	20.2908	20.4069	20.6070	20.8141	20.9450	20.9932	20.9991	20.9990	20.9837	20.8559	20.5662	20.2675	(87)
Th 2	20.0721	20.0770	20.0754	20.0785	20.0785	20.0800	20.0815	20.0829	20.0843	20.0800	20.0829	20.0800	(88)
util rest of house	0.9771	0.9624	0.9214	0.8272	0.6624	0.4326	0.2825	0.2875	0.5230	0.8070	0.9457	0.9815	(89)
MIT 2	19.1593	19.3279	19.6055	19.8808	20.0323	20.0764	20.0813	20.0827	20.0742	19.9384	19.5601	19.1325	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9726	0.9571	0.9167	0.8287	0.6754	0.4525	0.3042	0.3095	0.5427	0.8119	0.9408	0.9775	(94)
Useful gains	712.0456	765.6669	788.8163	743.5373	597.4017	401.0477	258.3069	257.9275	442.2661	623.1281	678.5152	674.6666	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1183.9515	1157.2709	1042.5505	857.5363	627.0051	403.7276	258.5323	258.1714	449.4550	707.0971	957.2758	1162.6014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	351.0980	263.1579	188.7782	82.0792	22.0249	0.0000	0.0000	0.0000	0.0000	62.4730	200.7076	363.0235	(98)
Space heating												1533.3423	(98)
Space heating per m2											(98) / (4) =	19.0904	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1643.4537	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	351.0980	263.1579	188.7782	82.0792	22.0249	0.0000	0.0000	0.0000	0.0000	62.4730	200.7076	363.0235	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	376.3108	282.0556	202.3346	87.9734	23.6066	0.0000	0.0000	0.0000	0.0000	66.9593	215.1207	389.0927	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1252	88.9981	88.6789	88.0552	87.2171	86.7000	86.7000	86.7000	86.7000	87.8046	88.7452	89.1747	(217)
Fuel for water heating, kWh/month													
	183.2145	160.8353	167.4366	148.2548	144.5550	126.8692	118.9361	134.5284	135.5568	154.3234	165.0735	177.7431	(219)
Water heating fuel used												1817.3266	(219)
Annual totals kWh/year													
Space heating fuel - main system												1643.4537	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3199.6452	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1643.4537	7.3800	121.2869	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1817.3266	7.3800	134.1187	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	369.4250	28.6600	105.8772	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			287.5642	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1643.4537	0.2160	354.9860	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.3266	0.2160	392.5425	(264)
Space and water heating			747.5286	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			611.9994	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1643.4537	1.2200	2005.0136	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.3266	1.2200	2217.1385	(264)
Space and water heating			4222.1520	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	369.4250	3.0700	1134.1348	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3420.4670	(272)
Primary energy kWh/m2/year			42.5855	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (30.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 91	A 94
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£127	£142	-£14
Mains gas	£362	£290	£72
Space heating	£250	£250	£0
Water heating	£134	£76	£58
Lighting	£106	£106	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£287	£230	£58
Total cost of uses	£288	£230	£58
Delivered energy	40 kWh/m²	28 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	8 kg/m²	5 kg/m²	2 kg/m²
Primary energy	43 kWh/m²	30 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3550	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3847	0.3772	0.3696	0.3319	0.3244	0.2867	0.2867	0.2791	0.3017	0.3244	0.3395	0.3545	(22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5390	0.5455	0.5526	0.5576	0.5629	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3291	39.1322	38.9392	38.0327	37.8631	37.0735	37.0735	36.9273	37.3776	37.8631	38.2062	38.5649	(38)
Heat transfer coeff	83.0398	82.8429	82.6499	81.7434	81.5738	80.7842	80.7842	80.6380	81.0884	81.5738	81.9169	82.2756	(39)
Average = Sum(39)m / 12 =												81.7426	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0339	1.0314	1.0290	1.0177	1.0156	1.0058	1.0058	1.0040	1.0096	1.0156	1.0199	1.0243	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331	(83)
Total gains	700.6887	791.3139	845.8646	874.0829	877.0177	841.0555	809.5507	789.8934	778.5745	736.7455	684.5529	665.5902	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.1699	67.3296	67.4868	68.2352	68.3771	69.0454	69.0454	69.1706	68.7864	68.3771	68.0907	67.7938	
alpha	5.4780	5.4886	5.4991	5.5490	5.5585	5.6030	5.6030	5.6114	5.5858	5.5585	5.5394	5.5196	
util living area													
	0.9881	0.9760	0.9517	0.8945	0.7800	0.5986	0.4366	0.4660	0.6826	0.9005	0.9753	0.9907	(86)
MIT	20.1705	20.3290	20.5296	20.7517	20.9107	20.9837	20.9976	20.9966	20.9663	20.7783	20.4359	20.1350	(87)
Th 2	20.0552	20.0572	20.0592	20.0686	20.0703	20.0785	20.0785	20.0800	20.0754	20.0703	20.0668	20.0631	(88)
util rest of house													
	0.9845	0.9691	0.9378	0.8651	0.7254	0.5193	0.3465	0.3747	0.6049	0.8669	0.9669	0.9879	(89)
MIT 2	18.9732	19.2017	19.4859	19.7935	19.9885	20.0683	20.0777	20.0787	20.0516	19.8353	19.3647	18.9281	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2739	19.4848	19.7480	20.0341	20.2200	20.2981	20.3087	20.3092	20.2813	20.0721	19.6337	19.2312	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2739	19.4848	19.7480	20.0341	20.2200	20.2981	20.3087	20.3092	20.2813	20.0721	19.6337	19.2312	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9639	0.9323	0.8639	0.7348	0.5387	0.3692	0.3977	0.6230	0.8670	0.9620	0.9846	(94)
Useful gains	687.1475	762.7238	788.6276	755.1144	644.4186	453.0699	298.8823	314.1335	485.0884	638.7258	658.5627	655.3504	(95)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1243.4255	1208.2453	1094.9438	910.1392	695.0126	460.3206	299.6028	315.2295	501.2313	772.6789	1026.7193	1236.6990	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	413.8708	299.3904	227.8993	111.6178	37.6420	0.0000	0.0000	0.0000	0.0000	99.6611	265.0728	432.5234	(98)
Space heating												1887.6776	(98)
Space heating per m2											(98) / (4) =	23.5020	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2023.2343	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	413.8708	299.3904	227.8993	111.6178	37.6420	0.0000	0.0000	0.0000	0.0000	99.6611	265.0728	432.5234	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	443.5915	320.8901	244.2650	119.6332	40.3451	0.0000	0.0000	0.0000	0.0000	106.8179	284.1080	463.5835	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3680	89.3552	89.3460	89.3708	89.4681	86.7000	86.7000	86.7000	86.7000	88.6249	89.1632	89.4020	(217)
Fuel for water heating, kWh/month	155.3186	114.4663	88.3016	41.7202	12.1400	0.0000	0.0000	21.8860	47.3352	93.9586	131.7268	154.3722	(219)
Water heating fuel used												861.2256	(219)
Annual totals kWh/year													
Space heating fuel - main system												2023.2343	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												2748.4425	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2023.2343	3.4800	70.4086	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.2256	3.4800	29.9706	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	369.4250	13.1900	48.7272	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			202.4385	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6785	(257)
SAP value		90.5355	
SAP rating (Section 12)		91	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2023.2343	0.2160	437.0186	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.2256	0.2160	186.0247	(264)
Space and water heating			623.0433	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy for lighting	369.4250	0.5190	191.7316 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			552.4503 (272)
CO2 emissions per m2			6.8800 (273)
EI value			94.0929
EI rating			94 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3550	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3168	0.2942	0.3017	0.2867	0.2867	0.2791	0.2716	0.2640	0.2565	0.2791	0.2640	0.2791	(22b)
Effective ac	0.5502	0.5433	0.5455	0.5411	0.5411	0.5390	0.5369	0.5349	0.5329	0.5390	0.5349	0.5390	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6974	37.2236	37.3776	37.0735	37.0735	36.9273	36.7850	36.6466	36.5121	36.9273	36.6466	36.9273	(38)
Heat transfer coeff	81.4081	80.9343	81.0884	80.7842	80.7842	80.6380	80.4957	80.3573	80.2228	80.6380	80.3573	80.6380	(39)
Average = Sum(39)m / 12 =												80.6955	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0135	1.0076	1.0096	1.0058	1.0058	1.0040	1.0022	1.0005	0.9988	1.0040	1.0005	1.0040	(40)
HLP (average)												1.0047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3896 (H8)
Utilisation factor	0.5131 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.8365 (H14)
Volume ratio Veff/V	0.8079 (H15)
Solar storage volume factor	0.9573 (H16)
Solar input	-876.6189 (H17)

Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392 (83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.5163	68.9173	68.7864	69.0454	69.0454	69.1706	69.2929	69.4122	69.5286	69.1706	69.4122	69.1706	
alpha	5.5678	5.5945	5.5858	5.6030	5.6030	5.6114	5.6195	5.6275	5.6352	5.6114	5.6275	5.6114	
util living area													
	0.9824	0.9708	0.9386	0.8629	0.7246	0.5122	0.3689	0.3751	0.6036	0.8524	0.9592	0.9859	(86)
MIT	20.2908	20.4069	20.6070	20.8141	20.9450	20.9932	20.9991	20.9990	20.9837	20.8559	20.5662	20.2675	(87)
Th 2	20.0721	20.0770	20.0754	20.0785	20.0785	20.0800	20.0815	20.0829	20.0843	20.0800	20.0829	20.0800	(88)
util rest of house													
	0.9771	0.9624	0.9214	0.8272	0.6624	0.4326	0.2825	0.2875	0.5230	0.8070	0.9457	0.9815	(89)
MIT 2	19.1593	19.3279	19.6055	19.8808	20.0323	20.0764	20.0813	20.0827	20.0742	19.9384	19.5601	19.1325	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4434	19.5989	19.8570	20.1151	20.2615	20.3067	20.3118	20.3128	20.3026	20.1688	19.8127	19.4175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9726	0.9571	0.9167	0.8287	0.6754	0.4525	0.3042	0.3095	0.5427	0.8119	0.9408	0.9775	(94)
Useful gains	712.0456	765.6669	788.8163	743.5373	597.4017	401.0477	258.3069	257.9275	442.2661	623.1281	678.5152	674.6666	(95)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1183.9515	1157.2709	1042.5505	857.5363	627.0051	403.7276	258.5323	258.1714	449.4550	707.0971	957.2758	1162.6014 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	351.0980	263.1579	188.7782	82.0792	22.0249	0.0000	0.0000	0.0000	0.0000	62.4730	200.7076	363.0235 (98)

Space heating 1533.3423 (98)
Space heating per m2 (98) / (4) = 19.0904 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 1643.4537 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	351.0980	263.1579	188.7782	82.0792	22.0249	0.0000	0.0000	0.0000	0.0000	62.4730	200.7076	363.0235	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	376.3108	282.0556	202.3346	87.9734	23.6066	0.0000	0.0000	0.0000	0.0000	66.9593	215.1207	389.0927	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2722	89.2612	89.2112	89.1659	88.7878	86.7000	86.7000	86.7000	86.7000	88.2493	88.9718	89.2950	(217)
Fuel for water heating, kWh/month	150.8788	114.8053	88.0940	40.6508	17.2506	0.0000	0.0000	14.9625	41.9449	89.9620	126.6375	151.1690	(219)

Water heating fuel used 836.3554 (219)
Annual totals kWh/year
Space heating fuel - main system 1643.4537 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 369.4250 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602 -705.5602 (233)
Total delivered energy for all uses 2268.6739 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1643.4537	7.3800	121.2869	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	836.3554	7.3800	61.7230	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	369.4250	28.6600	105.8772	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			229.4986	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1643.4537	0.2160	354.9860	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.3554	0.2160	180.6528	(264)
Space and water heating			535.6388	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			426.0596	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1643.4537	1.2200	2005.0136	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.3554	1.2200	1020.3536	(264)
Space and water heating			3025.3671	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	369.4250	3.0700	1134.1348	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			2377.1821	(272)
Primary energy kWh/m2/year			29.5964	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	43.71	(37)
Summer heat loss coefficient	591.85	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						437.0800

	Jun	Jul	Aug	
Solar gains	464	437	411	(P3)
Internal gains	429	412	420	
Total summer gains	894	849	831	(P5)
Summer gain/loss ratio	1.51	1.43	1.40	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.98	18.95	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 387 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 387 EPC	**Prop Type Ref**	
Property	30 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	10.95	**TER**	16.79
Environmental	92 A	**% DER<TER**	34.77		
CO_2 Emissions (t/year)	0.61	**DFEE**	35.81	**TFEE**	42.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.40		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	10.95	$kgCO_2/m^2$	Pass
	-5.84 (-34.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.84	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	35.81	$kWh/m^2/yr$	
	-7.0 (-16.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	3.61 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 388 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 388 EPC	**Prop Type Ref**	
Property	31 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.05	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.53		
CO_2 Emissions (t/year)	0.76	**DFEE**	45.99	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

End-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.33 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3300	
Infiltration rate		0.3610	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3068	0.3299	0.3452	0.3605	(22b)
Effective ac	0.5765	0.5736	0.5706	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5019	39.2983	39.0987	38.1613	37.9859	37.1695	37.1695	37.0183	37.4840	37.9859	38.3407	38.7117	(38)
Heat transfer coeff	99.8288	99.6251	99.4256	98.4882	98.3128	97.4963	97.4963	97.3451	97.8108	98.3128	98.6676	99.0385	(39)
Average = Sum(39)m / 12 =												98.4873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2429	1.2404	1.2379	1.2262	1.2240	1.2138	1.2138	1.2120	1.2178	1.2240	1.2284	1.2330	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8735	55.9877	56.1000	56.6340	56.7350	57.2101	57.2101	57.2990	57.0262	56.7350	56.5310	56.3193	
alpha	4.7249	4.7325	4.7400	4.7756	4.7823	4.8140	4.8140	4.8199	4.8017	4.7823	4.7687	4.7546	
util living area													
	0.9968	0.9920	0.9801	0.9470	0.8661	0.7109	0.5421	0.5867	0.8144	0.9622	0.9930	0.9977	(86)
MIT	19.6967	19.8904	20.1628	20.4923	20.7708	20.9377	20.9864	20.9802	20.8756	20.5074	20.0331	19.6594	(87)
Th 2	19.8858	19.8879	19.8898	19.8991	19.9008	19.9089	19.9089	19.9104	19.9058	19.9008	19.8973	19.8937	(88)
util rest of house													
	0.9957	0.9892	0.9731	0.9275	0.8167	0.6153	0.4155	0.4592	0.7340	0.9442	0.9902	0.9969	(89)
MIT 2	18.1633	18.4465	18.8411	19.3124	19.6789	19.8680	19.9041	19.9026	19.8099	19.3431	18.6623	18.1144	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5484	18.8091	19.1730	19.6087	19.9531	20.1366	20.1759	20.1732	20.0775	19.6355	19.0066	18.5024	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5484	18.8091	19.1730	19.6087	19.9531	20.1366	20.1759	20.1732	20.0775	19.6355	19.0066	18.5024	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9671	0.9211	0.8194	0.6368	0.4475	0.4913	0.7483	0.9385	0.9869	0.9954	(94)
Useful gains	532.0569	635.2691	704.7239	730.9022	677.1319	510.6295	344.3741	360.6643	521.1314	580.8388	529.4799	498.8395	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1422.3993	1385.6942	1260.0182	1054.6822	811.3857	539.7975	348.6337	367.3034	584.6653	888.3032	1174.7925	1416.4836	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	662.4147	504.2856	413.1390	233.1216	99.8849	0.0000	0.0000	0.0000	0.0000	228.7535	464.6251	682.7271	(98)
Space heating												3288.9516	(98)
Space heating per m2											(98) / (4) =	40.9481	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3525.1357	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	662.4147	504.2856	413.1390	233.1216	99.8849	0.0000	0.0000	0.0000	0.0000	228.7535	464.6251	682.7271	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	709.9836	540.4991	442.8071	249.8624	107.0577	0.0000	0.0000	0.0000	0.0000	245.1806	497.9905	731.7547	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5645	89.4786	89.3195	88.9738	88.2553	86.7000	86.7000	86.7000	86.7000	88.9264	89.4101	89.5990	(217)
Fuel for water heating, kWh/month													
	182.3158	159.9716	166.2357	146.7241	142.8545	126.8692	118.9361	134.5284	135.5568	152.3767	163.8460	176.9013	(219)
Water heating fuel used												1807.1162	(219)
Annual totals kWh/year													
Space heating fuel - main system												3525.1357	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5132.4762	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3525.1357	0.2160	761.4293	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1162	0.2160	390.3371	(264)
Space and water heating			1151.7664	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1048.0829	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3300	
Infiltration rate		0.3610	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3068	0.3299	0.3452	0.3605	(22b)
Effective ac	0.5765	0.5736	0.5706	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5019	39.2983	39.0987	38.1613	37.9859	37.1695	37.1695	37.0183	37.4840	37.9859	38.3407	38.7117	(38)
Heat transfer coeff	99.8288	99.6251	99.4256	98.4882	98.3128	97.4963	97.4963	97.3451	97.8108	98.3128	98.6676	99.0385	(39)
Average = Sum(39)m / 12 =												98.4873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2429	1.2404	1.2379	1.2262	1.2240	1.2138	1.2138	1.2120	1.2178	1.2240	1.2284	1.2330	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8735	55.9877	56.1000	56.6340	56.7350	57.2101	57.2101	57.2990	57.0262	56.7350	56.5310	56.3193	
alpha	4.7249	4.7325	4.7400	4.7756	4.7823	4.8140	4.8140	4.8199	4.8017	4.7823	4.7687	4.7546	
util living area													
	0.9975	0.9934	0.9830	0.9529	0.8769	0.7257	0.5561	0.6034	0.8295	0.9678	0.9945	0.9982	(86)
MIT	19.6611	19.8565	20.1324	20.4682	20.7555	20.9318	20.9848	20.9778	20.8642	20.4813	20.0002	19.6245	(87)
Th 2	19.8858	19.8879	19.8898	19.8991	19.9008	19.9089	19.9089	19.9104	19.9058	19.9008	19.8973	19.8937	(88)
util rest of house													
	0.9967	0.9912	0.9769	0.9351	0.8298	0.6304	0.4271	0.4737	0.7516	0.9520	0.9922	0.9976	(89)
MIT 2	18.6744	18.8702	19.1443	19.4766	19.7374	19.8780	19.9052	19.9043	19.8331	19.4961	19.0217	18.6440	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9222	19.1179	19.3925	19.7256	19.9931	20.1426	20.1763	20.1739	20.0920	19.7435	19.2674	18.8903	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9222	19.1179	19.3925	19.7256	19.9931	20.1426	20.1763	20.1739	20.0920	19.7435	19.2674	18.8903	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9734	0.9317	0.8343	0.6525	0.4598	0.5066	0.7668	0.9491	0.9905	0.9968	(94)
Useful gains	501.7878	607.2604	681.0673	714.2919	668.2689	508.0053	343.8963	359.8103	515.1077	561.8586	502.1788	469.0407	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1459.7133	1416.4619	1281.8401	1066.1940	815.3172	540.3833	348.6785	367.3693	586.0860	898.9235	1200.5274	1454.9019	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	712.6966	543.7834	446.9750	253.3695	109.4039	0.0000	0.0000	0.0000	0.0000	250.7763	502.8110	733.4807	(98)
Space heating												3553.2963	(98)
Space heating per m2											(98) / (4) =	44.2392	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.4654	721.4728	739.8230	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8628	0.9236	0.9053	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.7579	666.3403	669.7954	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.2752	221.8295	187.6988	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												561.8034 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0688	55.4574	46.9247	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												140.4509 (107)
Space cooling per m2												1.7486 (108)
Energy for space heating												44.2392 (99)
Energy for space cooling												1.7486 (108)
Total												45.9879 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3300	
Infiltration rate		0.3610	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3222	0.2992	0.3068	0.2915	0.2915	0.2838	0.2762	0.2685	0.2608	0.2838	0.2685	0.2838	(22b)
Effective ac	0.5519	0.5448	0.5471	0.5425	0.5425	0.5403	0.5381	0.5360	0.5340	0.5403	0.5360	0.5403	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8146	37.3247	37.4840	37.1695	37.1695	37.0183	36.8711	36.7280	36.5889	37.0183	36.7280	37.0183	(38)
Heat transfer coeff	98.1414	97.6515	97.8108	97.4963	97.4963	97.3451	97.1980	97.0548	96.9157	97.3451	97.0548	97.3451	(39)
Average = Sum(39)m / 12 =												97.4046	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2219	1.2158	1.2178	1.2138	1.2138	1.2120	1.2101	1.2084	1.2066	1.2120	1.2084	1.2120	(40)
HLP (average)												1.2127	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8341	57.1192	57.0262	57.2101	57.2101	57.2990	57.3857	57.4704	57.5529	57.2990	57.4704	57.2990	
alpha	4.7889	4.8079	4.8017	4.8140	4.8140	4.8199	4.8257	4.8314	4.8369	4.8199	4.8314	4.8199	
util living area													
	0.9848	0.9748	0.9463	0.8775	0.7497	0.5409	0.3943	0.4055	0.6488	0.8808	0.9671	0.9878	(86)
MIT	20.0309	20.1682	20.4225	20.7014	20.8956	20.9826	20.9969	20.9965	20.9592	20.7464	20.3639	20.0052	(87)
Th 2	19.9025	19.9074	19.9058	19.9089	19.9089	19.9104	19.9119	19.9133	19.9147	19.9104	19.9133	19.9104	(88)
util rest of house													
	0.9800	0.9670	0.9297	0.8408	0.6808	0.4444	0.2858	0.2943	0.5531	0.8364	0.9550	0.9839	(89)
MIT 2	18.6591	18.8587	19.2153	19.5905	19.8212	19.9015	19.9111	19.9124	19.8895	19.6576	19.1451	18.6282	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8393	0.6932	0.4683	0.3132	0.3224	0.5757	0.8374	0.9484	0.9792	(94)
Useful gains	732.8012	801.2448	847.5442	825.2678	682.7172	467.3654	298.9678	298.5157	510.5316	679.9119	707.7064	691.0084	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.1466	1356.1436	1224.4383	1010.9872	740.0931	474.3597	299.7370	299.3825	528.9758	830.4505	1121.0984	1360.3014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	484.6010	372.8920	280.4092	133.7179	42.6877	0.0000	0.0000	0.0000	0.0000	112.0007	297.6422	497.9540	(98)
Space heating												2221.9046	(98)
RHI space heating demand												2222	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3300	
Infiltration rate			0.3610	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3068	0.3299	0.3452	0.3605	(22b)
Effective ac	0.5765	0.5736	0.5706	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5019	39.2983	39.0987	38.1613	37.9859	37.1695	37.1695	37.0183	37.4840	37.9859	38.3407	38.7117	(38)
Heat transfer coeff	99.8288	99.6251	99.4256	98.4882	98.3128	97.4963	97.4963	97.3451	97.8108	98.3128	98.6676	99.0385	(39)
Average = Sum(39)m / 12 =												98.4873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2429	1.2404	1.2379	1.2262	1.2240	1.2138	1.2138	1.2120	1.2178	1.2240	1.2284	1.2330	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8735	55.9877	56.1000	56.6340	56.7350	57.2101	57.2101	57.2990	57.0262	56.7350	56.5310	56.3193	
alpha	4.7249	4.7325	4.7400	4.7756	4.7823	4.8140	4.8140	4.8199	4.8017	4.7823	4.7687	4.7546	
util living area													
	0.9894	0.9789	0.9570	0.9052	0.8002	0.6297	0.4678	0.5042	0.7263	0.9197	0.9794	0.9917	(86)
MIT	19.8972	20.0812	20.3308	20.6198	20.8438	20.9628	20.9927	20.9896	20.9256	20.6420	20.2135	19.8573	(87)
Th 2	19.8858	19.8879	19.8898	19.8991	19.9008	19.9089	19.9089	19.9104	19.9058	19.9008	19.8973	19.8937	(88)
util rest of house													
	0.9861	0.9724	0.9436	0.8755	0.7412	0.5363	0.3554	0.3900	0.6384	0.8880	0.9718	0.9890	(89)
MIT 2	18.4539	18.7197	19.0754	19.4776	19.7576	19.8859	19.9065	19.9065	19.8530	19.5176	18.9200	18.4019	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8164	19.0616	19.3907	19.7645	20.0304	20.1564	20.1792	20.1785	20.1223	19.8000	19.2448	18.7674	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8164	19.0616	19.3907	19.7645	20.0304	20.1564	20.1792	20.1785	20.1223	19.8000	19.2448	18.7674	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9361	0.8713	0.7489	0.5585	0.3838	0.4188	0.6572	0.8845	0.9658	0.9852	(94)
Useful gains	702.4689	794.6289	841.3856	829.7321	728.9424	524.8654	346.7566	364.4531	552.4282	684.8999	679.6548	667.4606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1449.1509	1410.8540	1281.6638	1070.0199	818.9838	541.7251	348.9623	367.8196	589.0501	904.4740	1198.3001	1442.7318	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	555.5314	414.1032	327.5670	173.0073	66.9908	0.0000	0.0000	0.0000	0.0000	163.3631	373.4246	576.8017	(98)
Space heating												2650.7891	(98)
Space heating per m2											(98) / (4) =	33.0029	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2841.1459	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	555.5314	414.1032	327.5670	173.0073	66.9908	0.0000	0.0000	0.0000	0.0000	163.3631	373.4246	576.8017	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	595.4249	443.8406	351.0900	185.4312	71.8015	0.0000	0.0000	0.0000	0.0000	175.0944	400.2408	618.2226	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4562	89.3470	89.1455	88.7158	87.9162	86.7000	86.7000	86.7000	86.7000	88.6314	89.2557	89.4989	(217)
Fuel for water heating, kWh/month													
	182.5366	160.2072	166.5602	147.1508	143.4056	126.8692	118.9361	134.5284	135.5568	152.8838	164.1293	177.0991	(219)
Water heating fuel used												1809.8630	(219)
Annual totals kWh/year													
Space heating fuel - main system												2841.1459	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4451.2333	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2841.1459	3.4800	98.8719	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8630	3.4800	62.9832	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.5047	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8563	(257)
SAP value		88.0546	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2841.1459	0.2160	613.6875	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8630	0.2160	390.9304	(264)
Space and water heating			1004.6179	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			900.9344	(272)
CO2 emissions per m2			11.2200	(273)
EI value			90.3666	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3300	
Infiltration rate			0.3610	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3222	0.2992	0.3068	0.2915	0.2915	0.2838	0.2762	0.2685	0.2608	0.2838	0.2685	0.2838	(22b)
Effective ac	0.5519	0.5448	0.5471	0.5425	0.5425	0.5403	0.5381	0.5360	0.5340	0.5403	0.5360	0.5403	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8146	37.3247	37.4840	37.1695	37.1695	37.0183	36.8711	36.7280	36.5889	37.0183	36.7280	37.0183	(38)
Heat transfer coeff	98.1414	97.6515	97.8108	97.4963	97.4963	97.3451	97.1980	97.0548	96.9157	97.3451	97.0548	97.3451	(39)
Average = Sum(39)m / 12 =												97.4046	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2219	1.2158	1.2178	1.2138	1.2138	1.2120	1.2101	1.2084	1.2066	1.2120	1.2084	1.2120	(40)
HLP (average)												1.2127	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8341	57.1192	57.0262	57.2101	57.2101	57.2990	57.3857	57.4704	57.5529	57.2990	57.4704	57.2990	
alpha	4.7889	4.8079	4.8017	4.8140	4.8140	4.8199	4.8257	4.8314	4.8369	4.8199	4.8314	4.8199	
util living area													
	0.9848	0.9748	0.9463	0.8775	0.7497	0.5409	0.3943	0.4055	0.6488	0.8808	0.9671	0.9878	(86)
MIT	20.0309	20.1682	20.4225	20.7014	20.8956	20.9826	20.9969	20.9965	20.9592	20.7464	20.3639	20.0052	(87)
Th 2	19.9025	19.9074	19.9058	19.9089	19.9089	19.9104	19.9119	19.9133	19.9147	19.9104	19.9133	19.9104	(88)
util rest of house													
	0.9800	0.9670	0.9297	0.8408	0.6808	0.4444	0.2858	0.2943	0.5531	0.8364	0.9550	0.9839	(89)
MIT 2	18.6591	18.8587	19.2153	19.5905	19.8212	19.9015	19.9111	19.9124	19.8895	19.6576	19.1451	18.6282	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8393	0.6932	0.4683	0.3132	0.3224	0.5757	0.8374	0.9484	0.9792	(94)
Useful gains	732.8012	801.2448	847.5442	825.2678	682.7172	467.3654	298.9678	298.5157	510.5316	679.9119	707.7064	691.0084	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.1466	1356.1436	1224.4383	1010.9872	740.0931	474.3597	299.7370	299.3825	528.9758	830.4505	1121.0984	1360.3014	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	484.6010	372.8920	280.4092	133.7179	42.6877	0.0000	0.0000	0.0000	0.0000	112.0007	297.6422	497.9540	(98)
Space heating												2221.9046	(98)
Space heating per m2											(98) / (4) =	27.6632	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2381.4626	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	484.6010	372.8920	280.4092	133.7179	42.6877	0.0000	0.0000	0.0000	0.0000	112.0007	297.6422	497.9540	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	519.4008	399.6699	300.5457	143.3204	45.7531	0.0000	0.0000	0.0000	0.0000	120.0436	319.0163	533.7128	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3648	89.2718	89.0203	88.4850	87.5832	86.7000	86.7000	86.7000	86.7000	88.2929	89.0800	89.4037	(217)
Fuel for water heating, kWh/month													
	182.7233	160.3422	166.7944	147.5346	143.9508	126.8692	118.9361	134.5284	135.5568	153.4701	164.4531	177.2878	(219)
Water heating fuel used												1812.4467	(219)
Annual totals kWh/year													
Space heating fuel - main system												2381.4626	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3919.0159	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2381.4626	7.3800	175.7519	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4467	7.3800	133.7586	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			337.7260	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2381.4626	0.2160	514.3959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4467	0.2160	391.4885	(264)
Space and water heating			905.8844	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			763.2147	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2381.4626	1.2200	2905.3844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4467	1.2200	2211.1850	(264)
Space and water heating			5116.5694	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4272.6465	(272)
Primary energy kWh/m2/year			53.1953	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£344	£72
Space heating	£304	£304	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£280	£58
Total cost of uses	£338	£280	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3300	
Infiltration rate		0.3610	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3068	0.3299	0.3452	0.3605	(22b)
Effective ac	0.5765	0.5736	0.5706	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5019	39.2983	39.0987	38.1613	37.9859	37.1695	37.1695	37.0183	37.4840	37.9859	38.3407	38.7117	(38)
Heat transfer coeff	99.8288	99.6251	99.4256	98.4882	98.3128	97.4963	97.4963	97.3451	97.8108	98.3128	98.6676	99.0385	(39)
Average = Sum(39)m / 12 =												98.4873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2429	1.2404	1.2379	1.2262	1.2240	1.2138	1.2138	1.2120	1.2178	1.2240	1.2284	1.2330	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8735	55.9877	56.1000	56.6340	56.7350	57.2101	57.2101	57.2990	57.0262	56.7350	56.5310	56.3193	
alpha	4.7249	4.7325	4.7400	4.7756	4.7823	4.8140	4.8140	4.8199	4.8017	4.7823	4.7687	4.7546	
util living area													
	0.9894	0.9789	0.9570	0.9052	0.8002	0.6297	0.4678	0.5042	0.7263	0.9197	0.9794	0.9917	(86)
MIT	19.8972	20.0812	20.3308	20.6198	20.8438	20.9628	20.9927	20.9896	20.9256	20.6420	20.2135	19.8573	(87)
Th 2	19.8858	19.8879	19.8898	19.8991	19.9008	19.9089	19.9089	19.9104	19.9058	19.9008	19.8973	19.8937	(88)
util rest of house													
	0.9861	0.9724	0.9436	0.8755	0.7412	0.5363	0.3554	0.3900	0.6384	0.8880	0.9718	0.9890	(89)
MIT 2	18.4539	18.7197	19.0754	19.4776	19.7576	19.8859	19.9065	19.9065	19.8530	19.5176	18.9200	18.4019	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8164	19.0616	19.3907	19.7645	20.0304	20.1564	20.1792	20.1785	20.1223	19.8000	19.2448	18.7674	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8164	19.0616	19.3907	19.7645	20.0304	20.1564	20.1792	20.1785	20.1223	19.8000	19.2448	18.7674	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9361	0.8713	0.7489	0.5585	0.3838	0.4188	0.6572	0.8845	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4689	794.6289	841.3856	829.7321	728.9424	524.8654	346.7566	364.4531	552.4282	684.8999	679.6548	667.4606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1449.1509	1410.8540	1281.6638	1070.0199	818.9838	541.7251	348.9623	367.8196	589.0501	904.4740	1198.3001	1442.7318	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	555.5314	414.1032	327.5670	173.0073	66.9908	0.0000	0.0000	0.0000	0.0000	163.3631	373.4246	576.8017	(98)
Space heating												2650.7891	(98)
Space heating per m2											(98) / (4) =	33.0029	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2841.1459	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	555.5314	414.1032	327.5670	173.0073	66.9908	0.0000	0.0000	0.0000	0.0000	163.3631	373.4246	576.8017	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	595.4249	443.8406	351.0900	185.4312	71.8015	0.0000	0.0000	0.0000	0.0000	175.0944	400.2408	618.2226	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5566	89.5634	89.5780	89.6401	89.7799	86.7000	86.7000	86.7000	86.7000	89.0516	89.4117	89.5818	(217)
Fuel for water heating, kWh/month													
	154.9915	114.2003	88.0728	41.5949	12.0979	0.0000	0.0000	21.8860	47.3352	93.5084	131.3608	154.0624	(219)
Water heating fuel used												859.1102	(219)
Annual totals kWh/year													
Space heating fuel - main system												2841.1459	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3550.4804	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2841.1459	3.4800	98.8719	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.1102	3.4800	29.8970	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.0135	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7675	(257)
SAP value		89.2931	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2841.1459	0.2160	613.6875	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.1102	0.2160	185.5678	(264)
Space and water heating			799.2553	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			721.5218 (272)
CO2 emissions per m2			8.9800 (273)
EI value			92.2850
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3300	
Infiltration rate			0.3610	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3068	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3222	0.2992	0.3068	0.2915	0.2915	0.2838	0.2762	0.2685	0.2608	0.2838	0.2685	0.2838	(22b)
Effective ac	0.5519	0.5448	0.5471	0.5425	0.5425	0.5403	0.5381	0.5360	0.5340	0.5403	0.5360	0.5403	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8146	37.3247	37.4840	37.1695	37.1695	37.0183	36.8711	36.7280	36.5889	37.0183	36.7280	37.0183	(38)
Heat transfer coeff	98.1414	97.6515	97.8108	97.4963	97.4963	97.3451	97.1980	97.0548	96.9157	97.3451	97.0548	97.3451	(39)
Average = Sum(39)m / 12 =												97.4046	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2219	1.2158	1.2178	1.2138	1.2138	1.2120	1.2101	1.2084	1.2066	1.2120	1.2084	1.2120	(40)
HLP (average)												1.2127	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
								Total per year (kWh/year) = Sum(64)m =				743.7098	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8341	57.1192	57.0262	57.2101	57.2101	57.2990	57.3857	57.4704	57.5529	57.2990	57.4704	57.2990	
alpha	4.7889	4.8079	4.8017	4.8140	4.8140	4.8199	4.8257	4.8314	4.8369	4.8199	4.8314	4.8199	
util living area													
	0.9848	0.9748	0.9463	0.8775	0.7497	0.5409	0.3943	0.4055	0.6488	0.8808	0.9671	0.9878	(86)
MIT	20.0309	20.1682	20.4225	20.7014	20.8956	20.9826	20.9969	20.9965	20.9592	20.7464	20.3639	20.0052	(87)
Th 2	19.9025	19.9074	19.9058	19.9089	19.9089	19.9104	19.9119	19.9133	19.9147	19.9104	19.9133	19.9104	(88)
util rest of house													
	0.9800	0.9670	0.9297	0.8408	0.6808	0.4444	0.2858	0.2943	0.5531	0.8364	0.9550	0.9839	(89)
MIT 2	18.6591	18.8587	19.2153	19.5905	19.8212	19.9015	19.9111	19.9124	19.8895	19.6576	19.1451	18.6282	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0036	19.1876	19.5184	19.8695	20.0910	20.1730	20.1838	20.1847	20.1581	19.9310	19.4512	18.9740	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8393	0.6932	0.4683	0.3132	0.3224	0.5757	0.8374	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8012	801.2448	847.5442	825.2678	682.7172	467.3654	298.9678	298.5157	510.5316	679.9119	707.7064	691.0084 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1384.1466	1356.1436	1224.4383	1010.9872	740.0931	474.3597	299.7370	299.3825	528.9758	830.4505	1121.0984	1360.3014 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	484.6010	372.8920	280.4092	133.7179	42.6877	0.0000	0.0000	0.0000	0.0000	112.0007	297.6422	497.9540 (98)
Space heating												2221.9046 (98)
Space heating per m2											(98) / (4) =	27.6632 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2381.4626 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.6010	372.8920	280.4092	133.7179	42.6877	0.0000	0.0000	0.0000	0.0000	112.0007	297.6422	497.9540	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	519.4008	399.6699	300.5457	143.3204	45.7531	0.0000	0.0000	0.0000	0.0000	120.0436	319.0163	533.7128	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4918	89.4989	89.4866	89.5074	89.3207	86.7000	86.7000	86.7000	86.7000	88.7710	89.2820	89.5074	(217)
Fuel for water heating, kWh/month	150.5086	114.5004	87.8229	40.4957	17.1477	0.0000	0.0000	14.9625	41.9449	89.4333	126.1974	150.8104	(219)
Water heating fuel used												833.8238	(219)

Annual totals kWh/year	
Space heating fuel - main system	2381.4626 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	355.6668 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602	-705.5602 (233)
Total delivered energy for all uses	2990.3929 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2381.4626	7.3800	175.7519	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8238	7.3800	61.5362	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			279.8337	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2381.4626	0.2160	514.3959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8238	0.2160	180.1059	(264)
Space and water heating			694.5019	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			577.7822	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2381.4626	1.2200	2905.3844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8238	1.2200	1017.2650	(264)
Space and water heating			3922.6494	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3232.2265	(272)
Primary energy kWh/m2/year			40.2419	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 388 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 388 EPC	**Prop Type Ref**	
Property	31 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.05	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.53		
CO_2 Emissions (t/year)	0.76	**DFEE**	45.99	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.05	$kgCO_2/m^2$	Pass
	-5.21 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.99	$kWh/m^2/yr$	
	-5.3 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.33 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.33 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 389 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 389 EPC	**Prop Type Ref**	
Property	32 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.53	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.01		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.65	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.53 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.90 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing South: 7.79 m², No overhang
Windows facing West: 1.53 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3462	0.3394	0.3326	0.2987	0.2919	0.2579	0.2579	0.2512	0.2715	0.2919	0.3055	0.3190	(22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5451	44.3600	44.1785	43.3262	43.1668	42.4244	42.4244	42.2870	42.7104	43.1668	43.4894	43.8266	(38)
Heat transfer coeff	108.0893	107.9042	107.7227	106.8704	106.7110	105.9686	105.9686	105.8312	106.2546	106.7110	107.0335	107.3708	(39)
Average = Sum(39)m / 12 =												106.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1590	1.1570	1.1551	1.1459	1.1442	1.1363	1.1363	1.1348	1.1393	1.1442	1.1477	1.1513	(40)
HLP (average)												1.1459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9170	60.0198	60.1209	60.6004	60.6909	61.1161	61.1161	61.1955	60.9516	60.6909	60.5080	60.3180	
alpha	4.9945	5.0013	5.0081	5.0400	5.0461	5.0744	5.0744	5.0797	5.0634	5.0461	5.0339	5.0212	
util living area													
	0.9980	0.9949	0.9873	0.9647	0.9020	0.7616	0.5897	0.6345	0.8540	0.9741	0.9955	0.9985	(86)
MIT	19.7493	19.9181	20.1642	20.4712	20.7480	20.9280	20.9843	20.9774	20.8631	20.5015	20.0613	19.7149	(87)
Th 2	19.9529	19.9545	19.9561	19.9635	19.9649	19.9713	19.9713	19.9725	19.9688	19.9649	19.9621	19.9592	(88)
util rest of house													
	0.9973	0.9932	0.9828	0.9509	0.8620	0.6718	0.4621	0.5077	0.7836	0.9612	0.9936	0.9980	(89)
MIT 2	18.2872	18.5344	18.8926	19.3362	19.7103	19.9212	19.9653	19.9629	19.8575	19.3859	18.7497	18.2413	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6654	18.8923	19.2215	19.6297	19.9787	20.1816	20.2289	20.2253	20.1175	19.6744	19.0889	18.6224	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6654	18.8923	19.2215	19.6297	19.9787	20.1816	20.2289	20.2253	20.1175	19.6744	19.0889	18.6224	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9784	0.9453	0.8626	0.6919	0.4954	0.5406	0.7954	0.9564	0.9914	0.9970	(94)
Useful gains	560.0079	658.7339	724.5950	752.8893	710.0704	551.3082	378.5997	395.6455	556.4323	604.1800	553.7397	526.5982	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1552.7425	1509.8282	1370.3936	1146.6919	883.4286	591.4741	384.5453	404.8332	639.3915	968.3413	1283.2137	1548.5475	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	738.5945	571.9354	480.4742	283.5379	128.9785	0.0000	0.0000	0.0000	0.0000	270.9360	525.2212	760.3303	(98)
Space heating												3760.0080	(98)
Space heating per m2											(98) / (4) =	40.3175	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4030.0193 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	738.5945	571.9354	480.4742	283.5379	128.9785	0.0000	0.0000	0.0000	0.0000	270.9360	525.2212	760.3303	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	791.6340	613.0069	514.9777	303.8992	138.2406	0.0000	0.0000	0.0000	0.0000	290.3923	562.9381	814.9307	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6005	89.5280	89.3926	89.0970	88.4431	86.7000	86.7000	86.7000	86.7000	89.0298	89.4604	89.6331	(217)
Fuel for water heating, kWh/month													
	190.8592	167.4305	173.9099	153.3518	149.1526	132.6794	124.3201	140.7076	141.8108	159.2985	171.4553	185.1757	(219)
Water heating fuel used												1890.1513	(219)
Annual totals kWh/year													
Space heating fuel - main system												4030.0193	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5706.9907	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4030.0193	0.2160	870.4842	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.1513	0.2160	408.2727	(264)
Space and water heating			1278.7569	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1168.1165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5300	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.0567	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0567	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0733	(36)
Total fabric heat loss	(33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3462	0.3394	0.3326	0.2987	0.2919	0.2579	0.2579	0.2512	0.2715	0.2919	0.3055	0.3190	(22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5451	44.3600	44.1785	43.3262	43.1668	42.4244	42.4244	42.2870	42.7104	43.1668	43.4894	43.8266	(38)
Heat transfer coeff	108.0893	107.9042	107.7227	106.8704	106.7110	105.9686	105.9686	105.8312	106.2546	106.7110	107.0335	107.3708	(39)
Average = Sum(39)m / 12 =												106.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1590	1.1570	1.1551	1.1459	1.1442	1.1363	1.1363	1.1348	1.1393	1.1442	1.1477	1.1513	(40)
HLP (average)												1.1459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9170	60.0198	60.1209	60.6004	60.6909	61.1161	61.1161	61.1955	60.9516	60.6909	60.5080	60.3180	
alpha	4.9945	5.0013	5.0081	5.0400	5.0461	5.0744	5.0744	5.0797	5.0634	5.0461	5.0339	5.0212	
util living area													
	0.9985	0.9959	0.9894	0.9692	0.9114	0.7766	0.6050	0.6525	0.8681	0.9783	0.9965	0.9989	(86)
MIT	19.7168	19.8869	20.1357	20.4476	20.7316	20.9210	20.9824	20.9744	20.8506	20.4767	20.0311	19.6831	(87)
Th 2	19.9529	19.9545	19.9561	19.9635	19.9649	19.9713	19.9713	19.9725	19.9688	19.9649	19.9621	19.9592	(88)
util rest of house													
	0.9979	0.9945	0.9855	0.9569	0.8739	0.6879	0.4754	0.5241	0.8010	0.9673	0.9950	0.9985	(89)
MIT 2	18.7833	18.9540	19.2021	19.5131	19.7778	19.9333	19.9667	19.9650	19.8844	19.5462	19.1044	18.7545	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0247	19.1953	19.4436	19.7548	20.0245	20.1888	20.2294	20.2260	20.1343	19.7869	19.3441	18.9947	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0247	19.1953	19.4436	19.7548	20.0245	20.1888	20.2294	20.2260	20.1343	19.7869	19.3441	18.9947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9931	0.9829	0.9538	0.8765	0.7086	0.5094	0.5577	0.8135	0.9648	0.9938	0.9980	(94)
Useful gains	528.1504	628.7356	698.3485	733.0990	698.3624	547.4545	377.8700	394.3668	548.3516	582.5343	524.6745	495.3364	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1591.5830	1542.5188	1394.3177	1160.0580	888.3114	592.2322	384.5997	404.9127	641.1713	980.3383	1310.5248	1588.5169	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	791.1938	614.0624	517.8011	307.4105	141.3221	0.0000	0.0000	0.0000	0.0000	295.9662	565.8122	813.3263	(98)
Space heating												4046.8946	(98)
Space heating per m2											(98) / (4) =	43.3937	(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calculated for June, July and August. See Table 10b													
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	996.1051	784.1679	804.3168	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8390	0.9093	0.8891	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	835.7124	713.0103	715.1105	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.7372	188.7624	158.4661	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												468.9657 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.4343	47.1906	39.6165	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												117.2414 (107)
Space cooling per m2												1.2571 (108)
Energy for space heating												43.3937 (99)
Energy for space cooling												1.2571 (108)
Total												44.6508 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			3.9000	
Infiltration rate			0.3194	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2851	0.2647	0.2715	0.2579	0.2579	0.2512	0.2444	0.2376	0.2308	0.2512	0.2376	0.2512	(22b)
Effective ac	0.5406	0.5350	0.5369	0.5333	0.5333	0.5315	0.5299	0.5282	0.5266	0.5315	0.5282	0.5315	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0110	42.5656	42.7104	42.4244	42.4244	42.2870	42.1532	42.0230	41.8966	42.2870	42.0230	42.2870	(38)
Heat transfer coeff	106.5552	106.1098	106.2546	105.9686	105.9686	105.8312	105.6974	105.5672	105.4408	105.8312	105.5672	105.8312	(39)
Average = Sum(39)m / 12 =												105.8852	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1426	1.1378	1.1393	1.1363	1.1363	1.1348	1.1334	1.1320	1.1306	1.1348	1.1320	1.1348	(40)
HLP (average)												1.1354	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
Total per year (kWh/year) = Sum(64)m =												1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7797	61.0348	60.9516	61.1161	61.1161	61.1955	61.2729	61.3485	61.4221	61.1955	61.3485	61.1955	
alpha	5.0520	5.0690	5.0634	5.0744	5.0744	5.0797	5.0849	5.0899	5.0948	5.0797	5.0899	5.0797	
util living area													
	0.9888	0.9817	0.9605	0.9058	0.7908	0.5823	0.4262	0.4370	0.6883	0.9043	0.9751	0.9910	(86)
MIT	20.0639	20.1832	20.4168	20.6846	20.8857	20.9808	20.9967	20.9964	20.9559	20.7399	20.3749	20.0408	(87)
Th 2	19.9662	19.9701	19.9688	19.9713	19.9713	19.9725	19.9737	19.9748	19.9759	19.9725	19.9748	19.9725	(88)
util rest of house													
	0.9852	0.9759	0.9478	0.8754	0.7274	0.4859	0.3159	0.3242	0.5957	0.8665	0.9658	0.9881	(89)
MIT 2	18.7536	18.9278	19.2588	19.6256	19.8716	19.9622	19.9728	19.9738	19.9475	19.7055	19.2087	18.7251	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8730	0.7383	0.5104	0.3446	0.3535	0.6180	0.8665	0.9604	0.9845	(94)
Useful gains	781.0616	846.9754	891.6374	873.3882	735.2053	512.1119	330.6586	330.2046	557.1940	726.7506	752.6939	738.5088	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1512.2806	1480.4956	1334.3810	1102.0220	808.9542	521.2848	331.6382	331.3001	580.7975	907.2967	1225.6684	1488.5586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	544.0269	425.7256	329.4012	164.6163	54.8692	0.0000	0.0000	0.0000	0.0000	134.3263	340.5416	558.0370	(98)
Space heating												2551.5442	(98)
RHI space heating demand												2552	(98)

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3462	0.3394	0.3326	0.2987	0.2919	0.2579	0.2579	0.2512	0.2715	0.2919	0.3055	0.3190	(22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5451	44.3600	44.1785	43.3262	43.1668	42.4244	42.4244	42.2870	42.7104	43.1668	43.4894	43.8266	(38)
Heat transfer coeff	108.0893	107.9042	107.7227	106.8704	106.7110	105.9686	105.9686	105.8312	106.2546	106.7110	107.0335	107.3708	(39)
Average = Sum(39)m / 12 =												106.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1590	1.1570	1.1551	1.1459	1.1442	1.1363	1.1363	1.1348	1.1393	1.1442	1.1477	1.1513	(40)
HLP (average)												1.1459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9170	60.0198	60.1209	60.6004	60.6909	61.1161	61.1161	61.1955	60.9516	60.6909	60.5080	60.3180	
alpha	4.9945	5.0013	5.0081	5.0400	5.0461	5.0744	5.0744	5.0797	5.0634	5.0461	5.0339	5.0212	
util living area													
	0.9922	0.9846	0.9686	0.9284	0.8377	0.6723	0.5030	0.5396	0.7630	0.9370	0.9845	0.9939	(86)
MIT	19.9452	20.1063	20.3334	20.6059	20.8314	20.9591	20.9922	20.9889	20.9211	20.6401	20.2387	19.9078	(87)
Th 2	19.9529	19.9545	19.9561	19.9635	19.9649	19.9713	19.9713	19.9725	19.9688	19.9649	19.9621	19.9592	(88)
util rest of house													
	0.9897	0.9798	0.9585	0.9046	0.7853	0.5813	0.3898	0.4254	0.6804	0.9110	0.9788	0.9919	(89)
MIT 2	18.5718	18.8056	19.1317	19.5156	19.8048	19.9449	19.9685	19.9682	19.9105	19.5701	19.0047	18.5222	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9270	19.1420	19.4425	19.7976	20.0703	20.2072	20.2333	20.2322	20.1719	19.8468	19.3238	18.8805	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9270	19.1420	19.4425	19.7976	20.0703	20.2072	20.2333	20.2322	20.1719	19.8468	19.3238	18.8805	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9522	0.9000	0.7913	0.6033	0.4193	0.4551	0.6981	0.9074	0.9740	0.9891	(94)
Useful gains	751.4282	840.2217	884.2233	874.5008	779.3965	572.2246	382.1968	401.2879	599.3177	729.0623	724.3031	715.5053	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1581.0238	1536.7724	1394.2017	1164.6264	893.2034	594.1892	385.0153	405.5627	645.1634	986.7393	1308.3599	1576.2597	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	617.2191	468.0821	379.4240	208.8904	84.6723	0.0000	0.0000	0.0000	0.0000	191.7117	420.5209	640.4013	(98)
Space heating												3010.9218	(98)
Space heating per m2											(98) / (4) =	32.2852	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3227.1402	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	617.2191	468.0821	379.4240	208.8904	84.6723	0.0000	0.0000	0.0000	0.0000	191.7117	420.5209	640.4013	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	661.5425	501.6957	406.6709	223.8911	90.7527	0.0000	0.0000	0.0000	0.0000	205.4788	450.7191	686.3894	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4938	89.3996	89.2232	88.8413	88.0727	86.7000	86.7000	86.7000	86.7000	88.7333	89.3089	89.5348	(217)
Fuel for water heating, kWh/month													
	191.0868	167.6710	174.2400	153.7932	149.7800	132.6794	124.3201	140.7076	141.8108	159.8308	171.7461	185.3791	(219)
Water heating fuel used												1893.0449	(219)
Annual totals kWh/year													
Space heating fuel - main system												3227.1402	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4907.0052	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3227.1402	3.4800	112.3045	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1893.0449	3.4800	65.8780	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			270.0640	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8204	(257)
SAP value		88.5556	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3227.1402	0.2160	697.0623	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.0449	0.2160	408.8977	(264)
Space and water heating			1105.9600	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			995.3196	(272)
CO2 emissions per m2			10.6700	(273)
EI value			90.3535	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8828 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8828 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2851	0.2647	0.2715	0.2579	0.2579	0.2512	0.2444	0.2376	0.2308	0.2512	0.2376	0.2512	(22b)
Effective ac	0.5406	0.5350	0.5369	0.5333	0.5333	0.5315	0.5299	0.5282	0.5266	0.5315	0.5282	0.5315	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0110	42.5656	42.7104	42.4244	42.4244	42.2870	42.1532	42.0230	41.8966	42.2870	42.0230	42.2870	(38)
Heat transfer coeff	106.5552	106.1098	106.2546	105.9686	105.9686	105.8312	105.6974	105.5672	105.4408	105.8312	105.5672	105.8312	(39)
Average = Sum(39)m / 12 =												105.8852	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1426	1.1378	1.1393	1.1363	1.1363	1.1348	1.1334	1.1320	1.1306	1.1348	1.1320	1.1348	(40)
HLP (average)												1.1354	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7797	61.0348	60.9516	61.1161	61.1161	61.1955	61.2729	61.3485	61.4221	61.1955	61.3485	61.1955	
alpha	5.0520	5.0690	5.0634	5.0744	5.0744	5.0797	5.0849	5.0899	5.0948	5.0797	5.0899	5.0797	
util living area													
	0.9888	0.9817	0.9605	0.9058	0.7908	0.5823	0.4262	0.4370	0.6883	0.9043	0.9751	0.9910	(86)
MIT	20.0639	20.1832	20.4168	20.6846	20.8857	20.9808	20.9967	20.9964	20.9559	20.7399	20.3749	20.0408	(87)
Th 2	19.9662	19.9701	19.9688	19.9713	19.9713	19.9725	19.9737	19.9748	19.9759	19.9725	19.9748	19.9725	(88)
util rest of house													
	0.9852	0.9759	0.9478	0.8754	0.7274	0.4859	0.3159	0.3242	0.5957	0.8665	0.9658	0.9881	(89)
MIT 2	18.7536	18.9278	19.2588	19.6256	19.8716	19.9622	19.9728	19.9738	19.9475	19.7055	19.2087	18.7251	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8730	0.7383	0.5104	0.3446	0.3535	0.6180	0.8665	0.9604	0.9845	(94)
Useful gains	781.0616	846.9754	891.6374	873.3882	735.2053	512.1119	330.6586	330.2046	557.1940	726.7506	752.6939	738.5088	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1512.2806	1480.4956	1334.3810	1102.0220	808.9542	521.2848	331.6382	331.3001	580.7975	907.2967	1225.6684	1488.5586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	544.0269	425.7256	329.4012	164.6163	54.8692	0.0000	0.0000	0.0000	0.0000	134.3263	340.5416	558.0370	(98)
Space heating												2551.5442	(98)
Space heating per m2											(98) / (4) =	27.3595	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2734.7741	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	544.0269	425.7256	329.4012	164.6163	54.8692	0.0000	0.0000	0.0000	0.0000	134.3263	340.5416	558.0370	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	583.0943	456.2975	353.0560	176.4377	58.8094	0.0000	0.0000	0.0000	0.0000	143.9724	364.9964	598.1104	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4121	89.3340	89.1136	88.6308	87.7274	86.7000	86.7000	86.7000	86.7000	88.4146	89.1505	89.4485	(217)
Fuel for water heating, kWh/month													
	191.2615	167.7940	174.4544	154.1583	150.3695	132.6794	124.3201	140.7076	141.8108	160.4070	172.0514	185.5578	(219)
Water heating fuel used												1895.5717	(219)
Annual totals kWh/year													
Space heating fuel - main system												2734.7741	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4333.8160	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2734.7741	7.3800	201.8263	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.5717	7.3800	139.8932	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			363.7341	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2734.7741	0.2160	590.7112	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5717	0.2160	409.4435	(264)
Space and water heating			1000.1547	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			846.2557	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2734.7741	1.2200	3336.4244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5717	1.2200	2312.5975	(264)
Space and water heating			5649.0218	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4738.6753	(272)
Primary energy kWh/m2/year			50.8114	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£449	£374	£74
Space heating	£330	£330	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£364	£304	£60
Total cost of uses	£364	£304	£60
Delivered energy	46 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	39 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3462	0.3394	0.3326	0.2987	0.2919	0.2579	0.2579	0.2512	0.2715	0.2919	0.3055	0.3190	(22b)
Effective ac	0.5599	0.5576	0.5553	0.5446	0.5426	0.5333	0.5333	0.5315	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.5451	44.3600	44.1785	43.3262	43.1668	42.4244	42.4244	42.2870	42.7104	43.1668	43.4894	43.8266	(38)
Heat transfer coeff	108.0893	107.9042	107.7227	106.8704	106.7110	105.9686	105.9686	105.8312	106.2546	106.7110	107.0335	107.3708	(39)
Average = Sum(39)m / 12 =												106.8697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1590	1.1570	1.1551	1.1459	1.1442	1.1363	1.1363	1.1348	1.1393	1.1442	1.1477	1.1513	(40)
HLP (average)												1.1459	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.1815 (H8)
Utilisation factor	0.5710 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	97.5594 (H14)
Volume ratio Veff/V	0.7688 (H15)
Solar storage volume factor	0.9474 (H16)
Solar input	-862.7264 (H17)

Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435 (64)
								Total per year (kWh/year) = Sum(64)m =				818.2658 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9170	60.0198	60.1209	60.6004	60.6909	61.1161	61.1161	61.1955	60.9516	60.6909	60.5080	60.3180	
alpha	4.9945	5.0013	5.0081	5.0400	5.0461	5.0744	5.0744	5.0797	5.0634	5.0461	5.0339	5.0212	
util living area													
	0.9922	0.9846	0.9686	0.9284	0.8377	0.6723	0.5030	0.5396	0.7630	0.9370	0.9845	0.9939	(86)
MIT	19.9452	20.1063	20.3334	20.6059	20.8314	20.9591	20.9922	20.9889	20.9211	20.6401	20.2387	19.9078	(87)
Th 2	19.9529	19.9545	19.9561	19.9635	19.9649	19.9713	19.9713	19.9725	19.9688	19.9649	19.9621	19.9592	(88)
util rest of house													
	0.9897	0.9798	0.9585	0.9046	0.7853	0.5813	0.3898	0.4254	0.6804	0.9110	0.9788	0.9919	(89)
MIT 2	18.5718	18.8056	19.1317	19.5156	19.8048	19.9449	19.9685	19.9682	19.9105	19.5701	19.0047	18.5222	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9270	19.1420	19.4425	19.7976	20.0703	20.2072	20.2333	20.2322	20.1719	19.8468	19.3238	18.8805	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9270	19.1420	19.4425	19.7976	20.0703	20.2072	20.2333	20.2322	20.1719	19.8468	19.3238	18.8805	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9522	0.9000	0.7913	0.6033	0.4193	0.4551	0.6981	0.9074	0.9740	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4282	840.2217	884.2233	874.5008	779.3965	572.2246	382.1968	401.2879	599.3177	729.0623	724.3031	715.5053	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1581.0238	1536.7724	1394.2017	1164.6264	893.2034	594.1892	385.0153	405.5627	645.1634	986.7393	1308.3599	1576.2597	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	617.2191	468.0821	379.4240	208.8904	84.6723	0.0000	0.0000	0.0000	0.0000	191.7117	420.5209	640.4013	(98)
Space heating												3010.9218	(98)
Space heating per m2											(98) / (4) =	32.2852	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3227.1402	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.2191	468.0821	379.4240	208.8904	84.6723	0.0000	0.0000	0.0000	0.0000	191.7117	420.5209	640.4013	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	661.5425	501.6957	406.6709	223.8911	90.7527	0.0000	0.0000	0.0000	0.0000	205.4788	450.7191	686.3894	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5884	89.6017	89.6231	89.6847	89.7648	86.7000	86.7000	86.7000	86.7000	89.1315	89.4557	89.6129	(217)
Fuel for water heating, kWh/month	162.9602	120.7013	94.1310	46.0998	15.8144	0.0000	0.0000	25.6169	51.6716	99.2415	138.2924	161.8556	(219)
Water heating fuel used												916.3848	(219)
Annual totals kWh/year													
Space heating fuel - main system												3227.1402	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												3980.3451	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3227.1402	3.4800	112.3045	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.3848	3.4800	31.8902	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			242.6712	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7372	(257)
SAP value		89.7164	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3227.1402	0.2160	697.0623	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.3848	0.2160	197.9391	(264)
Space and water heating			895.0014	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			810.3110 (272)
CO2 emissions per m2			8.6900 (273)
EI value			92.1466
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9000	
Infiltration rate		0.3194	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2715	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2851	0.2647	0.2715	0.2579	0.2579	0.2512	0.2444	0.2376	0.2308	0.2512	0.2376	0.2512	(22b)
Effective ac	0.5406	0.5350	0.5369	0.5333	0.5333	0.5315	0.5299	0.5282	0.5266	0.5315	0.5282	0.5315	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0110	42.5656	42.7104	42.4244	42.4244	42.2870	42.1532	42.0230	41.8966	42.2870	42.0230	42.2870	(38)
Heat transfer coeff	106.5552	106.1098	106.2546	105.9686	105.9686	105.8312	105.6974	105.5672	105.4408	105.8312	105.5672	105.8312	(39)
Average = Sum(39)m / 12 =												105.8852	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1426	1.1378	1.1393	1.1363	1.1363	1.1348	1.1334	1.1320	1.1306	1.1348	1.1320	1.1348	(40)
HLP (average)												1.1354	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3223 (H8)
Utilisation factor												0.5306 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-897.1283 (H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656 (63)
								Solar input (sum of months) = Sum(63)m =				-897.1283 (63)
Output from w/h												
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132 (64)
								Total per year (kWh/year) = Sum(64)m =				793.5279 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7797	61.0348	60.9516	61.1161	61.1161	61.1955	61.2729	61.3485	61.4221	61.1955	61.3485	61.1955	
alpha	5.0520	5.0690	5.0634	5.0744	5.0744	5.0797	5.0849	5.0899	5.0948	5.0797	5.0899	5.0797	
util living area													
	0.9888	0.9817	0.9605	0.9058	0.7908	0.5823	0.4262	0.4370	0.6883	0.9043	0.9751	0.9910	(86)
MIT	20.0639	20.1832	20.4168	20.6846	20.8857	20.9808	20.9967	20.9964	20.9559	20.7399	20.3749	20.0408	(87)
Th 2	19.9662	19.9701	19.9688	19.9713	19.9713	19.9725	19.9737	19.9748	19.9759	19.9725	19.9748	19.9725	(88)
util rest of house													
	0.9852	0.9759	0.9478	0.8754	0.7274	0.4859	0.3159	0.3242	0.5957	0.8665	0.9658	0.9881	(89)
MIT 2	18.7536	18.9278	19.2588	19.6256	19.8716	19.9622	19.9728	19.9738	19.9475	19.7055	19.2087	18.7251	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0925	19.2525	19.5583	19.8995	20.1339	20.2256	20.2376	20.2383	20.2083	19.9731	19.5103	19.0654	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8730	0.7383	0.5104	0.3446	0.3535	0.6180	0.8665	0.9604	0.9845	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.0616	846.9754	891.6374	873.3882	735.2053	512.1119	330.6586	330.2046	557.1940	726.7506	752.6939	738.5088	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1512.2806	1480.4956	1334.3810	1102.0220	808.9542	521.2848	331.6382	331.3001	580.7975	907.2967	1225.6684	1488.5586	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	544.0269	425.7256	329.4012	164.6163	54.8692	0.0000	0.0000	0.0000	0.0000	134.3263	340.5416	558.0370	(98)
Space heating												2551.5442	(98)
Space heating per m2											(98) / (4) =	27.3595	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2734.7741	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.0269	425.7256	329.4012	164.6163	54.8692	0.0000	0.0000	0.0000	0.0000	134.3263	340.5416	558.0370	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	583.0943	456.2975	353.0560	176.4377	58.8094	0.0000	0.0000	0.0000	0.0000	143.9724	364.9964	598.1104	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5316	89.5461	89.5450	89.5711	89.3620	86.7000	86.7000	86.7000	86.7000	88.8760	89.3407	89.5461	(217)
Fuel for water heating, kWh/month	158.3177	120.9234	93.7364	44.7982	20.7735	0.0000	0.0000	18.3443	46.0088	94.9616	132.9405	158.4805	(219)
Water heating fuel used												889.2847	(219)
Annual totals kWh/year													
Space heating fuel - main system												2734.7741	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												3377.5290	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2734.7741	7.3800	201.8263	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.2847	7.3800	65.6292	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			303.8001	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2734.7741	0.2160	590.7112	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2847	0.2160	192.0855	(264)
Space and water heating			782.7967	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			654.8477	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2734.7741	1.2200	3336.4244	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2847	1.2200	1084.9274	(264)
Space and water heating			4421.3518	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3664.5052	(272)
Primary energy kWh/m2/year			39.2934	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
West	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 389 BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 389 EPC	**Prop Type Ref**	
Property	32 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.53	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.01		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.65	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.49		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.53	$kgCO_2/m^2$	Pass
	-4.88 (-28.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.65	$kWh/m^2/yr$	
	-5.2 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.90 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	4.09 m², No overhang 7.79 m², No overhang 1.53 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.90 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 390 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 390	**Prop Type Ref**	
Property	33 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.50	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.18		
CO_2 Emissions (t/year)	0.84	**DFEE**	44.53	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.5 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.74 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing East: 1.53 m², No overhang
Windows facing South: 7.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.7 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3375	0.3309	0.3243	0.2912	0.2846	0.2515	0.2515	0.2449	0.2647	0.2846	0.2978	0.3111	(22b)
Effective ac	0.5570	0.5547	0.5526	0.5424	0.5405	0.5316	0.5316	0.5300	0.5350	0.5405	0.5443	0.5484	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3093	44.1333	43.9609	43.1507	42.9991	42.2935	42.2935	42.1629	42.5653	42.9991	43.3058	43.6264	(38)
Heat transfer coeff	107.8535	107.6775	107.5051	106.6949	106.5433	105.8377	105.8377	105.7071	106.1095	106.5433	106.8500	107.1705	(39)
Average = Sum(39)m / 12 =												106.6942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1565	1.1546	1.1527	1.1441	1.1424	1.1349	1.1349	1.1335	1.1378	1.1424	1.1457	1.1492	(40)
HLP (average)												1.1441	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0480	60.1461	60.2426	60.7001	60.7864	61.1917	61.1917	61.2673	61.0349	60.7864	60.6120	60.4307	
alpha	5.0032	5.0097	5.0162	5.0467	5.0524	5.0794	5.0794	5.0845	5.0690	5.0524	5.0408	5.0287	
util living area													
	0.9980	0.9949	0.9873	0.9646	0.9017	0.7611	0.5891	0.6340	0.8536	0.9740	0.9955	0.9985	(86)
MIT	19.7527	19.9213	20.1670	20.4730	20.7493	20.9284	20.9844	20.9775	20.8638	20.5031	20.0636	19.7178	(87)
Th 2	19.9550	19.9565	19.9580	19.9650	19.9663	19.9725	19.9725	19.9736	19.9701	19.9663	19.9637	19.9609	(88)
util rest of house													
	0.9973	0.9932	0.9827	0.9508	0.8617	0.6713	0.4618	0.5073	0.7832	0.9611	0.9936	0.9980	(89)
MIT 2	18.2936	18.5405	18.8980	19.3400	19.7131	19.9227	19.9665	19.9641	19.8593	19.3892	18.7540	18.2468	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6710	18.8976	19.2262	19.6330	19.9811	20.1828	20.2298	20.2262	20.1191	19.6773	19.0927	18.6272	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6710	18.8976	19.2262	19.6330	19.9811	20.1828	20.2298	20.2262	20.1191	19.6773	19.0927	18.6272	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9784	0.9452	0.8623	0.6914	0.4949	0.5402	0.7950	0.9564	0.9914	0.9970	(94)
Useful gains	560.0099	658.7314	724.5715	752.8028	709.8189	550.9549	378.2723	395.3353	556.1719	604.1337	553.7387	526.6000	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1549.9604	1507.2283	1368.1338	1145.1604	882.2934	590.8691	384.1670	404.4532	638.6848	967.1217	1281.4220	1546.1720	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	736.5232	570.1899	478.8103	282.4975	128.3210	0.0000	0.0000	0.0000	0.0000	270.0631	523.9320	758.5616	(98)
Space heating												3748.8986	(98)
Space heating per m2											(98) / (4) =	40.1984	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4018.1121	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	736.5232	570.1899	478.8103	282.4975	128.3210	0.0000	0.0000	0.0000	0.0000	270.0631	523.9320	758.5616	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	789.4139	611.1360	513.1944	302.7840	137.5359	0.0000	0.0000	0.0000	0.0000	289.4567	561.5563	813.0349	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5990	89.5262	89.3902	89.0940	88.4385	86.7000	86.7000	86.7000	86.7000	89.0272	89.4588	89.6319	(217)
Fuel for water heating, kWh/month													
	190.8626	167.4339	173.9145	153.3569	149.1604	132.6794	124.3201	140.7076	141.8108	159.3033	171.4583	185.1783	(219)
Water heating fuel used												1890.1859	(219)
Annual totals kWh/year													
Space heating fuel - main system												4018.1121	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5695.1181	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4018.1121	0.2160	867.9122	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.1859	0.2160	408.2802	(264)
Space and water heating			1276.1924	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1165.5520	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5000	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.0267	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0267	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0733	(36)
Total fabric heat loss	(33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3375	0.3309	0.3243	0.2912	0.2846	0.2515	0.2515	0.2449	0.2647	0.2846	0.2978	0.3111	(22b)
Effective ac	0.5570	0.5547	0.5526	0.5424	0.5405	0.5316	0.5316	0.5300	0.5350	0.5405	0.5443	0.5484	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3093	44.1333	43.9609	43.1507	42.9991	42.2935	42.2935	42.1629	42.5653	42.9991	43.3058	43.6264	(38)
Heat transfer coeff	107.8535	107.6775	107.5051	106.6949	106.5433	105.8377	105.8377	105.7071	106.1095	106.5433	106.8500	107.1705	(39)
Average = Sum(39)m / 12 =												106.6942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1565	1.1546	1.1527	1.1441	1.1424	1.1349	1.1349	1.1335	1.1378	1.1424	1.1457	1.1492	(40)
HLP (average)												1.1441	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206 (72)

Total internal gains

	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0480	60.1461	60.2426	60.7001	60.7864	61.1917	61.1917	61.2673	61.0349	60.7864	60.6120	60.4307	
alpha	5.0032	5.0097	5.0162	5.0467	5.0524	5.0794	5.0794	5.0845	5.0690	5.0524	5.0408	5.0287	
util living area	0.9985	0.9959	0.9893	0.9691	0.9111	0.7761	0.6044	0.6520	0.8677	0.9783	0.9965	0.9989	(86)
MIT	19.7202	19.8901	20.1385	20.4494	20.7329	20.9215	20.9825	20.9745	20.8514	20.4782	20.0334	19.6859	(87)
Th 2	19.9550	19.9565	19.9580	19.9650	19.9663	19.9725	19.9725	19.9736	19.9701	19.9663	19.9637	19.9609	(88)
util rest of house	0.9979	0.9945	0.9854	0.9568	0.8736	0.6875	0.4750	0.5237	0.8006	0.9672	0.9950	0.9985	(89)
MIT 2	18.7882	18.9587	19.2064	19.5162	19.7801	19.9347	19.9679	19.9661	19.8861	19.5489	19.1079	18.7588	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0293	19.1996	19.4475	19.7576	20.0266	20.1899	20.2303	20.2269	20.1357	19.7893	19.3472	18.9986	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0293	19.1996	19.4475	19.7576	20.0266	20.1899	20.2303	20.2269	20.1357	19.7893	19.3472	18.9986	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9931	0.9829	0.9537	0.8762	0.7081	0.5089	0.5573	0.8132	0.9648	0.9938	0.9980	(94)
Useful gains	528.1521	628.7343	698.3308	733.0259	698.1335	547.1160	377.5474	394.0639	548.1124	582.4981	524.6743	495.3377	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1588.6044	1539.7456	1391.9198	1158.4486	887.1387	591.6205	384.2208	404.5317	640.4497	979.0548	1308.6151	1585.9720	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	788.9765	612.1996	516.0302	306.3043	140.6199	0.0000	0.0000	0.0000	0.0000	295.0382	564.4374	811.4318	(98)
Space heating												4035.0379	(98)
Space heating per m2											(98) / (4) =	43.2665	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	994.8746	783.1992	803.3736	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8396	0.9097	0.8896	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	835.3235	712.5095	714.6863	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	122.0172	189.1349	158.7817	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												469.9338 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.5043	47.2837	39.6954	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												117.4835 (107)
Space cooling per m2												1.2597 (108)
Energy for space heating												43.2665 (99)
Energy for space cooling												1.2597 (108)
Total												44.5263 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2780	0.2581	0.2647	0.2515	0.2515	0.2449	0.2383	0.2316	0.2250	0.2449	0.2316	0.2449	(22b)
Effective ac	0.5386	0.5333	0.5350	0.5316	0.5316	0.5300	0.5284	0.5268	0.5253	0.5300	0.5268	0.5300	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8511	42.4277	42.5653	42.2935	42.2935	42.1629	42.0357	41.9120	41.7918	42.1629	41.9120	42.1629	(38)
Heat transfer coeff	106.3952	105.9719	106.1095	105.8377	105.8377	105.7071	105.5799	105.4562	105.3360	105.7071	105.4562	105.7071	(39)
Average = Sum(39)m / 12 =												105.7585	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1408	1.1363	1.1378	1.1349	1.1349	1.1335	1.1321	1.1308	1.1295	1.1335	1.1308	1.1335	(40)
HLP (average)												1.1340	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8710	61.1142	61.0349	61.1917	61.1917	61.2673	61.3411	61.4131	61.4832	61.2673	61.4131	61.2673	
alpha	5.0581	5.0743	5.0690	5.0794	5.0794	5.0845	5.0894	5.0942	5.0989	5.0845	5.0942	5.0845	
util living area													
	0.9888	0.9816	0.9604	0.9055	0.7904	0.5818	0.4258	0.4365	0.6879	0.9041	0.9751	0.9910	(86)
MIT	20.0662	20.1851	20.4186	20.6858	20.8863	20.9810	20.9968	20.9964	20.9561	20.7409	20.3762	20.0425	(87)
Th 2	19.9676	19.9713	19.9701	19.9725	19.9725	19.9736	19.9747	19.9758	19.9768	19.9736	19.9758	19.9736	(88)
util rest of house													
	0.9852	0.9759	0.9477	0.8752	0.7269	0.4855	0.3157	0.3240	0.5953	0.8663	0.9658	0.9881	(89)
MIT 2	18.7579	18.9315	19.2623	19.6281	19.8734	19.9633	19.9738	19.9748	19.9486	19.7076	19.2113	18.7285	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8727	0.7379	0.5100	0.3443	0.3532	0.6176	0.8663	0.9603	0.9845	(94)
Useful gains	781.0460	846.9434	891.5409	873.1585	734.7851	511.6714	330.3809	329.9430	556.8464	726.5622	752.6579	738.5009	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1510.4150	1478.9129	1332.8824	1100.8909	808.1071	520.7688	331.3511	331.0287	580.3112	906.4235	1224.6157	1487.1231	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	542.6506	424.6835	328.3581	163.9673	54.5516	0.0000	0.0000	0.0000	0.0000	133.8168	339.8096	556.9749	(98)
Space heating												2544.8125	(98)
RHI space heating demand												2545	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3375	0.3309	0.3243	0.2912	0.2846	0.2515	0.2515	0.2449	0.2647	0.2846	0.2978	0.3111	(22b)
Effective ac	0.5570	0.5547	0.5526	0.5424	0.5405	0.5316	0.5316	0.5300	0.5350	0.5405	0.5443	0.5484	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3093	44.1333	43.9609	43.1507	42.9991	42.2935	42.2935	42.1629	42.5653	42.9991	43.3058	43.6264	(38)
Heat transfer coeff	107.8535	107.6775	107.5051	106.6949	106.5433	105.8377	105.8377	105.7071	106.1095	106.5433	106.8500	107.1705	(39)
Average = Sum(39)m / 12 =												106.6942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1565	1.1546	1.1527	1.1441	1.1424	1.1349	1.1349	1.1335	1.1378	1.1424	1.1457	1.1492	(40)
HLP (average)												1.1441	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0480	60.1461	60.2426	60.7001	60.7864	61.1917	61.1917	61.2673	61.0349	60.7864	60.6120	60.4307	
alpha	5.0032	5.0097	5.0162	5.0467	5.0524	5.0794	5.0794	5.0845	5.0690	5.0524	5.0408	5.0287	
util living area													
	0.9922	0.9846	0.9685	0.9282	0.8372	0.6717	0.5025	0.5391	0.7624	0.9368	0.9845	0.9939	(86)
MIT	19.9486	20.1095	20.3362	20.6077	20.8324	20.9594	20.9923	20.9890	20.9217	20.6416	20.2410	19.9107	(87)
Th 2	19.9550	19.9565	19.9580	19.9650	19.9663	19.9725	19.9725	19.9736	19.9701	19.9663	19.9637	19.9609	(88)
util rest of house													
	0.9897	0.9798	0.9584	0.9043	0.7848	0.5808	0.3895	0.4251	0.6799	0.9108	0.9787	0.9919	(89)
MIT 2	18.5783	18.8117	19.1371	19.5192	19.8073	19.9463	19.9697	19.9693	19.9121	19.5732	19.0091	18.5277	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9327	19.1474	19.4472	19.8007	20.0724	20.2083	20.2342	20.2330	20.1732	19.8496	19.3277	18.8854	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9327	19.1474	19.4472	19.8007	20.0724	20.2083	20.2342	20.2330	20.1732	19.8496	19.3277	18.8854	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9748	0.9521	0.8998	0.7908	0.6028	0.4189	0.4547	0.6976	0.9072	0.9740	0.9891	(94)
Useful gains	751.4179	840.1838	884.1191	874.2751	778.9483	571.7674	381.8418	400.9398	598.8967	728.9022	724.2751	715.5006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1578.1911	1534.1224	1391.8912	1163.0490	892.0258	593.5678	384.6330	405.1772	644.4276	985.4785	1306.5301	1573.8423	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.1192	466.3267	377.7824	207.9172	84.1297	0.0000	0.0000	0.0000	0.0000	190.8928	419.2236	638.6062	(98)
Space heating												2999.9979	(98)
Space heating per m2											(98) / (4) =	32.1681	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3215.4318	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.1192	466.3267	377.7824	207.9172	84.1297	0.0000	0.0000	0.0000	0.0000	190.8928	419.2236	638.6062	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	659.2918	499.8143	404.9115	222.8480	90.1711	0.0000	0.0000	0.0000	0.0000	204.6011	449.3286	684.4654	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4917	89.3971	89.2199	88.8372	88.0672	86.7000	86.7000	86.7000	86.7000	88.7295	89.3067	89.5331	(217)
Fuel for water heating, kWh/month													
	191.0914	167.6758	174.2464	153.8002	149.7893	132.6794	124.3201	140.7076	141.8108	159.8376	171.7504	185.3826	(219)
Water heating fuel used												1893.0915	(219)
Annual totals kWh/year													
Space heating fuel - main system												3215.4318	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4895.3434	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3215.4318	3.4800	111.8970	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1893.0915	3.4800	65.8796	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			269.6582	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8192	(257)
SAP value		88.5728	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3215.4318	0.2160	694.5333	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.0915	0.2160	408.9078	(264)
Space and water heating			1103.4410	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			992.8007	(272)
CO2 emissions per m2			10.6500	(273)
EI value			90.3779	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8828 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8828 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2780	0.2581	0.2647	0.2515	0.2515	0.2449	0.2383	0.2316	0.2250	0.2449	0.2316	0.2449	(22b)
Effective ac	0.5386	0.5333	0.5350	0.5316	0.5316	0.5300	0.5284	0.5268	0.5253	0.5300	0.5268	0.5300	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8511	42.4277	42.5653	42.2935	42.2935	42.1629	42.0357	41.9120	41.7918	42.1629	41.9120	42.1629	(38)
Heat transfer coeff	106.3952	105.9719	106.1095	105.8377	105.8377	105.7071	105.5799	105.4562	105.3360	105.7071	105.4562	105.7071	(39)
Average = Sum(39)m / 12 =												105.7585	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1408	1.1363	1.1378	1.1349	1.1349	1.1335	1.1321	1.1308	1.1295	1.1335	1.1308	1.1335	(40)
HLP (average)												1.1340	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8710	61.1142	61.0349	61.1917	61.1917	61.2673	61.3411	61.4131	61.4832	61.2673	61.4131	61.2673	
alpha	5.0581	5.0743	5.0690	5.0794	5.0794	5.0845	5.0894	5.0942	5.0989	5.0845	5.0942	5.0845	
util living area	0.9888	0.9816	0.9604	0.9055	0.7904	0.5818	0.4258	0.4365	0.6879	0.9041	0.9751	0.9910	(86)
MIT	20.0662	20.1851	20.4186	20.6858	20.8863	20.9810	20.9968	20.9964	20.9561	20.7409	20.3762	20.0425	(87)
Th 2	19.9676	19.9713	19.9701	19.9725	19.9725	19.9736	19.9747	19.9758	19.9768	19.9736	19.9758	19.9736	(88)
util rest of house	0.9852	0.9759	0.9477	0.8752	0.7269	0.4855	0.3157	0.3240	0.5953	0.8663	0.9658	0.9881	(89)
MIT 2	18.7579	18.9315	19.2623	19.6281	19.8734	19.9633	19.9738	19.9748	19.9486	19.7076	19.2113	18.7285	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8727	0.7379	0.5100	0.3443	0.3532	0.6176	0.8663	0.9603	0.9845	(94)
Useful gains	781.0460	846.9434	891.5409	873.1585	734.7851	511.6714	330.3809	329.9430	556.8464	726.5622	752.6579	738.5009	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1510.4150	1478.9129	1332.8824	1100.8909	808.1071	520.7688	331.3511	331.0287	580.3112	906.4235	1224.6157	1487.1231	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	542.6506	424.6835	328.3581	163.9673	54.5516	0.0000	0.0000	0.0000	0.0000	133.8168	339.8096	556.9749	(98)
Space heating												2544.8125	(98)
Space heating per m2											(98) / (4) =	27.2873	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2727.5589	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	542.6506	424.6835	328.3581	163.9673	54.5516	0.0000	0.0000	0.0000	0.0000	133.8168	339.8096	556.9749	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	581.6191	455.1806	351.9380	175.7420	58.4690	0.0000	0.0000	0.0000	0.0000	143.4264	364.2118	596.9721	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4104	89.3323	89.1111	88.6273	87.7231	86.7000	86.7000	86.7000	86.7000	88.4112	89.1488	89.4473	(217)
Fuel for water heating, kWh/month													
	191.2651	167.7973	174.4593	154.1644	150.3768	132.6794	124.3201	140.7076	141.8108	160.4132	172.0546	185.5603	(219)
Water heating fuel used												1895.6090	(219)
Annual totals kWh/year													
Space heating fuel - main system												2727.5589	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4326.6381	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2727.5589	7.3800	201.2938	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.6090	7.3800	139.8959	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			363.2043	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2727.5589	0.2160	589.1527	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.6090	0.2160	409.4515	(264)
Space and water heating			998.6043	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			844.7053	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2727.5589	1.2200	3327.6219	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.6090	1.2200	2312.6430	(264)
Space and water heating			5640.2648	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4729.9183	(272)
Primary energy kWh/m2/year			50.7175	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£448	£374	£74
Space heating	£330	£330	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£363	£304	£60
Total cost of uses	£364	£304	£60
Delivered energy	46 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	39 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3375	0.3309	0.3243	0.2912	0.2846	0.2515	0.2515	0.2449	0.2647	0.2846	0.2978	0.3111	(22b)
Effective ac	0.5570	0.5547	0.5526	0.5424	0.5405	0.5316	0.5316	0.5300	0.5350	0.5405	0.5443	0.5484	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3093	44.1333	43.9609	43.1507	42.9991	42.2935	42.2935	42.1629	42.5653	42.9991	43.3058	43.6264	(38)
Heat transfer coeff	107.8535	107.6775	107.5051	106.6949	106.5433	105.8377	105.8377	105.7071	106.1095	106.5433	106.8500	107.1705	(39)
Average = Sum(39)m / 12 =												106.6942	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1565	1.1546	1.1527	1.1441	1.1424	1.1349	1.1349	1.1335	1.1378	1.1424	1.1457	1.1492	(40)
HLP (average)												1.1441	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1815 (H8)
Utilisation factor												0.5710 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-862.7264 (H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435 (64)
								Total per year (kWh/year) = Sum(64)m =				818.2658 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0480	60.1461	60.2426	60.7001	60.7864	61.1917	61.1917	61.2673	61.0349	60.7864	60.6120	60.4307	
alpha	5.0032	5.0097	5.0162	5.0467	5.0524	5.0794	5.0794	5.0845	5.0690	5.0524	5.0408	5.0287	
util living area													
	0.9922	0.9846	0.9685	0.9282	0.8372	0.6717	0.5025	0.5391	0.7624	0.9368	0.9845	0.9939	(86)
MIT	19.9486	20.1095	20.3362	20.6077	20.8324	20.9594	20.9923	20.9890	20.9217	20.6416	20.2410	19.9107	(87)
Th 2	19.9550	19.9565	19.9580	19.9650	19.9663	19.9725	19.9725	19.9736	19.9701	19.9663	19.9637	19.9609	(88)
util rest of house													
	0.9897	0.9798	0.9584	0.9043	0.7848	0.5808	0.3895	0.4251	0.6799	0.9108	0.9787	0.9919	(89)
MIT 2	18.5783	18.8117	19.1371	19.5192	19.8073	19.9463	19.9697	19.9693	19.9121	19.5732	19.0091	18.5277	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9327	19.1474	19.4472	19.8007	20.0724	20.2083	20.2342	20.2330	20.1732	19.8496	19.3277	18.8854	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9327	19.1474	19.4472	19.8007	20.0724	20.2083	20.2342	20.2330	20.1732	19.8496	19.3277	18.8854	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9748	0.9521	0.8998	0.7908	0.6028	0.4189	0.4547	0.6976	0.9072	0.9740	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4179	840.1838	884.1191	874.2751	778.9483	571.7674	381.8418	400.9398	598.8967	728.9022	724.2751	715.5006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1578.1911	1534.1224	1391.8912	1163.0490	892.0258	593.5678	384.6330	405.1772	644.4276	985.4785	1306.5301	1573.8423	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	615.1192	466.3267	377.7824	207.9172	84.1297	0.0000	0.0000	0.0000	0.0000	190.8928	419.2236	638.6062	(98)
Space heating												2999.9979	(98)
Space heating per m2											(98) / (4) =	32.1681	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3215.4318	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	615.1192	466.3267	377.7824	207.9172	84.1297	0.0000	0.0000	0.0000	0.0000	190.8928	419.2236	638.6062	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	659.2918	499.8143	404.9115	222.8480	90.1711	0.0000	0.0000	0.0000	0.0000	204.6011	449.3286	684.4654	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5865	89.5996	89.6207	89.6823	89.7619	86.7000	86.7000	86.7000	86.7000	89.1281	89.4537	89.6113	(217)
Fuel for water heating, kWh/month	162.9638	120.7042	94.1335	46.1010	15.8149	0.0000	0.0000	25.6169	51.6716	99.2453	138.2955	161.8585	(219)
Water heating fuel used												916.4051	(219)
Annual totals kWh/year													
Space heating fuel - main system												3215.4318	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												3968.6570	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3215.4318	3.4800	111.8970	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.4051	3.4800	31.8909	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			242.2645	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7359	(257)
SAP value		89.7336	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3215.4318	0.2160	694.5333	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.4051	0.2160	197.9435	(264)
Space and water heating			892.4768	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			807.7864 (272)
CO2 emissions per m2			8.6600 (273)
EI value			92.1710
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3114	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2647	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2780	0.2581	0.2647	0.2515	0.2515	0.2449	0.2383	0.2316	0.2250	0.2449	0.2316	0.2449	(22b)
Effective ac	0.5386	0.5333	0.5350	0.5316	0.5316	0.5300	0.5284	0.5268	0.5253	0.5300	0.5268	0.5300	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8511	42.4277	42.5653	42.2935	42.2935	42.1629	42.0357	41.9120	41.7918	42.1629	41.9120	42.1629	(38)
Heat transfer coeff	106.3952	105.9719	106.1095	105.8377	105.8377	105.7071	105.5799	105.4562	105.3360	105.7071	105.4562	105.7071	(39)
Average = Sum(39)m / 12 =												105.7585	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1408	1.1363	1.1378	1.1349	1.1349	1.1335	1.1321	1.1308	1.1295	1.1335	1.1308	1.1335	(40)
HLP (average)												1.1340	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3223 (H8)
Utilisation factor												0.5306 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-897.1283 (H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656 (63)
								Solar input (sum of months) = Sum(63)m =				-897.1283 (63)
Output from w/h												
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132 (64)
								Total per year (kWh/year) = Sum(64)m =				793.5279 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8710	61.1142	61.0349	61.1917	61.1917	61.2673	61.3411	61.4131	61.4832	61.2673	61.4131	61.2673	
alpha	5.0581	5.0743	5.0690	5.0794	5.0794	5.0845	5.0894	5.0942	5.0989	5.0845	5.0942	5.0845	
util living area													
	0.9888	0.9816	0.9604	0.9055	0.7904	0.5818	0.4258	0.4365	0.6879	0.9041	0.9751	0.9910	(86)
MIT	20.0662	20.1851	20.4186	20.6858	20.8863	20.9810	20.9968	20.9964	20.9561	20.7409	20.3762	20.0425	(87)
Th 2	19.9676	19.9713	19.9701	19.9725	19.9725	19.9736	19.9747	19.9758	19.9768	19.9736	19.9758	19.9736	(88)
util rest of house													
	0.9852	0.9759	0.9477	0.8752	0.7269	0.4855	0.3157	0.3240	0.5953	0.8663	0.9658	0.9881	(89)
MIT 2	18.7579	18.9315	19.2623	19.6281	19.8734	19.9633	19.9738	19.9748	19.9486	19.7076	19.2113	18.7285	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0963	19.2557	19.5614	19.9017	20.1353	20.2265	20.2384	20.2390	20.2091	19.9749	19.5126	19.0683	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8727	0.7379	0.5100	0.3443	0.3532	0.6176	0.8663	0.9603	0.9845	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.0460	846.9434	891.5409	873.1585	734.7851	511.6714	330.3809	329.9430	556.8464	726.5622	752.6579	738.5009	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1510.4150	1478.9129	1332.8824	1100.8909	808.1071	520.7688	331.3511	331.0287	580.3112	906.4235	1224.6157	1487.1231	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	542.6506	424.6835	328.3581	163.9673	54.5516	0.0000	0.0000	0.0000	0.0000	133.8168	339.8096	556.9749	(98)
Space heating												2544.8125	(98)
Space heating per m2											(98) / (4) =	27.2873	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2727.5589	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	542.6506	424.6835	328.3581	163.9673	54.5516	0.0000	0.0000	0.0000	0.0000	133.8168	339.8096	556.9749	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	581.6191	455.1806	351.9380	175.7420	58.4690	0.0000	0.0000	0.0000	0.0000	143.4264	364.2118	596.9721	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5301	89.5446	89.5431	89.5688	89.3580	86.7000	86.7000	86.7000	86.7000	88.8727	89.3392	89.5450	(217)
Fuel for water heating, kWh/month													
	158.3204	120.9253	93.7384	44.7993	20.7745	0.0000	0.0000	18.3443	46.0088	94.9651	132.9427	158.4825	(219)
Water heating fuel used												889.3013	(219)
Annual totals kWh/year													
Space heating fuel - main system												2727.5589	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												3370.3304	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2727.5589	7.3800	201.2938	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.3013	7.3800	65.6304	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			303.2688	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2727.5589	0.2160	589.1527	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.3013	0.2160	192.0891	(264)
Space and water heating			781.2418	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			653.2928	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2727.5589	1.2200	3327.6219	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.3013	1.2200	1084.9475	(264)
Space and water heating			4412.5694	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3655.7229	(272)
Primary energy kWh/m2/year			39.1993	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
East	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 390 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 390	**Prop Type Ref**	
Property	33 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.50	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.18		
CO_2 Emissions (t/year)	0.84	**DFEE**	44.53	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.50	$kgCO_2/m^2$	Pass
	-4.91 (-28.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.53	$kWh/m^2/yr$	
	-5.4 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.74 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.09 m², No overhang
Windows facing East	1.53 m², No overhang
Windows facing South	7.79 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.74 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.7	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 391 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 391 EPC	**Prop Type Ref**	
Property	34 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

End-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9968	0.9920	0.9802	0.9471	0.8663	0.7113	0.5426	0.5871	0.8147	0.9622	0.9930	0.9977	(86)
MIT	19.6941	19.8880	20.1606	20.4908	20.7699	20.9374	20.9863	20.9801	20.8751	20.5062	20.0314	19.6572	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9276	0.8170	0.6156	0.4157	0.4595	0.7343	0.9443	0.9902	0.9969	(89)
MIT 2	18.1584	18.4418	18.8369	19.3096	19.6768	19.8669	19.9032	19.9017	19.8085	19.3406	18.6589	18.1102	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5440	18.8050	19.1693	19.6062	19.9513	20.1357	20.1752	20.1725	20.0763	19.6333	19.0036	18.4986	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5440	18.8050	19.1693	19.6062	19.9513	20.1357	20.1752	20.1725	20.0763	19.6333	19.0036	18.4986	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9212	0.8197	0.6371	0.4478	0.4916	0.7486	0.9386	0.9869	0.9954	(94)
Useful gains	532.0553	635.2733	704.7518	730.9923	677.3560	510.8958	344.5971	360.8787	521.3410	580.8855	529.4818	498.8380	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.2583	1387.4355	1261.5362	1055.7171	812.1571	540.2059	348.8841	367.5558	585.1431	889.1228	1175.9911	1418.0713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	663.7990	505.4530	414.2476	233.8019	100.2920	0.0000	0.0000	0.0000	0.0000	229.3285	465.4867	683.9096	(98)
Space heating												3296.3183	(98)
Space heating per m2											(98) / (4) =	41.0398	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3533.0315	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	663.7990	505.4530	414.2476	233.8019	100.2920	0.0000	0.0000	0.0000	0.0000	229.3285	465.4867	683.9096	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	711.4674	541.7503	443.9953	250.5915	107.4941	0.0000	0.0000	0.0000	0.0000	245.7969	498.9139	733.0221	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5658	89.4800	89.3214	88.9763	88.2589	86.7000	86.7000	86.7000	86.7000	88.9285	89.4113	89.6000	(217)
Fuel for water heating, kWh/month													
	182.3133	159.9690	166.2322	146.7200	142.8487	126.8692	118.9361	134.5284	135.5568	152.3730	163.8437	176.8993	(219)
Water heating fuel used												1807.0898	(219)
Annual totals kWh/year													
Space heating fuel - main system												3533.0315	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5140.3456	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3533.0315	0.2160	763.1348	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0898	0.2160	390.3314	(264)
Space and water heating			1153.4662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1049.7826	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0700	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5283	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8772	0.7261	0.5565	0.6038	0.8298	0.9678	0.9945	0.9982	(86)
MIT	19.6585	19.8541	20.1302	20.4668	20.7546	20.9315	20.9847	20.9776	20.8636	20.4801	19.9985	19.6223	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9352	0.8300	0.6307	0.4273	0.4740	0.7519	0.9521	0.9922	0.9976	(89)
MIT 2	18.6705	18.8666	19.1410	19.4742	19.7357	19.8769	19.9043	19.9034	19.8318	19.4940	19.0190	18.6408	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9186	19.1146	19.3894	19.7235	19.9915	20.1418	20.1756	20.1732	20.0909	19.7416	19.2649	18.8872	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9186	19.1146	19.3894	19.7235	19.9915	20.1418	20.1756	20.1732	20.0909	19.7416	19.2649	18.8872	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8346	0.6528	0.4601	0.5069	0.7670	0.9492	0.9905	0.9968	(94)
Useful gains	501.7864	607.2631	681.0895	714.3709	668.4778	508.2633	344.1170	360.0209	515.3039	561.8966	502.1798	469.0395	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1461.7131	1418.3264	1283.4548	1067.2815	816.1122	540.7956	348.9293	367.6223	586.5728	899.7869	1201.8099	1456.6109	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.1854	545.0345	448.1598	254.0956	109.8400	0.0000	0.0000	0.0000	0.0000	251.3904	503.7337	734.7531	(98)
Space heating												3561.1925	(98)
Space heating per m2											(98) / (4) =	44.3376	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.3056	722.1342	740.4670	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8624	0.9233	0.9050	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.0799	666.7222	670.1244	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0433	221.5453	187.4540	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												561.0426 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0108	55.3863	46.8635	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												140.2606 (107)
Space cooling per m2												1.7463 (108)
Energy for space heating												44.3376 (99)
Energy for space cooling												1.7463 (108)
Total												46.0838 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7709	57.0642	56.9685	57.1577	57.1577	57.2492	57.3384	57.4255	57.5104	57.2492	57.4255	57.2492	
alpha	4.7847	4.8043	4.7979	4.8105	4.8105	4.8166	4.8226	4.8284	4.8340	4.8166	4.8284	4.8166	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0291	20.1667	20.4212	20.7005	20.8951	20.9825	20.9969	20.9965	20.9590	20.7457	20.3629	20.0038	(87)
Th 2	19.9015	19.9065	19.9048	19.9080	19.9080	19.9096	19.9111	19.9126	19.9140	19.9096	19.9126	19.9096	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4447	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6558	18.8559	19.2126	19.5887	19.8199	19.9006	19.9103	19.9117	19.8887	19.6560	19.1431	18.6256	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)
Useful gains	732.8156	801.2748	847.6321	825.4626	683.0353	467.6674	299.1508	298.6881	510.7767	680.0630	707.7382	691.0158	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.3970	1357.2072	1225.4493	1011.7548	740.6671	474.7048	299.9254	299.5606	529.3024	831.0403	1121.8056	1361.2635	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating												2226.3316	(98)
RHI space heating demand												2226	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8006	0.6301	0.4682	0.5045	0.7268	0.9198	0.9794	0.9917	(86)
MIT	19.8945	20.0787	20.3287	20.6184	20.8430	20.9626	20.9926	20.9895	20.9253	20.6408	20.2117	19.8551	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8758	0.7416	0.5366	0.3557	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4489	18.7150	19.0713	19.4749	19.7558	19.8849	19.9056	19.9057	19.8517	19.5152	18.9166	18.3976	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)
Useful gains	702.4784	794.6642	841.4810	829.9279	729.2941	525.1878	346.9935	364.6867	552.7332	685.0319	679.6797	667.4651	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.0453	1412.6309	1283.2185	1071.0876	819.7824	542.1426	349.2149	368.0749	589.5454	905.3229	1199.5258	1444.3488	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating												2658.0056	(98)
Space heating per m2											(98) / (4) =	33.0927	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.8806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	596.9280	445.0950	352.2537	186.1040	72.1579	0.0000	0.0000	0.0000	0.0000	175.6661	401.1674	619.5085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4578	89.3490	89.1481	88.7190	87.9201	86.7000	86.7000	86.7000	86.7000	88.6344	89.2575	89.5002	(217)
Fuel for water heating, kWh/month													
	182.5333	160.2036	166.5554	147.1455	143.3991	126.8692	118.9361	134.5284	135.5568	152.8788	164.1261	177.0965	(219)
Water heating fuel used												1809.8287	(219)
Annual totals kWh/year													
Space heating fuel - main system												2848.8806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4458.9336	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.8806	3.4800	99.1410	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8287	3.4800	62.9820	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.7727	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8572	(257)
SAP value		88.0420	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.8806	0.2160	615.3582	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8287	0.2160	390.9230	(264)
Space and water heating			1006.2812	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			902.5977	(272)
CO2 emissions per m2			11.2400	(273)
EI value			90.3489	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7709	57.0642	56.9685	57.1577	57.1577	57.2492	57.3384	57.4255	57.5104	57.2492	57.4255	57.2492	
alpha	4.7847	4.8043	4.7979	4.8105	4.8105	4.8166	4.8226	4.8284	4.8340	4.8166	4.8284	4.8166	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0291	20.1667	20.4212	20.7005	20.8951	20.9825	20.9969	20.9965	20.9590	20.7457	20.3629	20.0038	(87)
Th 2	19.9015	19.9065	19.9048	19.9080	19.9080	19.9096	19.9111	19.9126	19.9140	19.9096	19.9126	19.9096	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4447	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6558	18.8559	19.2126	19.5887	19.8199	19.9006	19.9103	19.9117	19.8887	19.6560	19.1431	18.6256	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)
Useful gains	732.8156	801.2748	847.6321	825.4626	683.0353	467.6674	299.1508	298.6881	510.7767	680.0630	707.7382	691.0158	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.3970	1357.2072	1225.4493	1011.7548	740.6671	474.7048	299.9254	299.5606	529.3024	831.0403	1121.8056	1361.2635	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating												2226.3316	(98)
Space heating per m2											(98) / (4) =	27.7183	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2386.2075	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	520.3865	400.4144	301.2819	143.7625	45.9572	0.0000	0.0000	0.0000	0.0000	120.3934	319.5375	534.4741	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3661	89.2732	89.0223	88.4878	87.5862	86.7000	86.7000	86.7000	86.7000	88.2955	89.0813	89.4046	(217)
Fuel for water heating, kWh/month													
	182.7206	160.3397	166.7906	147.5300	143.9459	126.8692	118.9361	134.5284	135.5568	153.4656	164.4507	177.2859	(219)
Water heating fuel used												1812.4195	(219)
Annual totals kWh/year													
Space heating fuel - main system												2386.2075	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3923.7335	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2386.2075	7.3800	176.1021	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4195	7.3800	133.7566	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			338.0742	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2386.2075	0.2160	515.4208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4195	0.2160	391.4826	(264)
Space and water heating			906.9034	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			764.2337	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2386.2075	1.2200	2911.1732	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4195	1.2200	2211.1518	(264)
Space and water heating			5122.3249	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4278.4020	(272)
Primary energy kWh/m2/year			53.2670	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£345	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£281	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8006	0.6301	0.4682	0.5045	0.7268	0.9198	0.9794	0.9917	(86)
MIT	19.8945	20.0787	20.3287	20.6184	20.8430	20.9626	20.9926	20.9895	20.9253	20.6408	20.2117	19.8551	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8758	0.7416	0.5366	0.3557	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4489	18.7150	19.0713	19.4749	19.7558	19.8849	19.9056	19.9057	19.8517	19.5152	18.9166	18.3976	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4784	794.6642	841.4810	829.9279	729.2941	525.1878	346.9935	364.6867	552.7332	685.0319	679.6797	667.4651	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1451.0453	1412.6309	1283.2185	1071.0876	819.7824	542.1426	349.2149	368.0749	589.5454	905.3229	1199.5258	1444.3488	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating												2658.0056	(98)
Space heating per m2											(98) / (4) =	33.0927	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.8806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	596.9280	445.0950	352.2537	186.1040	72.1579	0.0000	0.0000	0.0000	0.0000	175.6661	401.1674	619.5085	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5581	89.5650	89.5800	89.6420	89.7821	86.7000	86.7000	86.7000	86.7000	89.0542	89.4132	89.5830	(217)
Fuel for water heating, kWh/month	154.9890	114.1982	88.0709	41.5940	12.0976	0.0000	0.0000	21.8860	47.3352	93.5056	131.3585	154.0603	(219)
Water heating fuel used												859.0953	(219)
Annual totals kWh/year													
Space heating fuel - main system												2848.8806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3558.2002	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.8806	3.4800	99.1410	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.0953	3.4800	29.8965	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.2822	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7684	(257)
SAP value		89.2805	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.8806	0.2160	615.3582	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.0953	0.2160	185.5646	(264)
Space and water heating			800.9228	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			723.1892 (272)
CO2 emissions per m2			9.0000 (273)
EI value			92.2672
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
								Total per year (kWh/year) = Sum(64)m =				743.7098	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7709	57.0642	56.9685	57.1577	57.1577	57.2492	57.3384	57.4255	57.5104	57.2492	57.4255	57.2492	
alpha	4.7847	4.8043	4.7979	4.8105	4.8105	4.8166	4.8226	4.8284	4.8340	4.8166	4.8284	4.8166	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0291	20.1667	20.4212	20.7005	20.8951	20.9825	20.9969	20.9965	20.9590	20.7457	20.3629	20.0038	(87)
Th 2	19.9015	19.9065	19.9048	19.9080	19.9080	19.9096	19.9111	19.9126	19.9140	19.9096	19.9126	19.9096	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4447	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6558	18.8559	19.2126	19.5887	19.8199	19.9006	19.9103	19.9117	19.8887	19.6560	19.1431	18.6256	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8156	801.2748	847.6321	825.4626	683.0353	467.6674	299.1508	298.6881	510.7767	680.0630	707.7382	691.0158 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1385.3970	1357.2072	1225.4493	1011.7548	740.6671	474.7048	299.9254	299.5606	529.3024	831.0403	1121.8056	1361.2635 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643 (98)
Space heating												2226.3316 (98)
Space heating per m2											(98) / (4) =	27.7183 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2386.2075 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	520.3865	400.4144	301.2819	143.7625	45.9572	0.0000	0.0000	0.0000	0.0000	120.3934	319.5375	534.4741	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4930	89.5000	89.4881	89.5093	89.3238	86.7000	86.7000	86.7000	86.7000	88.7736	89.2832	89.5083	(217)
Fuel for water heating, kWh/month	150.5066	114.4989	87.8214	40.4948	17.1471	0.0000	0.0000	14.9625	41.9449	89.4307	126.1957	150.8089	(219)
Water heating fuel used												833.8116	(219)
Annual totals kWh/year													
Space heating fuel - main system												2386.2075	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2995.1256	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2386.2075	7.3800	176.1021	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8116	7.3800	61.5353	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			280.1829	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2386.2075	0.2160	515.4208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8116	0.2160	180.1033	(264)
Space and water heating			695.5241	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			578.8044	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2386.2075	1.2200	2911.1732	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8116	1.2200	1017.2501	(264)
Space and water heating			3928.4233	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3238.0004	(272)
Primary energy kWh/m2/year			40.3138	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 391 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 391 EPC	**Prop Type Ref**	
Property	34 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.07	$kgCO_2/m^2$	Pass
	-5.19 (-28.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.08	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	3.61 m², No overhang 7.97 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 392 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 392	**Prop Type Ref**	
Property	35 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	11.11	**TER**	16.79
Environmental	92 A	**% DER<TER**	33.82		
CO_2 Emissions (t/year)	0.62	**DFEE**	36.53	**TFEE**	42.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Mid-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.11 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.98 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.9800	
Infiltration rate		0.3935	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4264	0.4181	0.4097	0.3679	0.3596	0.3177	0.3177	0.3094	0.3345	0.3596	0.3763	0.3930	(22b)
Effective ac	0.5909	0.5874	0.5839	0.5677	0.5646	0.5505	0.5505	0.5479	0.5559	0.5646	0.5708	0.5772	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4886	40.2466	40.0095	38.8957	38.6873	37.7172	37.7172	37.5376	38.0909	38.6873	39.1089	39.5496	(38)
Heat transfer coeff	84.1993	83.9574	83.7202	82.6064	82.3980	81.4280	81.4280	81.2483	81.8016	82.3980	82.8196	83.2603	(39)
Average = Sum(39)m / 12 =												82.6054	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0483	1.0453	1.0423	1.0285	1.0259	1.0138	1.0138	1.0116	1.0184	1.0259	1.0311	1.0366	(40)
HLP (average)												1.0285	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	375.7219	373.5175	359.8284	337.8381	315.5431	294.1292	280.2885	286.3813	297.7540	319.9564	345.4020	364.4526	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331	(83)
Total gains	519.2729	612.2814	674.8714	714.6309	729.5164	702.7122	675.1186	653.0781	633.7199	580.3496	516.2063	488.0857	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.2450	66.4358	66.6240	67.5223	67.6931	68.4995	68.4995	68.6510	68.1866	67.6931	67.3485	66.9920	
alpha	5.4163	5.4291	5.4416	5.5015	5.5129	5.5666	5.5666	5.5767	5.5458	5.5129	5.4899	5.4661	
util living area	0.9971	0.9925	0.9814	0.9493	0.8665	0.6994	0.5233	0.5611	0.7942	0.9591	0.9932	0.9979	(86)
MIT	19.9417	20.1131	20.3421	20.6160	20.8395	20.9644	20.9940	20.9912	20.9268	20.6407	20.2369	19.9115	(87)
Th 2	20.0433	20.0458	20.0482	20.0597	20.0618	20.0719	20.0719	20.0737	20.0680	20.0618	20.0575	20.0529	(88)
util rest of house	0.9962	0.9901	0.9751	0.9315	0.8213	0.6147	0.4168	0.4539	0.7195	0.9412	0.9906	0.9973	(89)
MIT 2	18.6329	18.8841	19.2164	19.6111	19.9044	20.0480	20.0696	20.0701	20.0115	19.6528	19.0741	18.5960	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9616	19.1927	19.4991	19.8634	20.1392	20.2781	20.3017	20.3014	20.2413	19.9009	19.3661	18.9263	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9616	19.1927	19.4991	19.8634	20.1392	20.2781	20.3017	20.3014	20.2413	19.9009	19.3661	18.9263	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9871	0.9704	0.9271	0.8255	0.6346	0.4437	0.4809	0.7347	0.9373	0.9879	0.9961	(94)
Useful gains	516.4997	604.4070	654.9148	662.5127	602.1885	445.9232	299.5392	314.0609	465.6182	543.9857	509.9554	486.1692	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1234.4942	1199.9805	1088.2855	905.6486	695.3728	462.3581	301.4230	316.9823	502.3696	766.3771	1015.8728	1226.1191	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	534.1879	400.2254	322.4278	175.0578	69.3291	0.0000	0.0000	0.0000	0.0000	165.4592	364.2605	550.5227	(98)
Space heating												2581.4705	(98)
Space heating per m2											(98) / (4) =	32.1398	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2766.8494	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	534.1879	400.2254	322.4278	175.0578	69.3291	0.0000	0.0000	0.0000	0.0000	165.4592	364.2605	550.5227	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	572.5487	428.9661	345.5818	187.6289	74.3077	0.0000	0.0000	0.0000	0.0000	177.3411	390.4186	590.0565	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4306	89.3230	89.1330	88.7262	87.9439	86.7000	86.7000	86.7000	86.7000	88.6428	89.2372	89.4695	(217)
Fuel for water heating, kWh/month													
	182.5888	160.2503	166.5835	147.1335	143.3603	126.8692	118.9361	134.5284	135.5568	152.8641	164.1633	177.1573	(219)
Water heating fuel used												1809.9916	(219)
Annual totals kWh/year													
Space heating fuel - main system												2766.8494	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4390.8236	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2766.8494	0.2160	597.6395	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.9916	0.2160	390.9582	(264)
Space and water heating			988.5977	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			892.0546	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.1100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.1100	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		29.5683	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.5683	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	44.8300	13.7000	31.1300	0.1800	5.6034			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9413			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.8839 (36)
Total fabric heat loss	(33) + (36) =	42.8251 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	83.3454	83.1022	82.8639	81.7444	81.5350	80.5600	80.5600	80.3794	80.9355	81.5350	81.9587	82.4017	(39)
Average = Sum(39)m / 12 =												81.7434	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0346	1.0317	1.0177	1.0151	1.0030	1.0030	1.0007	1.0077	1.0151	1.0204	1.0259	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.8637	386.3915	372.0770	349.4630	326.5409	304.5014	290.6669	297.3849	309.3876	332.2137	358.2809	377.5977	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	125.6071	208.9184	275.6626	329.6938	362.2267	357.5101	345.4764	320.8596	293.9701	227.8440	149.4537	108.1790	(83)
Total gains	514.4707	595.3099	647.7396	679.1568	688.7675	662.0115	636.1433	618.2445	603.3577	560.0576	507.7346	485.7767	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9236	67.1195	67.3125	68.2343	68.4096	69.2376	69.2376	69.3931	68.9163	68.4096	68.0559	67.6901	
alpha	5.4616	5.4746	5.4875	5.5490	5.5606	5.6158	5.6158	5.6262	5.5944	5.5606	5.5371	5.5127	
util living area													
	0.9972	0.9934	0.9842	0.9575	0.8852	0.7265	0.5478	0.5843	0.8137	0.9638	0.9937	0.9980	(86)
MIT	19.9510	20.1083	20.3260	20.5940	20.8219	20.9584	20.9928	20.9898	20.9190	20.6306	20.2399	19.9239	(87)
Th 2	20.0521	20.0546	20.0570	20.0686	20.0707	20.0808	20.0808	20.0827	20.0770	20.0707	20.0664	20.0618	(88)
util rest of house													
	0.9963	0.9912	0.9788	0.9421	0.8437	0.6424	0.4383	0.4748	0.7416	0.9476	0.9912	0.9973	(89)
MIT 2	18.6529	18.8837	19.2004	19.5892	19.8927	20.0523	20.0781	20.0784	20.0131	19.6467	19.0851	18.6205	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9789	19.1913	19.4831	19.8415	20.1260	20.2798	20.3078	20.3072	20.2406	19.8938	19.3751	18.9478	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9789	19.1913	19.4831	19.8415	20.1260	20.2798	20.3078	20.3072	20.2406	19.8938	19.3751	18.9478	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9885	0.9745	0.9375	0.8465	0.6618	0.4660	0.5024	0.7557	0.9437	0.9886	0.9962	(94)
Useful gains	511.8326	588.4620	631.2000	636.6828	583.0386	438.1223	296.4119	310.6025	455.9660	528.5170	501.9656	483.9121	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1223.4171	1187.6353	1075.8285	894.4105	687.0173	457.5658	298.6975	314.0618	496.9912	757.7706	1006.0515	1215.2443	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	529.4189	402.6445	330.8036	185.5639	77.3601	0.0000	0.0000	0.0000	0.0000	170.5647	362.9419	544.1112	(98)
Space heating												2603.4087	(98)
Space heating per m2											(98) / (4) =	32.4130	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2787.3755	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	529.4189	402.6445	330.8036	185.5639	77.3601	0.0000	0.0000	0.0000	0.0000	170.5647	362.9419	544.1112	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	566.8296	431.0968	354.1794	198.6766	82.8267	0.0000	0.0000	0.0000	0.0000	182.6175	388.5888	582.5601	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3610	87.0470	86.4988	85.3624	83.3504	80.3000	80.3000	80.3000	80.3000	85.0304	86.7354	87.4688	(217)
Fuel for water heating, kWh/month													
	231.6825	204.1949	213.7980	192.1525	190.5282	174.1812	166.8789	186.0308	188.0853	202.2578	211.6621	225.9339	(219)
Water heating fuel used												2387.3861	(219)
Annual totals kWh/year													
Space heating fuel - main system												2787.3755	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Total delivered energy for all uses												5619.1866	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2787.3755	0.2160	602.0731	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2387.3861	0.2160	515.6754	(264)
Space and water heating			1117.7485	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Total CO2, kg/m2/year			1348.4051	(272)
Emissions per m2 for space and water heating			13.9162	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3871	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9162 * 1.00) + 2.3871 + 0.4846, rounded to 2 d.p.			16.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.9800	
Infiltration rate		0.3935	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4264	0.4181	0.4097	0.3679	0.3596	0.3177	0.3177	0.3094	0.3345	0.3596	0.3763	0.3930	(22b)
Effective ac	0.5909	0.5874	0.5839	0.5677	0.5646	0.5505	0.5505	0.5479	0.5559	0.5646	0.5708	0.5772	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4886	40.2466	40.0095	38.8957	38.6873	37.7172	37.7172	37.5376	38.0909	38.6873	39.1089	39.5496	(38)
Heat transfer coeff	84.1993	83.9574	83.7202	82.6064	82.3980	81.4280	81.4280	81.2483	81.8016	82.3980	82.8196	83.2603	(39)
Average = Sum(39)m / 12 =												82.6054	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0483	1.0453	1.0423	1.0285	1.0259	1.0138	1.0138	1.0116	1.0184	1.0259	1.0311	1.0366	(40)
HLP (average)												1.0285	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562 (71)

Water heating gains (Table 5)

	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896 (72)

Total internal gains

	344.3144	342.8890	330.8176	311.0244	290.1567	270.7505	258.6138	262.5206	273.1146	293.0433	315.9210	333.8192 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331 (83)
Total gains	487.8653	581.6528	645.8606	687.8173	704.1300	679.3335	653.4439	629.2174	609.0804	553.4364	486.7253	457.4523 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.2450	66.4358	66.6240	67.5223	67.6931	68.4995	68.4995	68.6510	68.1866	67.6931	67.3485	66.9920	
alpha	5.4163	5.4291	5.4416	5.5015	5.5129	5.5666	5.5666	5.5767	5.5458	5.5129	5.4899	5.4661	
util living area	0.9979	0.9941	0.9846	0.9563	0.8799	0.7176	0.5394	0.5803	0.8132	0.9662	0.9949	0.9985	(86)
MIT	19.9048	20.0780	20.3106	20.5913	20.8244	20.9597	20.9930	20.9897	20.9172	20.6146	20.2029	19.8753	(87)
Th 2	20.0433	20.0458	20.0482	20.0597	20.0618	20.0719	20.0719	20.0737	20.0680	20.0618	20.0575	20.0529	(88)
util rest of house	0.9972	0.9922	0.9794	0.9404	0.8371	0.6329	0.4303	0.4704	0.7406	0.9509	0.9928	0.9980	(89)
MIT 2	19.0436	19.2179	19.4498	19.7308	19.9427	20.0531	20.0700	20.0708	20.0235	19.7587	19.3525	19.0221	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2599	19.4339	19.6660	19.9469	20.1641	20.2808	20.3018	20.3015	20.2479	19.9736	19.5660	19.2364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2599	19.4339	19.6660	19.9469	20.1641	20.2808	20.3018	20.3015	20.2479	19.9736	19.5660	19.2364	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9905	0.9767	0.9382	0.8424	0.6531	0.4579	0.4983	0.7561	0.9491	0.9914	0.9974	(94)
Useful gains	486.1060	576.1547	630.7922	645.2905	593.1463	443.6807	299.2296	313.5161	460.5021	525.2438	482.5487	456.2678	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1259.6127	1220.2285	1102.2586	912.5461	697.4286	462.5728	301.4312	316.9917	502.9105	772.3673	1032.4310	1251.9334	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	575.4890	432.8175	350.7710	192.4240	77.5861	0.0000	0.0000	0.0000	0.0000	183.8599	395.9152	591.9752	(98)
Space heating												2800.8380	(98)
Space heating per m2											(98) / (4) =	34.8710	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	765.4228	602.5669	617.4872	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9026	0.9531	0.9421	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	690.8670	574.3055	581.7056	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	886.6584	854.5355	827.9425	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	140.9698	208.4911	183.2003	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												532.6613	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.2425	52.1228	45.8001	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												133.1653 (107)
Space cooling per m2												1.6579 (108)
Energy for space heating												34.8710 (99)
Energy for space cooling												1.6579 (108)
Total												36.5289 (109)
Dwelling Fabric Energy Efficiency (DFEE)												36.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.5800	1.3258	15.3523			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	44.8300	13.7000	31.1300	0.1800	5.6034			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9413			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.8839	(36)
Total fabric heat loss (33) + (36) =	42.8251	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	83.3454	83.1022	82.8639	81.7444	81.5350	80.5600	80.5600	80.3794	80.9355	81.5350	81.9587	82.4017	(39)
Average = Sum(39)m / 12 =												81.7434	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0346	1.0317	1.0177	1.0151	1.0030	1.0030	1.0007	1.0077	1.0151	1.0204	1.0259	(40)
HLP (average)												1.0177	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.9184	18.5795	15.1099	11.4391	8.5509	7.2190	7.8004	10.1393	13.6089	17.2796	20.1679	21.4998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	344.3144	342.8890	330.8176	311.0244	290.1567	270.7505	258.6138	262.5206	273.1146	293.0433	315.9210	333.8192	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	125.6071	208.9184	275.6626	329.6938	362.2267	357.5101	345.4764	320.8596	293.9701	227.8440	149.4537	108.1790	(83)
Total gains	469.9215	551.8073	606.4802	640.7182	652.3834	628.2606	604.0901	583.3803	567.0847	520.8872	465.3747	441.9981	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9236	67.1195	67.3125	68.2343	68.4096	69.2376	69.2376	69.3931	68.9163	68.4096	68.0559	67.6901	
alpha	5.4616	5.4746	5.4875	5.5490	5.5606	5.6158	5.6158	5.6262	5.5944	5.5606	5.5371	5.5127	
util living area													
	0.9982	0.9954	0.9882	0.9664	0.9035	0.7542	0.5743	0.6150	0.8418	0.9732	0.9958	0.9987	(86)
MIT	19.8985	20.0580	20.2804	20.5568	20.7976	20.9498	20.9909	20.9868	20.9027	20.5912	20.1907	19.8720	(87)
Th 2	20.0521	20.0546	20.0570	20.0686	20.0707	20.0808	20.0808	20.0827	20.0770	20.0707	20.0664	20.0618	(88)
util rest of house													
	0.9976	0.9938	0.9841	0.9536	0.8660	0.6709	0.4608	0.5019	0.7737	0.9606	0.9942	0.9983	(89)
MIT 2	19.0445	19.2054	19.4278	19.7068	19.9299	20.0568	20.0784	20.0788	20.0229	19.7449	19.3478	19.0260	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2590	19.4195	19.6419	19.9202	20.1478	20.2810	20.3076	20.3068	20.2439	19.9574	19.5595	19.2385	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2590	19.4195	19.6419	19.9202	20.1478	20.2810	20.3076	20.3068	20.2439	19.9574	19.5595	19.2385	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9925	0.9817	0.9512	0.8696	0.6904	0.4896	0.5305	0.7875	0.9586	0.9929	0.9978	(94)
Useful gains	468.4992	547.6490	595.4090	609.4301	567.3196	433.7493	295.7613	309.5090	446.6061	499.3338	462.0906	441.0293	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1246.7618	1206.6041	1088.9872	900.8440	688.7899	457.6629	298.6805	314.0299	497.2566	762.9564	1021.1613	1239.1961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	579.0274	442.8179	367.2221	209.8180	90.3739	0.0000	0.0000	0.0000	0.0000	196.1352	402.5309	593.8361	(98)
Space heating												2881.7615	(98)
Space heating per m2											(98) / (4) =	35.8785	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	757.2638	596.1439	610.8836	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8836	0.9421	0.9298	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.0964	561.6563	568.0091	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	826.9628	796.8493	774.3667	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	113.6638	174.9836	153.5301	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												442.1776	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   28.4160   43.7459   38.3825    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.5444 (107)
Space cooling per m2                                                                                                     1.3763 (108)
Energy for space heating                                                                                                35.8785 (99)
Energy for space cooling                                                                                                 1.3763 (108)
Total                                                                                                                   37.2548 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     42.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.9800	
Infiltration rate		0.3935	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3512	0.3261	0.3345	0.3177	0.3177	0.3094	0.3010	0.2927	0.2843	0.3094	0.2927	0.3094	(22b)
Effective ac	0.5617	0.5532	0.5559	0.5505	0.5505	0.5479	0.5453	0.5428	0.5404	0.5479	0.5428	0.5479	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4837	37.9017	38.0909	37.7172	37.7172	37.5376	37.3627	37.1927	37.0274	37.5376	37.1927	37.5376	(38)
Heat transfer coeff	82.1944	81.6124	81.8016	81.4280	81.4280	81.2483	81.0735	80.9034	80.7381	81.2483	80.9034	81.2483	(39)
Average = Sum(39)m / 12 =												81.3190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0233	1.0161	1.0184	1.0138	1.0138	1.0116	1.0094	1.0073	1.0052	1.0116	1.0073	1.0116	(40)
HLP (average)												1.0124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392	(83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.8608	68.3447	68.1866	68.4995	68.4995	68.6510	68.7991	68.9437	69.0848	68.6510	68.9437	68.6510	
alpha	5.5241	5.5563	5.5458	5.5666	5.5666	5.5767	5.5866	5.5962	5.6057	5.5767	5.5962	5.5767	
util living area													
	0.9827	0.9713	0.9398	0.8652	0.7282	0.5157	0.3715	0.3776	0.6067	0.8547	0.9598	0.9860	(86)
MIT	20.2772	20.3956	20.5969	20.8080	20.9424	20.9928	20.9990	20.9990	20.9829	20.8513	20.5586	20.2570	(87)
Th 2	20.0639	20.0699	20.0680	20.0719	20.0719	20.0737	20.0755	20.0773	20.0790	20.0737	20.0773	20.0737	(88)
util rest of house													
	0.9775	0.9630	0.9228	0.8296	0.6658	0.4351	0.2839	0.2889	0.5255	0.8096	0.9464	0.9818	(89)
MIT 2	19.1335	19.3063	19.5856	19.8673	20.0233	20.0699	20.0753	20.0770	20.0684	19.9272	19.5451	19.1125	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9576	0.9179	0.8310	0.6787	0.4553	0.3060	0.3112	0.5454	0.8142	0.9415	0.9777	(94)
Useful gains	712.2839	766.0878	789.8647	745.5673	600.3392	403.5147	259.7789	259.3187	444.4253	624.8862	678.9752	674.8023	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1193.5217	1165.4121	1050.2968	863.4239	631.4021	406.3750	260.0218	259.5803	451.9729	711.6748	962.7198	1169.9691	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	358.0409	268.3459	193.7615	84.8567	23.1108	0.0000	0.0000	0.0000	0.0000	64.5708	204.2961	368.4042	(98)
Space heating												1565.3868	(98)
RHI space heating demand												1565	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.9800	
Infiltration rate			0.3935	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4264	0.4181	0.4097	0.3679	0.3596	0.3177	0.3177	0.3094	0.3345	0.3596	0.3763	0.3930	(22b)
Effective ac	0.5909	0.5874	0.5839	0.5677	0.5646	0.5505	0.5505	0.5479	0.5559	0.5646	0.5708	0.5772	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4886	40.2466	40.0095	38.8957	38.6873	37.7172	37.7172	37.5376	38.0909	38.6873	39.1089	39.5496	(38)
Heat transfer coeff	84.1993	83.9574	83.7202	82.6064	82.3980	81.4280	81.4280	81.2483	81.8016	82.3980	82.8196	83.2603	(39)
Average = Sum(39)m / 12 =												82.6054	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0483	1.0453	1.0423	1.0285	1.0259	1.0138	1.0138	1.0116	1.0184	1.0259	1.0311	1.0366	(40)
HLP (average)												1.0285	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331 (83)
Total gains	700.6887	791.3139	845.8646	874.0829	877.0177	841.0555	809.5507	789.8934	778.5745	736.7455	684.5529	665.5902 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.2450	66.4358	66.6240	67.5223	67.6931	68.4995	68.4995	68.6510	68.1866	67.6931	67.3485	66.9920	
alpha	5.4163	5.4291	5.4416	5.5015	5.5129	5.5666	5.5666	5.5767	5.5458	5.5129	5.4899	5.4661	
util living area	0.9883	0.9766	0.9530	0.8969	0.7841	0.6025	0.4399	0.4693	0.6868	0.9026	0.9758	0.9909	(86)
MIT	20.1498	20.3099	20.5135	20.7422	20.9059	20.9827	20.9974	20.9963	20.9644	20.7704	20.4225	20.1174	(87)
Th 2	20.0433	20.0458	20.0482	20.0597	20.0618	20.0719	20.0719	20.0737	20.0680	20.0618	20.0575	20.0529	(88)
util rest of house	0.9848	0.9698	0.9393	0.8678	0.7294	0.5224	0.3486	0.3768	0.6086	0.8694	0.9676	0.9881	(89)
MIT 2	18.9344	19.1655	19.4548	19.7736	19.9754	20.0610	20.0709	20.0723	20.0428	19.8180	19.3384	18.8949	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2396	19.4529	19.7206	20.0168	20.2091	20.2924	20.3036	20.3043	20.2742	20.0572	19.6106	19.2019	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2396	19.4529	19.7206	20.0168	20.2091	20.2924	20.3036	20.3043	20.2742	20.0572	19.6106	19.2019	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9645	0.9337	0.8663	0.7386	0.5420	0.3716	0.4001	0.6267	0.8692	0.9626	0.9848	(94)
Useful gains	687.3295	763.2255	789.7757	757.2032	647.7770	455.8219	300.7988	316.0454	487.9624	640.3540	658.9477	655.4556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1257.9036	1221.8248	1106.8350	918.3217	701.1343	463.5237	301.5758	317.2200	505.0627	779.2537	1036.1267	1249.0611	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	424.5071	308.1787	235.8922	116.0053	39.6978	0.0000	0.0000	0.0000	0.0000	103.3414	271.5689	441.6425	(98)
Space heating												1940.8339	(98)
Space heating per m2											(98) / (4) =	24.1638	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2080.2078	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	424.5071	308.1787	235.8922	116.0053	39.6978	0.0000	0.0000	0.0000	0.0000	103.3414	271.5689	441.6425	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	454.9915	330.3095	252.8319	124.3358	42.5486	0.0000	0.0000	0.0000	0.0000	110.7625	291.0706	473.3574	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2703	89.1263	88.8745	88.3574	87.5357	86.7000	86.7000	86.7000	86.7000	88.2218	89.0050	89.3205	(217)
Fuel for water heating, kWh/month													
	182.9168	160.6040	167.0681	147.7476	144.0289	126.8692	118.9361	134.5284	135.5568	153.5937	164.5917	177.4529	(219)
Water heating fuel used												1813.8942	(219)
Annual totals kWh/year													
Space heating fuel - main system												2080.2078	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3708.0847	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2080.2078	3.4800	72.3912	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1813.8942	3.4800	63.1235	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	369.4250	13.1900	48.7272	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			230.9791	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7741	(257)
SAP value		89.2012	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2080.2078	0.2160	449.3249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1813.8942	0.2160	391.8012	(264)
Space and water heating			841.1260	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			744.5830	(272)
CO2 emissions per m2			9.2700	(273)
EI value			92.0385	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8804 = 3.953, stars = 4
Water heating environmental impact	0.216 / 0.8804 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.9800	
Infiltration rate			0.3935	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3512	0.3261	0.3345	0.3177	0.3177	0.3094	0.3010	0.2927	0.2843	0.3094	0.2927	0.3094	(22b)
Effective ac	0.5617	0.5532	0.5559	0.5505	0.5505	0.5479	0.5453	0.5428	0.5404	0.5479	0.5428	0.5479	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4837	37.9017	38.0909	37.7172	37.7172	37.5376	37.3627	37.1927	37.0274	37.5376	37.1927	37.5376	(38)
Heat transfer coeff	82.1944	81.6124	81.8016	81.4280	81.4280	81.2483	81.0735	80.9034	80.7381	81.2483	80.9034	81.2483	(39)
Average = Sum(39)m / 12 =												81.3190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0233	1.0161	1.0184	1.0138	1.0138	1.0116	1.0094	1.0073	1.0052	1.0116	1.0073	1.0116	(40)
HLP (average)												1.0124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392	(83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.8608	68.3447	68.1866	68.4995	68.4995	68.6510	68.7991	68.9437	69.0848	68.6510	68.9437	68.6510	
alpha	5.5241	5.5563	5.5458	5.5666	5.5666	5.5767	5.5866	5.5962	5.6057	5.5767	5.5962	5.5767	
util living area	0.9827	0.9713	0.9398	0.8652	0.7282	0.5157	0.3715	0.3776	0.6067	0.8547	0.9598	0.9860	(86)
MIT	20.2772	20.3956	20.5969	20.8080	20.9424	20.9928	20.9990	20.9990	20.9829	20.8513	20.5586	20.2570	(87)
Th 2	20.0639	20.0699	20.0680	20.0719	20.0719	20.0737	20.0755	20.0773	20.0790	20.0737	20.0773	20.0737	(88)
util rest of house	0.9775	0.9630	0.9228	0.8296	0.6658	0.4351	0.2839	0.2889	0.5255	0.8096	0.9464	0.9818	(89)
MIT 2	19.1335	19.3063	19.5856	19.8673	20.0233	20.0699	20.0753	20.0770	20.0684	19.9272	19.5451	19.1125	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9576	0.9179	0.8310	0.6787	0.4553	0.3060	0.3112	0.5454	0.8142	0.9415	0.9777	(94)
Useful gains	712.2839	766.0878	789.8647	745.5673	600.3392	403.5147	259.7789	259.3187	444.4253	624.8862	678.9752	674.8023	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1193.5217	1165.4121	1050.2968	863.4239	631.4021	406.3750	260.0218	259.5803	451.9729	711.6748	962.7198	1169.9691	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	358.0409	268.3459	193.7615	84.8567	23.1108	0.0000	0.0000	0.0000	0.0000	64.5708	204.2961	368.4042	(98)
Space heating												1565.3868	(98)
Space heating per m2											(98) / (4) =	19.4894	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1677.7994	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	358.0409	268.3459	193.7615	84.8567	23.1108	0.0000	0.0000	0.0000	0.0000	64.5708	204.2961	368.4042	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	383.7523	287.6162	207.6757	90.9504	24.7704	0.0000	0.0000	0.0000	0.0000	69.2077	218.9669	394.8598	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1407	89.0143	88.7021	88.0834	87.2388	86.7000	86.7000	86.7000	86.7000	87.8301	88.7609	89.1860	(217)
Fuel for water heating, kWh/month													
	183.1827	160.8060	167.3928	148.2073	144.5191	126.8692	118.9361	134.5284	135.5568	154.2787	165.0444	177.7205	(219)
Water heating fuel used												1817.0420	(219)
Annual totals kWh/year													
Space heating fuel - main system												1677.7994	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3233.7062	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1677.7994	7.3800	123.8216	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1817.0420	7.3800	134.0977	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	369.4250	28.6600	105.8772	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			290.0780	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1677.7994	0.2160	362.4047	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.0420	0.2160	392.4811	(264)
Space and water heating			754.8857	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			619.3566	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1677.7994	1.2200	2046.9153	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.0420	1.2200	2216.7912	(264)
Space and water heating			4263.7065	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	369.4250	3.0700	1134.1348	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3462.0215	(272)
Primary energy kWh/m2/year			43.1029	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (30.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 90	A 94
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£127	£142	-£14
Mains gas	£365	£293	£72
Space heating	£252	£252	£0
Water heating	£134	£76	£58
Lighting	£106	£106	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£290	£233	£58
Total cost of uses	£290	£232	£58
Delivered energy	40 kWh/m²	29 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	8 kg/m²	5 kg/m²	2 kg/m²
Primary energy	43 kWh/m²	30 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.9800	
Infiltration rate		0.3935	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4264	0.4181	0.4097	0.3679	0.3596	0.3177	0.3177	0.3094	0.3345	0.3596	0.3763	0.3930	(22b)
Effective ac	0.5909	0.5874	0.5839	0.5677	0.5646	0.5505	0.5505	0.5479	0.5559	0.5646	0.5708	0.5772	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4886	40.2466	40.0095	38.8957	38.6873	37.7172	37.7172	37.5376	38.0909	38.6873	39.1089	39.5496	(38)
Heat transfer coeff	84.1993	83.9574	83.7202	82.6064	82.3980	81.4280	81.4280	81.2483	81.8016	82.3980	82.8196	83.2603	(39)
Average = Sum(39)m / 12 =												82.6054	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0483	1.0453	1.0423	1.0285	1.0259	1.0138	1.0138	1.0116	1.0184	1.0259	1.0311	1.0366	(40)
HLP (average)												1.0285	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	143.5510	238.7638	315.0430	376.7929	413.9733	408.5830	394.8301	366.6967	335.9658	260.3931	170.8043	123.6331	(83)
Total gains	700.6887	791.3139	845.8646	874.0829	877.0177	841.0555	809.5507	789.8934	778.5745	736.7455	684.5529	665.5902	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.2450	66.4358	66.6240	67.5223	67.6931	68.4995	68.4995	68.6510	68.1866	67.6931	67.3485	66.9920	
alpha	5.4163	5.4291	5.4416	5.5015	5.5129	5.5666	5.5666	5.5767	5.5458	5.5129	5.4899	5.4661	
util living area													
	0.9883	0.9766	0.9530	0.8969	0.7841	0.6025	0.4399	0.4693	0.6868	0.9026	0.9758	0.9909	(86)
MIT	20.1498	20.3099	20.5135	20.7422	20.9059	20.9827	20.9974	20.9963	20.9644	20.7704	20.4225	20.1174	(87)
Th 2	20.0433	20.0458	20.0482	20.0597	20.0618	20.0719	20.0719	20.0737	20.0680	20.0618	20.0575	20.0529	(88)
util rest of house													
	0.9848	0.9698	0.9393	0.8678	0.7294	0.5224	0.3486	0.3768	0.6086	0.8694	0.9676	0.9881	(89)
MIT 2	18.9344	19.1655	19.4548	19.7736	19.9754	20.0610	20.0709	20.0723	20.0428	19.8180	19.3384	18.8949	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.2396	19.4529	19.7206	20.0168	20.2091	20.2924	20.3036	20.3043	20.2742	20.0572	19.6106	19.2019	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2396	19.4529	19.7206	20.0168	20.2091	20.2924	20.3036	20.3043	20.2742	20.0572	19.6106	19.2019	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9809	0.9645	0.9337	0.8663	0.7386	0.5420	0.3716	0.4001	0.6267	0.8692	0.9626	0.9848	(94)
Useful gains	687.3295	763.2255	789.7757	757.2032	647.7770	455.8219	300.7988	316.0454	487.9624	640.3540	658.9477	655.4556	(95)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1257.9036	1221.8248	1106.8350	918.3217	701.1343	463.5237	301.5758	317.2200	505.0627	779.2537	1036.1267	1249.0611	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	424.5071	308.1787	235.8922	116.0053	39.6978	0.0000	0.0000	0.0000	0.0000	103.3414	271.5689	441.6425	(98)
Space heating												1940.8339	(98)
Space heating per m2											(98) / (4) =	24.1638	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2080.2078	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.5071	308.1787	235.8922	116.0053	39.6978	0.0000	0.0000	0.0000	0.0000	103.3414	271.5689	441.6425	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	454.9915	330.3095	252.8319	124.3358	42.5486	0.0000	0.0000	0.0000	0.0000	110.7625	291.0706	473.3574	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3855	89.3752	89.3700	89.3971	89.5016	86.7000	86.7000	86.7000	86.7000	88.6573	89.1820	89.4160	(217)
Fuel for water heating, kWh/month	155.2883	114.4407	88.2779	41.7079	12.1355	0.0000	0.0000	21.8860	47.3352	93.9242	131.6991	154.3481	(219)
Water heating fuel used												861.0429	(219)
Annual totals kWh/year													
Space heating fuel - main system												2080.2078	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												2805.2334	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2080.2078	3.4800	72.3912	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.0429	3.4800	29.9643	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	369.4250	13.1900	48.7272	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			204.4148	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6851	(257)
SAP value		90.4431	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2080.2078	0.2160	449.3249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.0429	0.2160	185.9853	(264)
Space and water heating			635.3102	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy for lighting	369.4250	0.5190	191.7316 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			564.7171 (272)
CO2 emissions per m2			7.0300 (273)
EI value			93.9617
EI rating			94 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.9800	
Infiltration rate			0.3935	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3345	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3512	0.3261	0.3345	0.3177	0.3177	0.3094	0.3010	0.2927	0.2843	0.3094	0.2927	0.3094	(22b)
Effective ac	0.5617	0.5532	0.5559	0.5505	0.5505	0.5479	0.5453	0.5428	0.5404	0.5479	0.5428	0.5479	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5800	1.2357	14.3099			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1600	6.4256			(28a)
External Wall	44.8300	13.7000	31.1300	0.2700	8.4051			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			125.1500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.7462			(33)
Party Wall			95.3900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.9645	(36)
Total fabric heat loss (33) + (36) =	43.7107	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4837	37.9017	38.0909	37.7172	37.7172	37.5376	37.3627	37.1927	37.0274	37.5376	37.1927	37.5376	(38)
Heat transfer coeff	82.1944	81.6124	81.8016	81.4280	81.4280	81.2483	81.0735	80.9034	80.7381	81.2483	80.9034	81.2483	(39)
Average = Sum(39)m / 12 =												81.3190	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0233	1.0161	1.0184	1.0138	1.0138	1.0116	1.0094	1.0073	1.0052	1.0116	1.0073	1.0116	(40)
HLP (average)												1.0124	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.2959	46.4488	37.7747	28.5979	21.3772	18.0476	19.5010	25.3482	34.0223	43.1991	50.4197	53.7494	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	557.1378	552.5501	530.8216	497.2900	463.0444	432.4726	414.7205	423.1967	442.6087	476.3524	513.7486	541.9572	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	174.9926	247.4214	329.7005	399.9249	421.4674	453.8754	434.3205	410.0920	372.2718	291.1521	207.4354	148.2392	(83)
Total gains	732.1304	799.9715	860.5221	897.2149	884.5118	886.3479	849.0410	833.2887	814.8805	767.5044	721.1840	690.1963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.8608	68.3447	68.1866	68.4995	68.4995	68.6510	68.7991	68.9437	69.0848	68.6510	68.9437	68.6510	
alpha	5.5241	5.5563	5.5458	5.5666	5.5666	5.5767	5.5866	5.5962	5.6057	5.5767	5.5962	5.5767	
util living area													
	0.9827	0.9713	0.9398	0.8652	0.7282	0.5157	0.3715	0.3776	0.6067	0.8547	0.9598	0.9860	(86)
MIT	20.2772	20.3956	20.5969	20.8080	20.9424	20.9928	20.9990	20.9990	20.9829	20.8513	20.5586	20.2570	(87)
Th 2	20.0639	20.0699	20.0680	20.0719	20.0719	20.0737	20.0755	20.0773	20.0790	20.0737	20.0773	20.0737	(88)
util rest of house													
	0.9775	0.9630	0.9228	0.8296	0.6658	0.4351	0.2839	0.2889	0.5255	0.8096	0.9464	0.9818	(89)
MIT 2	19.1335	19.3063	19.5856	19.8673	20.0233	20.0699	20.0753	20.0770	20.0684	19.9272	19.5451	19.1125	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4207	19.5798	19.8396	20.1035	20.2541	20.3016	20.3072	20.3085	20.2980	20.1593	19.7996	19.3999	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9576	0.9179	0.8310	0.6787	0.4553	0.3060	0.3112	0.5454	0.8142	0.9415	0.9777	(94)
Useful gains	712.2839	766.0878	789.8647	745.5673	600.3392	403.5147	259.7789	259.3187	444.4253	624.8862	678.9752	674.8023	(95)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1193.5217	1165.4121	1050.2968	863.4239	631.4021	406.3750	260.0218	259.5803	451.9729	711.6748	962.7198	1169.9691 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	358.0409	268.3459	193.7615	84.8567	23.1108	0.0000	0.0000	0.0000	0.0000	64.5708	204.2961	368.4042 (98)
Space heating												1565.3868 (98)
Space heating per m2											(98) / (4) =	19.4894 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1677.7994	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	358.0409	268.3459	193.7615	84.8567	23.1108	0.0000	0.0000	0.0000	0.0000	64.5708	204.2961	368.4042	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	383.7523	287.6162	207.6757	90.9504	24.7704	0.0000	0.0000	0.0000	0.0000	69.2077	218.9669	394.8598	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2866	89.2756	89.2309	89.1915	88.8299	86.7000	86.7000	86.7000	86.7000	88.2786	88.9866	89.3056	(217)
Fuel for water heating, kWh/month	150.8546	114.7868	88.0746	40.6391	17.2424	0.0000	0.0000	14.9625	41.9449	89.9322	126.6164	151.1510	(219)
Water heating fuel used												836.2046	(219)
Annual totals kWh/year													
Space heating fuel - main system												1677.7994	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												369.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2302.8688	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1677.7994	7.3800	123.8216	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	836.2046	7.3800	61.7119	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	369.4250	28.6600	105.8772	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			232.0221	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1677.7994	0.2160	362.4047	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.2046	0.2160	180.6202	(264)
Space and water heating			543.0249	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	369.4250	0.5190	191.7316	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			433.4457	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1677.7994	1.2200	2046.9153	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.2046	1.2200	1020.1696	(264)
Space and water heating			3067.0849	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	369.4250	3.0700	1134.1348	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			2418.8998	(272)
Primary energy kWh/m2/year			30.1158	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		548.14 (P1)
Transmission heat loss coefficient		43.71 (37)
Summer heat loss coefficient		591.85 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						437.0800

	Jun	Jul	Aug	
Solar gains	464	437	411	(P3)
Internal gains	429	412	420	
Total summer gains	894	849	831	(P5)
Summer gain/loss ratio	1.51	1.43	1.40	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.98	18.95	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 392 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 392	**Prop Type Ref**	
Property	35 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	11.11	**TER**	16.79
Environmental	92 A	**% DER<TER**	33.82		
CO_2 Emissions (t/year)	0.62	**DFEE**	36.53	**TFEE**	42.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	14.74		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.11	$kgCO_2/m^2$	Pass
	-5.68 (-33.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.84	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	36.53	$kWh/m^2/yr$	
	-6.3 (-14.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.98 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	3.61 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.98 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 393 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 393	**Prop Type Ref**	
Property	36 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.05	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.53		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.01	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

End-Terrace House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.36 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3625	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5772	0.5742	0.5712	0.5574	0.5549	0.5428	0.5428	0.5406	0.5475	0.5549	0.5601	0.5655	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5456	39.3403	39.1390	38.1938	38.0170	37.1937	37.1937	37.0413	37.5108	38.0170	38.3747	38.7488	(38)
Heat transfer coeff	99.8724	99.6671	99.4659	98.5207	98.3438	97.5206	97.5206	97.3681	97.8377	98.3438	98.7016	99.0756	(39)
Average = Sum(39)m / 12 =												98.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2434	1.2409	1.2384	1.2266	1.2244	1.2142	1.2142	1.2123	1.2181	1.2244	1.2289	1.2335	(40)
HLP (average)												1.2266	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8490	55.9641	56.0773	56.6153	56.7171	57.1959	57.1959	57.2855	57.0105	56.7171	56.5115	56.2982	
alpha	4.7233	4.7309	4.7385	4.7744	4.7811	4.8131	4.8131	4.8190	4.8007	4.7811	4.7674	4.7532	
util living area													
	0.9968	0.9920	0.9801	0.9471	0.8661	0.7110	0.5423	0.5869	0.8145	0.9622	0.9930	0.9977	(86)
MIT	19.6960	19.8898	20.1622	20.4919	20.7706	20.9376	20.9864	20.9802	20.8754	20.5070	20.0327	19.6588	(87)
Th 2	19.8854	19.8874	19.8894	19.8988	19.9005	19.9087	19.9087	19.9102	19.9055	19.9005	19.8970	19.8933	(88)
util rest of house													
	0.9957	0.9892	0.9732	0.9275	0.8168	0.6154	0.4156	0.4593	0.7341	0.9442	0.9902	0.9969	(89)
MIT 2	18.1620	18.4452	18.8399	19.3117	19.6783	19.8677	19.9038	19.9023	19.8095	19.3424	18.6614	18.1132	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5472	18.8080	19.1720	19.6080	19.9526	20.1364	20.1757	20.1730	20.0772	19.6349	19.0058	18.5013	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5472	18.8080	19.1720	19.6080	19.9526	20.1364	20.1757	20.1730	20.0772	19.6349	19.0058	18.5013	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9671	0.9212	0.8195	0.6369	0.4476	0.4914	0.7484	0.9386	0.9869	0.9954	(94)
Useful gains	532.0565	635.2703	704.7315	730.9267	677.1928	510.7018	344.4346	360.7225	521.1883	580.8515	529.4804	498.8391	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1422.9036	1386.1666	1260.4300	1054.9630	811.5950	539.9083	348.7016	367.3719	584.7950	888.5255	1175.1177	1416.9143	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	662.7903	504.6023	413.4397	233.3061	99.9953	0.0000	0.0000	0.0000	0.0000	228.9095	464.8588	683.0479	(98)
Space heating												3290.9499	(98)
Space heating per m2											(98) / (4) =	40.9730	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3527.2775	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	662.7903	504.6023	413.4397	233.3061	99.9953	0.0000	0.0000	0.0000	0.0000	228.9095	464.8588	683.0479	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	710.3861	540.8385	443.1294	250.0602	107.1761	0.0000	0.0000	0.0000	0.0000	245.3478	498.2410	732.0985	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5649	89.4790	89.3200	88.9745	88.2563	86.7000	86.7000	86.7000	86.7000	88.9270	89.4104	89.5993	(217)
Fuel for water heating, kWh/month													
	182.3151	159.9709	166.2348	146.7230	142.8529	126.8692	118.9361	134.5284	135.5568	152.3757	163.8454	176.9007	(219)
Water heating fuel used												1807.1090	(219)
Annual totals kWh/year													
Space heating fuel - main system												3527.2775	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5134.6109	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3527.2775	0.2160	761.8919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1090	0.2160	390.3355	(264)
Space and water heating			1152.2275	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1048.5439	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0500	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5083	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5083	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3625	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5772	0.5742	0.5712	0.5574	0.5549	0.5428	0.5428	0.5406	0.5475	0.5549	0.5601	0.5655	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5456	39.3403	39.1390	38.1938	38.0170	37.1937	37.1937	37.0413	37.5108	38.0170	38.3747	38.7488	(38)
Heat transfer coeff	99.8724	99.6671	99.4659	98.5207	98.3438	97.5206	97.5206	97.3681	97.8377	98.3438	98.7016	99.0756	(39)
Average = Sum(39)m / 12 =												98.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2434	1.2409	1.2384	1.2266	1.2244	1.2142	1.2142	1.2123	1.2181	1.2244	1.2289	1.2335	(40)
HLP (average)												1.2266	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8490	55.9641	56.0773	56.6153	56.7171	57.1959	57.1959	57.2855	57.0105	56.7171	56.5115	56.2982	
alpha	4.7233	4.7309	4.7385	4.7744	4.7811	4.8131	4.8131	4.8190	4.8007	4.7811	4.7674	4.7532	
util living area													
	0.9975	0.9934	0.9830	0.9529	0.8770	0.7258	0.5562	0.6036	0.8296	0.9678	0.9945	0.9982	(86)
MIT	19.6604	19.8559	20.1318	20.4678	20.7552	20.9317	20.9848	20.9777	20.8640	20.4810	19.9998	19.6239	(87)
Th 2	19.8854	19.8874	19.8894	19.8988	19.9005	19.9087	19.9087	19.9102	19.9055	19.9005	19.8970	19.8933	(88)
util rest of house													
	0.9967	0.9912	0.9769	0.9351	0.8298	0.6305	0.4271	0.4738	0.7517	0.9521	0.9922	0.9976	(89)
MIT 2	18.6733	18.8692	19.1434	19.4760	19.7370	19.8777	19.9050	19.9041	19.8328	19.4955	19.0209	18.6432	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9212	19.1170	19.3916	19.7250	19.9927	20.1424	20.1761	20.1737	20.0917	19.7430	19.2667	18.8894	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9212	19.1170	19.3916	19.7250	19.9927	20.1424	20.1761	20.1737	20.0917	19.7430	19.2667	18.8894	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9734	0.9317	0.8344	0.6526	0.4599	0.5067	0.7668	0.9492	0.9905	0.9968	(94)
Useful gains	501.7874	607.2612	681.0734	714.3134	668.3256	508.0753	343.9562	359.8674	515.1609	561.8689	502.1791	469.0404	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1460.2558	1416.9676	1282.2781	1066.4890	815.5329	540.4951	348.7465	367.4379	586.2181	899.1577	1200.8753	1455.3655	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.1004	544.1228	447.2964	253.5664	109.5222	0.0000	0.0000	0.0000	0.0000	250.9429	503.0613	733.8259	(98)
Space heating												3555.4382	(98)
Space heating per m2											(98) / (4) =	44.2659	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.6933	721.6522	739.9976	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8627	0.9235	0.9053	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.8453	666.4440	669.8847	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.2122	221.7524	187.6323	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												561.5969 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0531	55.4381	46.9081	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												140.3992 (107)
Space cooling per m2												1.7480 (108)
Energy for space heating												44.2659 (99)
Energy for space cooling												1.7480 (108)
Total												46.0139 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3600	
Infiltration rate			0.3625	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3235	0.3004	0.3081	0.2927	0.2927	0.2850	0.2773	0.2696	0.2619	0.2850	0.2696	0.2850	(22b)
Effective ac	0.5523	0.5451	0.5475	0.5428	0.5428	0.5406	0.5384	0.5363	0.5343	0.5406	0.5363	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8442	37.3503	37.5108	37.1937	37.1937	37.0413	36.8929	36.7486	36.6083	37.0413	36.7486	37.0413	(38)
Heat transfer coeff	98.1710	97.6771	97.8377	97.5206	97.5206	97.3681	97.2197	97.0754	96.9351	97.3681	97.0754	97.3681	(39)
Average = Sum(39)m / 12 =												97.4281	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2222	1.2161	1.2181	1.2142	1.2142	1.2123	1.2104	1.2086	1.2069	1.2123	1.2086	1.2123	(40)
HLP (average)												1.2130	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8169	57.1043	57.0105	57.1959	57.1959	57.2855	57.3729	57.4582	57.5413	57.2855	57.4582	57.2855	
alpha	4.7878	4.8070	4.8007	4.8131	4.8131	4.8190	4.8249	4.8305	4.8361	4.8190	4.8305	4.8190	
util living area													
	0.9848	0.9748	0.9463	0.8776	0.7498	0.5410	0.3944	0.4056	0.6489	0.8809	0.9671	0.9878	(86)
MIT	20.0304	20.1678	20.4222	20.7011	20.8955	20.9826	20.9969	20.9965	20.9591	20.7462	20.3636	20.0048	(87)
Th 2	19.9022	19.9071	19.9055	19.9087	19.9087	19.9102	19.9117	19.9131	19.9145	19.9102	19.9131	19.9102	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6809	0.4445	0.2859	0.2943	0.5532	0.8364	0.9550	0.9839	(89)
MIT 2	18.6582	18.8580	19.2145	19.5900	19.8208	19.9012	19.9109	19.9122	19.8893	19.6571	19.1446	18.6275	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8394	0.6933	0.4684	0.3133	0.3224	0.5758	0.8374	0.9484	0.9792	(94)
Useful gains	732.8051	801.2530	847.5681	825.3207	682.8035	467.4473	299.0175	298.5625	510.5981	679.9529	707.7151	691.0104	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.4858	1356.4321	1224.7125	1011.1954	740.2488	474.4533	299.7881	299.4308	529.0644	830.6105	1121.2902	1360.5624	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	484.8504	373.0804	280.5955	133.8298	42.7393	0.0000	0.0000	0.0000	0.0000	112.0892	297.7741	498.1467	(98)
Space heating												2223.1053	(98)
RHI space heating demand												2223	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3600	
Infiltration rate			0.3625	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5772	0.5742	0.5712	0.5574	0.5549	0.5428	0.5428	0.5406	0.5475	0.5549	0.5601	0.5655	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5456	39.3403	39.1390	38.1938	38.0170	37.1937	37.1937	37.0413	37.5108	38.0170	38.3747	38.7488	(38)
Heat transfer coeff	99.8724	99.6671	99.4659	98.5207	98.3438	97.5206	97.5206	97.3681	97.8377	98.3438	98.7016	99.0756	(39)
Average = Sum(39)m / 12 =												98.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2434	1.2409	1.2384	1.2266	1.2244	1.2142	1.2142	1.2123	1.2181	1.2244	1.2289	1.2335	(40)
HLP (average)												1.2266	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8490	55.9641	56.0773	56.6153	56.7171	57.1959	57.1959	57.2855	57.0105	56.7171	56.5115	56.2982	
alpha	4.7233	4.7309	4.7385	4.7744	4.7811	4.8131	4.8131	4.8190	4.8007	4.7811	4.7674	4.7532	
util living area													
	0.9894	0.9789	0.9571	0.9053	0.8003	0.6298	0.4679	0.5043	0.7265	0.9197	0.9794	0.9917	(86)
MIT	19.8965	20.0805	20.3302	20.6194	20.8436	20.9628	20.9927	20.9895	20.9255	20.6417	20.2130	19.8567	(87)
Th 2	19.8854	19.8874	19.8894	19.8988	19.9005	19.9087	19.9087	19.9102	19.9055	19.9005	19.8970	19.8933	(88)
util rest of house													
	0.9861	0.9724	0.9436	0.8756	0.7413	0.5364	0.3555	0.3901	0.6385	0.8881	0.9718	0.9890	(89)
MIT 2	18.4526	18.7185	19.0743	19.4769	19.7571	19.8857	19.9062	19.9063	19.8526	19.5170	18.9191	18.4007	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8152	19.0605	19.3897	19.7638	20.0300	20.1561	20.1790	20.1783	20.1221	19.7994	19.2440	18.7664	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8152	19.0605	19.3897	19.7638	20.0300	20.1561	20.1790	20.1783	20.1221	19.7994	19.2440	18.7664	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9361	0.8713	0.7490	0.5585	0.3839	0.4188	0.6573	0.8846	0.9658	0.9852	(94)
Useful gains	702.4715	794.6385	841.4115	829.7853	729.0379	524.9529	346.8209	364.5165	552.5110	684.9358	679.6616	667.4619	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1449.6648	1411.3360	1282.0856	1070.3096	819.2005	541.8384	349.0309	367.8888	589.1845	904.7043	1198.6326	1443.1704	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	555.9118	414.4207	327.8615	173.1775	67.0809	0.0000	0.0000	0.0000	0.0000	163.5077	373.6591	577.1272	(98)
Space heating												2652.7466	(98)
Space heating per m2											(98) / (4) =	33.0272	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2843.2439	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	555.9118	414.4207	327.8615	173.1775	67.0809	0.0000	0.0000	0.0000	0.0000	163.5077	373.6591	577.1272	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	595.8326	444.1808	351.4057	185.6136	71.8981	0.0000	0.0000	0.0000	0.0000	175.2495	400.4921	618.5715	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4567	89.3476	89.1462	88.7167	87.9172	86.7000	86.7000	86.7000	86.7000	88.6322	89.2562	89.4993	(217)
Fuel for water heating, kWh/month													
	182.5357	160.2062	166.5589	147.1493	143.4039	126.8692	118.9361	134.5284	135.5568	152.8824	164.1284	177.0984	(219)
Water heating fuel used												1809.8537	(219)
Annual totals kWh/year													
Space heating fuel - main system												2843.2439	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4453.3220	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2843.2439	3.4800	98.9449	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8537	3.4800	62.9829	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.5774	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8565	(257)
SAP value		88.0512	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2843.2439	0.2160	614.1407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8537	0.2160	390.9284	(264)
Space and water heating			1005.0691	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			901.3855	(272)
CO2 emissions per m2			11.2200	(273)
EI value			90.3618	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3600	
Infiltration rate			0.3625	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3235	0.3004	0.3081	0.2927	0.2927	0.2850	0.2773	0.2696	0.2619	0.2850	0.2696	0.2850	(22b)
Effective ac	0.5523	0.5451	0.5475	0.5428	0.5428	0.5406	0.5384	0.5363	0.5343	0.5406	0.5363	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8442	37.3503	37.5108	37.1937	37.1937	37.0413	36.8929	36.7486	36.6083	37.0413	36.7486	37.0413	(38)
Heat transfer coeff	98.1710	97.6771	97.8377	97.5206	97.5206	97.3681	97.2197	97.0754	96.9351	97.3681	97.0754	97.3681	(39)
Average = Sum(39)m / 12 =												97.4281	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2222	1.2161	1.2181	1.2142	1.2142	1.2123	1.2104	1.2086	1.2069	1.2123	1.2086	1.2123	(40)
HLP (average)												1.2130	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8169	57.1043	57.0105	57.1959	57.1959	57.2855	57.3729	57.4582	57.5413	57.2855	57.4582	57.2855	
alpha	4.7878	4.8070	4.8007	4.8131	4.8131	4.8190	4.8249	4.8305	4.8361	4.8190	4.8305	4.8190	
util living area													
	0.9848	0.9748	0.9463	0.8776	0.7498	0.5410	0.3944	0.4056	0.6489	0.8809	0.9671	0.9878	(86)
MIT	20.0304	20.1678	20.4222	20.7011	20.8955	20.9826	20.9969	20.9965	20.9591	20.7462	20.3636	20.0048	(87)
Th 2	19.9022	19.9071	19.9055	19.9087	19.9087	19.9102	19.9117	19.9131	19.9145	19.9102	19.9131	19.9102	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6809	0.4445	0.2859	0.2943	0.5532	0.8364	0.9550	0.9839	(89)
MIT 2	18.6582	18.8580	19.2145	19.5900	19.8208	19.9012	19.9109	19.9122	19.8893	19.6571	19.1446	18.6275	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8394	0.6933	0.4684	0.3133	0.3224	0.5758	0.8374	0.9484	0.9792	(94)
Useful gains	732.8051	801.2530	847.5681	825.3207	682.8035	467.4473	299.0175	298.5625	510.5981	679.9529	707.7151	691.0104	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.4858	1356.4321	1224.7125	1011.1954	740.2488	474.4533	299.7881	299.4308	529.0644	830.6105	1121.2902	1360.5624	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	484.8504	373.0804	280.5955	133.8298	42.7393	0.0000	0.0000	0.0000	0.0000	112.0892	297.7741	498.1467	(98)
Space heating												2223.1053	(98)
Space heating per m2											(98) / (4) =	27.6781	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2382.7495	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	484.8504	373.0804	280.5955	133.8298	42.7393	0.0000	0.0000	0.0000	0.0000	112.0892	297.7741	498.1467	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	519.6682	399.8718	300.7454	143.4403	45.8084	0.0000	0.0000	0.0000	0.0000	120.1385	319.1577	533.9193	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3651	89.2722	89.0209	88.4857	87.5840	86.7000	86.7000	86.7000	86.7000	88.2936	89.0803	89.4039	(217)
Fuel for water heating, kWh/month													
	182.7226	160.3415	166.7933	147.5334	143.9495	126.8692	118.9361	134.5284	135.5568	153.4688	164.4525	177.2873	(219)
Water heating fuel used												1812.4393	(219)
Annual totals kWh/year													
Space heating fuel - main system												2382.7495	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3920.2954	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2382.7495	7.3800	175.8469	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4393	7.3800	133.7580	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			337.8205	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2382.7495	0.2160	514.6739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4393	0.2160	391.4869	(264)
Space and water heating			906.1608	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			763.4911	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2382.7495	1.2200	2906.9544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4393	1.2200	2211.1760	(264)
Space and water heating			5118.1304	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4274.2075	(272)
Primary energy kWh/m2/year			53.2147	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£344	£72
Space heating	£304	£304	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£280	£58
Total cost of uses	£338	£280	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3625	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5772	0.5742	0.5712	0.5574	0.5549	0.5428	0.5428	0.5406	0.5475	0.5549	0.5601	0.5655	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5456	39.3403	39.1390	38.1938	38.0170	37.1937	37.1937	37.0413	37.5108	38.0170	38.3747	38.7488	(38)
Heat transfer coeff	99.8724	99.6671	99.4659	98.5207	98.3438	97.5206	97.5206	97.3681	97.8377	98.3438	98.7016	99.0756	(39)
Average = Sum(39)m / 12 =												98.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2434	1.2409	1.2384	1.2266	1.2244	1.2142	1.2142	1.2123	1.2181	1.2244	1.2289	1.2335	(40)
HLP (average)												1.2266	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8490	55.9641	56.0773	56.6153	56.7171	57.1959	57.1959	57.2855	57.0105	56.7171	56.5115	56.2982	
alpha	4.7233	4.7309	4.7385	4.7744	4.7811	4.8131	4.8131	4.8190	4.8007	4.7811	4.7674	4.7532	
util living area													
	0.9894	0.9789	0.9571	0.9053	0.8003	0.6298	0.4679	0.5043	0.7265	0.9197	0.9794	0.9917	(86)
MIT	19.8965	20.0805	20.3302	20.6194	20.8436	20.9628	20.9927	20.9895	20.9255	20.6417	20.2130	19.8567	(87)
Th 2	19.8854	19.8874	19.8894	19.8988	19.9005	19.9087	19.9087	19.9102	19.9055	19.9005	19.8970	19.8933	(88)
util rest of house													
	0.9861	0.9724	0.9436	0.8756	0.7413	0.5364	0.3555	0.3901	0.6385	0.8881	0.9718	0.9890	(89)
MIT 2	18.4526	18.7185	19.0743	19.4769	19.7571	19.8857	19.9062	19.9063	19.8526	19.5170	18.9191	18.4007	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8152	19.0605	19.3897	19.7638	20.0300	20.1561	20.1790	20.1783	20.1221	19.7994	19.2440	18.7664	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8152	19.0605	19.3897	19.7638	20.0300	20.1561	20.1790	20.1783	20.1221	19.7994	19.2440	18.7664	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9361	0.8713	0.7490	0.5585	0.3839	0.4188	0.6573	0.8846	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4715	794.6385	841.4115	829.7853	729.0379	524.9529	346.8209	364.5165	552.5110	684.9358	679.6616	667.4619	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1449.6648	1411.3360	1282.0856	1070.3096	819.2005	541.8384	349.0309	367.8888	589.1845	904.7043	1198.6326	1443.1704	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	555.9118	414.4207	327.8615	173.1775	67.0809	0.0000	0.0000	0.0000	0.0000	163.5077	373.6591	577.1272	(98)

Space heating 2652.7466 (98)
Space heating per m2 (98) / (4) = 33.0272 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2843.2439 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	555.9118	414.4207	327.8615	173.1775	67.0809	0.0000	0.0000	0.0000	0.0000	163.5077	373.6591	577.1272	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	595.8326	444.1808	351.4057	185.6136	71.8981	0.0000	0.0000	0.0000	0.0000	175.2495	400.4921	618.5715	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5570	89.5638	89.5786	89.6406	89.7805	86.7000	86.7000	86.7000	86.7000	89.0523	89.4121	89.5822	(217)
Fuel for water heating, kWh/month	154.9908	114.1997	88.0723	41.5946	12.0978	0.0000	0.0000	21.8860	47.3352	93.5077	131.3602	154.0618	(219)

Water heating fuel used 859.1061 (219)
Annual totals kWh/year
Space heating fuel - main system 2843.2439 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) = -630.4424 -630.4424 (233)
Total delivered energy for all uses 3552.5744 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2843.2439	3.4800	98.9449	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.1061	3.4800	29.8969	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.0864	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7678 (257)
SAP value 89.2897
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2843.2439	0.2160	614.1407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.1061	0.2160	185.5669	(264)
Space and water heating			799.7076	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			721.9741 (272)
CO2 emissions per m2			8.9900 (273)
EI value			92.2802
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3600	
Infiltration rate			0.3625	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3081	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3235	0.3004	0.3081	0.2927	0.2927	0.2850	0.2773	0.2696	0.2619	0.2850	0.2696	0.2850	(22b)
Effective ac	0.5523	0.5451	0.5475	0.5428	0.5428	0.5406	0.5384	0.5363	0.5343	0.5406	0.5363	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8442	37.3503	37.5108	37.1937	37.1937	37.0413	36.8929	36.7486	36.6083	37.0413	36.7486	37.0413	(38)
Heat transfer coeff	98.1710	97.6771	97.8377	97.5206	97.5206	97.3681	97.2197	97.0754	96.9351	97.3681	97.0754	97.3681	(39)
Average = Sum(39)m / 12 =												97.4281	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2222	1.2161	1.2181	1.2142	1.2142	1.2123	1.2104	1.2086	1.2069	1.2123	1.2086	1.2123	(40)
HLP (average)												1.2130	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3896 (H8)
Utilisation factor	0.5131 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.8365 (H14)
Volume ratio Veff/V	0.8079 (H15)
Solar storage volume factor	0.9573 (H16)
Solar input	-876.6189 (H17)

Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8169	57.1043	57.0105	57.1959	57.1959	57.2855	57.3729	57.4582	57.5413	57.2855	57.4582	57.2855	
alpha	4.7878	4.8070	4.8007	4.8131	4.8131	4.8190	4.8249	4.8305	4.8361	4.8190	4.8305	4.8190	
util living area													
	0.9848	0.9748	0.9463	0.8776	0.7498	0.5410	0.3944	0.4056	0.6489	0.8809	0.9671	0.9878	(86)
MIT	20.0304	20.1678	20.4222	20.7011	20.8955	20.9826	20.9969	20.9965	20.9591	20.7462	20.3636	20.0048	(87)
Th 2	19.9022	19.9071	19.9055	19.9087	19.9087	19.9102	19.9117	19.9131	19.9145	19.9102	19.9131	19.9102	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6809	0.4445	0.2859	0.2943	0.5532	0.8364	0.9550	0.9839	(89)
MIT 2	18.6582	18.8580	19.2145	19.5900	19.8208	19.9012	19.9109	19.9122	19.8893	19.6571	19.1446	18.6275	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0028	19.1869	19.5178	19.8690	20.0907	20.1728	20.1836	20.1845	20.1579	19.9306	19.4507	18.9734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9225	0.8394	0.6933	0.4684	0.3133	0.3224	0.5758	0.8374	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8051	801.2530	847.5681	825.3207	682.8035	467.4473	299.0175	298.5625	510.5981	679.9529	707.7151	691.0104 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1384.4858	1356.4321	1224.7125	1011.1954	740.2488	474.4533	299.7881	299.4308	529.0644	830.6105	1121.2902	1360.5624 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	484.8504	373.0804	280.5955	133.8298	42.7393	0.0000	0.0000	0.0000	0.0000	112.0892	297.7741	498.1467 (98)
Space heating												2223.1053 (98)
Space heating per m2											(98) / (4) =	27.6781 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2382.7495 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.8504	373.0804	280.5955	133.8298	42.7393	0.0000	0.0000	0.0000	0.0000	112.0892	297.7741	498.1467	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	519.6682	399.8718	300.7454	143.4403	45.8084	0.0000	0.0000	0.0000	0.0000	120.1385	319.1577	533.9193	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4921	89.4992	89.4870	89.5079	89.3215	86.7000	86.7000	86.7000	86.7000	88.7717	89.2823	89.5076	(217)
Fuel for water heating, kWh/month	150.5081	114.5000	87.8225	40.4954	17.1475	0.0000	0.0000	14.9625	41.9449	89.4326	126.1970	150.8099	(219)
Water heating fuel used												833.8205	(219)

Annual totals kWh/year	
Space heating fuel - main system	2382.7495 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	355.6668 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602	-705.5602 (233)
Total delivered energy for all uses	2991.6766 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2382.7495	7.3800	175.8469	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8205	7.3800	61.5360	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			279.9284	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2382.7495	0.2160	514.6739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8205	0.2160	180.1052	(264)
Space and water heating			694.7791	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			578.0594	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2382.7495	1.2200	2906.9544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8205	1.2200	1017.2610	(264)
Space and water heating			3924.2154	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3233.7925	(272)
Primary energy kWh/m2/year			40.2614	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 393 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 393	**Prop Type Ref**	
Property	36 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.05	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.53		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.01	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.05	$kgCO_2/m^2$	Pass
	-5.21 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.01	$kWh/m^2/yr$	
	-5.3 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 394 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 394 EPC	**Prop Type Ref**	
Property	37 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.36	**TER**	18.40
Environmental	90 B	**% DER<TER**	27.39		
CO_2 Emissions (t/year)	0.80	**DFEE**	47.31	**TFEE**	53.53
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.62		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 81 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.3 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.97 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 3.89 m², No overhang
Windows facing South West: 1.02 m², No overhang
Windows facing West: 3.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.031 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3961	0.3883	0.3805	0.3417	0.3339	0.2951	0.2951	0.2873	0.3106	0.3339	0.3495	0.3650	(22b)
Effective ac	0.5784	0.5754	0.5724	0.5584	0.5558	0.5435	0.5435	0.5413	0.5482	0.5558	0.5611	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.1996	39.9879	39.7805	38.8060	38.6237	37.7749	37.7749	37.6178	38.1019	38.6237	38.9925	39.3781	(38)
Heat transfer coeff	105.0290	104.8173	104.6099	103.6354	103.4531	102.6043	102.6043	102.4472	102.9312	103.4531	103.8219	104.2075	(39)
Average = Sum(39)m / 12 =												103.6345	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2889	1.2863	1.2837	1.2718	1.2695	1.2591	1.2591	1.2572	1.2631	1.2695	1.2740	1.2788	(40)
HLP (average)												1.2717	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408 (61)
Total heat required for water heating calculated for each month												
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147 (64)
								Total per year (kWh/year) = Sum(64)m =				1607.4181 (64)
Heat gains from water heating, kWh/month												
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8649	17.6438	14.3489	10.8631	8.1203	6.8555	7.4076	9.6286	12.9236	16.4094	19.1522	20.4170	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	222.5264	224.8355	219.0166	206.6288	190.9914	176.2945	166.4760	164.1669	169.9858	182.3736	198.0110	212.7079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	377.7860	375.7132	362.1109	340.1371	317.7958	296.2586	282.2558	288.2392	299.5123	321.6992	347.2086	366.3689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	3.8900	46.7521	0.7200	0.7000	0.7700	63.5205	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	169.1731	304.0806	449.5287	598.7111	698.2799	702.6234	673.6998	599.8197	502.2241	345.9492	205.7423	142.6478	(83)
Total gains	546.9591	679.7938	811.6396	938.8482	1016.0757	998.8819	955.9556	888.0588	801.7363	667.6485	552.9509	509.0167	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8806	53.9894	54.0965	54.6052	54.7014	55.1539	55.1539	55.2385	54.9787	54.7014	54.5071	54.3054	
alpha	4.5920	4.5993	4.6064	4.6403	4.6468	4.6769	4.6769	4.6826	4.6652	4.6468	4.6338	4.6204	
util living area													
	0.9967	0.9908	0.9731	0.9185	0.7997	0.6225	0.4647	0.5175	0.7702	0.9557	0.9927	0.9976	(86)
MIT	19.6412	19.8597	20.1820	20.5584	20.8314	20.9606	20.9918	20.9868	20.8953	20.5061	19.9922	19.6004	(87)
Th 2	19.8496	19.8516	19.8536	19.8630	19.8648	19.8730	19.8730	19.8745	19.8698	19.8648	19.8612	19.8575	(88)
util rest of house													
	0.9956	0.9877	0.9639	0.8913	0.7396	0.5271	0.3496	0.3975	0.6828	0.9350	0.9898	0.9968	(89)
MIT 2	18.0574	18.3762	18.8409	19.3686	19.7108	19.8489	19.8703	19.8696	19.7930	19.3127	18.5776	18.0033	(90)
Living area fraction										fLA = Living area / (4) =		0.2620	(91)
MIT	18.4723	18.7649	19.1923	19.6803	20.0044	20.1402	20.1641	20.1623	20.0818	19.6254	18.9483	18.4218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4723	18.7649	19.1923	19.6803	20.0044	20.1402	20.1641	20.1623	20.0818	19.6254	18.9483	18.4218	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9836	0.9570	0.8861	0.7477	0.5508	0.3799	0.4290	0.7010	0.9294	0.9863	0.9953	(94)
Useful gains	543.4592	668.6495	776.7435	831.8737	759.7281	550.1614	363.1613	381.0204	561.9825	620.5193	545.3801	506.6142	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1488.5054	1453.2816	1327.7377	1117.2225	859.1109	568.4479	365.6953	385.4380	615.7143	933.7008	1230.1083	1482.0132	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	703.1144	527.2728	409.9397	205.4511	73.9408	0.0000	0.0000	0.0000	0.0000	233.0071	493.0043	725.6969	(98)
Space heating												3371.4270	(98)
Space heating per m2											(98) / (4) =	41.3723	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3613.5338	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	703.1144	527.2728	409.9397	205.4511	73.9408	0.0000	0.0000	0.0000	0.0000	233.0071	493.0043	725.6969	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	753.6060	565.1369	439.3781	220.2048	79.2506	0.0000	0.0000	0.0000	0.0000	249.7396	528.4076	777.8101	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5959	89.5033	89.3103	88.8620	87.9927	86.7000	86.7000	86.7000	86.7000	88.9377	89.4458	89.6300	(217)
Fuel for water heating, kWh/month													
	183.1888	160.7493	167.1027	147.6532	144.0022	127.5008	119.5214	135.2002	136.2367	153.1297	164.6190	177.7469	(219)
Water heating fuel used												1816.6509	(219)
Annual totals kWh/year													
Space heating fuel - main system												3613.5338	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5267.7155	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3613.5338	0.2160	780.5233	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1816.6509	0.2160	392.3966	(264)
Space and water heating			1172.9199	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.8204	0.5190	182.0758	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1088.5984	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6300	ZC1
Total Floor Area	TFA	81.4900	
Assumed number of occupants	N	2.4905	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.1817	ZC2
CO2 emissions from cooking, equation (L16)		2.1938	ZC3
Total CO2 emissions		31.7355	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.7355	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1425	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3925	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3336	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			17.5100	1.3258	23.2140			(27)
Ground floor			41.3300	0.1300	5.3729			(28a)
External Wall	93.8000	19.6300	74.1700	0.1800	13.3506			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Bay Roof	1.1800		1.1800	0.1300	0.1534			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.8557			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8146	(36)
Total fabric heat loss (33) + (36) =	60.6703	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.0348	40.7907	40.5514	39.4276	39.2174	38.2386	38.2386	38.0573	38.6156	39.2174	39.6427	40.0874	(38)
Heat transfer coeff	101.7051	101.4610	101.2217	100.0979	99.8877	98.9089	98.9089	98.7276	99.2859	99.8877	100.3130	100.7577	(39)
Average = Sum(39)m / 12 =												100.0969	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2481	1.2451	1.2421	1.2283	1.2258	1.2138	1.2138	1.2115	1.2184	1.2258	1.2310	1.2364	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.5445	48.5215	45.1149	44.7159	41.4320	42.8131	44.7159	45.1149	48.5215	48.7977	50.9589 (61)
Total heat required for water heating calculated for each month												
	203.2377	178.7286	185.9555	164.9332	159.6844	140.6411	134.7449	150.2090	151.8679	172.9318	184.6013	198.4328 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	203.2377	178.7286	185.9555	164.9332	159.6844	140.6411	134.7449	150.2090	151.8679	172.9318	184.6013	198.4328 (64)
								Total per year (kWh/year) = Sum(64)m =				2025.9682 (64)
Heat gains from water heating, kWh/month												
	63.3724	55.6698	57.8272	51.1183	49.4060	43.3450	41.2706	46.2554	46.7741	53.4968	57.3541	61.7748 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8649	17.6438	14.3489	10.8631	8.1203	6.8555	7.4076	9.6286	12.9236	16.4094	19.1522	20.4170	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	222.5264	224.8355	219.0166	206.6288	190.9914	176.2945	166.4760	164.1669	169.9858	182.3736	198.0110	212.7079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	85.1780	82.8420	77.7247	70.9976	66.4059	60.2014	55.4712	62.1713	64.9640	71.9043	79.6585	83.0306	(72)
Total internal gains													
	390.9272	388.6792	374.4481	351.8474	328.8755	306.7092	292.7127	299.3247	311.2313	334.0452	360.1796	379.5135	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
South	3.8900	46.7521	0.6300	0.7000	0.7700	55.5805	(78)
Southwest	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(79)
West	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(80)

Solar gains	148.0265	266.0705	393.3376	523.8722	610.9949	614.7954	589.4873	524.8422	439.4460	302.7056	180.0245	124.8168	(83)
Total gains	538.9536	654.7497	767.7857	875.7196	939.8704	921.5047	882.2000	824.1669	750.6773	636.7508	540.2041	504.3303	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6416	55.7754	55.9073	56.5349	56.6539	57.2146	57.2146	57.3196	56.9973	56.6539	56.4137	56.1647	
alpha	4.7094	4.7184	4.7272	4.7690	4.7769	4.8143	4.8143	4.8213	4.7998	4.7769	4.7609	4.7443	
util living area													
	0.9969	0.9919	0.9771	0.9303	0.8220	0.6472	0.4848	0.5366	0.7877	0.9603	0.9933	0.9978	(86)
MIT	19.6852	19.8852	20.1868	20.5494	20.8223	20.9583	20.9915	20.9864	20.8933	20.5142	20.0258	19.6503	(87)
Th 2	19.8817	19.8841	19.8864	19.8974	19.8994	19.9090	19.9090	19.9108	19.9053	19.8994	19.8953	19.8910	(88)
util rest of house													
	0.9959	0.9892	0.9693	0.9063	0.7656	0.5528	0.3690	0.4168	0.7038	0.9416	0.9905	0.9970	(89)
MIT 2	18.1438	18.4362	18.8724	19.3862	19.7338	19.8829	19.9061	19.9056	19.8252	19.3511	18.6503	18.0992	(90)
Living area fraction										fLA = Living area / (4) =		0.2620	(91)
MIT	18.5476	18.8159	19.2168	19.6909	20.0190	20.1646	20.1905	20.1888	20.1051	19.6558	19.0107	18.5056	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5476	18.8159	19.2168	19.6909	20.0190	20.1646	20.1905	20.1888	20.1051	19.6558	19.0107	18.5056	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9855	0.9630	0.9009	0.7724	0.5761	0.3995	0.4483	0.7209	0.9363	0.9874	0.9955	(94)
Useful gains	535.7309	645.2835	739.3792	788.9051	725.9384	530.8760	352.4601	369.4805	541.1362	596.1727	533.3730	502.0760	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1449.0556	1411.9159	1287.2123	1080.1513	830.9614	550.3911	355.1292	374.0572	596.2178	904.5665	1194.7947	1441.3999	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	679.5136	515.1770	407.5878	209.6973	78.1372	0.0000	0.0000	0.0000	0.0000	229.4450	476.2236	698.8570	(98)
Space heating												3294.6384	(98)
Space heating per m2											(98) / (4) =	40.4300	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3527.4501	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	679.5136	515.1770	407.5878	209.6973	78.1372	0.0000	0.0000	0.0000	0.0000	229.4450	476.2236	698.8570	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	727.5306	551.5814	436.3895	224.5153	83.6586	0.0000	0.0000	0.0000	0.0000	245.6585	509.8753	748.2409	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	203.2377	178.7286	185.9555	164.9332	159.6844	140.6411	134.7449	150.2090	151.8679	172.9318	184.6013	198.4328	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8559	87.5632	86.9728	85.6568	83.3600	80.3000	80.3000	80.3000	80.3000	85.7639	87.3315	87.9535	(217)
Fuel for water heating, kWh/month													
	231.3309	204.1137	213.8089	192.5512	191.5601	175.1446	167.8019	187.0597	189.1256	201.6371	211.3800	225.6110	(219)
Water heating fuel used												2391.1246	(219)
Annual totals kWh/year													
Space heating fuel - main system												3527.4501	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Total delivered energy for all uses												6344.3950	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3527.4501	0.2160	761.9292	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2391.1246	0.2160	516.4829	(264)
Space and water heating			1278.4121	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.8204	0.5190	182.0758	(268)
Total CO2, kg/m2/year			1499.4129	(272)
Emissions per m2 for space and water heating			15.6880	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2343	(272b)
Emissions per m2 for pumps and fans			0.4777	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6880 * 1.00) + 2.2343 + 0.4777, rounded to 2 d.p.			18.4000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3961	0.3883	0.3805	0.3417	0.3339	0.2951	0.2951	0.2873	0.3106	0.3339	0.3495	0.3650	(22b)
Effective ac	0.5784	0.5754	0.5724	0.5584	0.5558	0.5435	0.5435	0.5413	0.5482	0.5558	0.5611	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.1996	39.9879	39.7805	38.8060	38.6237	37.7749	37.7749	37.6178	38.1019	38.6237	38.9925	39.3781	(38)
Heat transfer coeff	105.0290	104.8173	104.6099	103.6354	103.4531	102.6043	102.6043	102.4472	102.9312	103.4531	103.8219	104.2075	(39)
Average = Sum(39)m / 12 =												103.6345	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2889	1.2863	1.2837	1.2718	1.2695	1.2591	1.2591	1.2572	1.2631	1.2695	1.2740	1.2788	(40)
HLP (average)												1.2717	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.3592	28.3016	29.2047	25.4614	24.4308	21.0819	19.5355	22.4173	22.6850	26.4372	28.8583	31.3382	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.8649	17.6438	14.3489	10.8631	8.1203	6.8555	7.4076	9.6286	12.9236	16.4094	19.1522	20.4170	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	222.5264	224.8355	219.0166	206.6288	190.9914	176.2945	166.4760	164.1669	169.9858	182.3736	198.0110	212.7079	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	43.4936	42.1155	39.2537	35.3630	32.8371	29.2805	26.2574	30.1307	31.5070	35.5339	40.0809	42.1212	(72)
Total internal gains													
	346.2428	344.9527	332.9771	313.2128	292.3066	272.7883	260.4989	264.2842	274.7742	294.6748	317.6020	335.6041	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	3.8900	46.7521	0.7200	0.7000	0.7700	63.5205	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	169.1731	304.0806	449.5287	598.7111	698.2799	702.6234	673.6998	599.8197	502.2241	345.9492	205.7423	142.6478	(83)
Total gains	515.4159	649.0333	782.5058	911.9239	990.5866	975.4116	934.1987	864.1038	776.9983	640.6240	523.3443	478.2519	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8806	53.9894	54.0965	54.6052	54.7014	55.1539	55.1539	55.2385	54.9787	54.7014	54.5071	54.3054	
alpha	4.5920	4.5993	4.6064	4.6403	4.6468	4.6769	4.6769	4.6826	4.6652	4.6468	4.6338	4.6204	
util living area													
	0.9974	0.9924	0.9765	0.9254	0.8107	0.6346	0.4748	0.5304	0.7846	0.9616	0.9942	0.9982	(86)
MIT	19.6063	19.8265	20.1531	20.5376	20.8206	20.9574	20.9911	20.9854	20.8864	20.4813	19.9600	19.5662	(87)
Th 2	19.8496	19.8516	19.8536	19.8630	19.8648	19.8730	19.8730	19.8745	19.8698	19.8648	19.8612	19.8575	(88)
util rest of house													
	0.9966	0.9898	0.9683	0.8999	0.7517	0.5384	0.3575	0.4081	0.6986	0.9432	0.9918	0.9976	(89)
MIT 2	18.5912	18.8116	19.1344	19.5073	19.7520	19.8551	19.8710	19.8708	19.8121	19.4652	18.9530	18.5574	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.8571	19.0775	19.4013	19.7772	20.0320	20.1439	20.1644	20.1628	20.0936	19.7314	19.2168	18.8217	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8571	19.0775	19.4013	19.7772	20.0320	20.1439	20.1644	20.1628	20.0936	19.7314	19.2168	18.8217	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9874	0.9642	0.8976	0.7613	0.5627	0.3885	0.4404	0.7175	0.9404	0.9899	0.9967	(94)
Useful gains	513.0926	640.8577	754.4867	818.5373	754.1716	548.8556	362.9418	380.5638	557.5253	602.4444	518.0558	476.6975	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1528.9212	1486.0489	1349.6050	1127.2639	861.9673	568.8263	365.7261	385.4885	616.9277	944.6721	1257.9917	1523.6897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	755.7765	567.9685	442.7680	222.2832	80.2000	0.0000	0.0000	0.0000	0.0000	254.6174	532.7539	778.9622	(98)
Space heating												3635.3296	(98)
Space heating per m2											(98) / (4) =	44.6107	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	964.4807	759.2720	778.5984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9082	0.9510	0.9331	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	875.9362	722.0849	726.5193	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1233.0374	1182.9335	1102.5597	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	257.1129	342.8714	279.7740	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												879.7583 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	64.2782	85.7178	69.9435	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												219.9396 (107)
Space cooling per m2												2.6990 (108)
Energy for space heating												44.6107 (99)
Energy for space cooling												2.6990 (108)
Total												47.3097 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3336	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4253	0.4170	0.4086	0.3669	0.3586	0.3169	0.3169	0.3086	0.3336	0.3586	0.3753	0.3920	(22b)
Effective ac	0.5904	0.5869	0.5835	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			17.5100	1.3258	23.2140			(27)
Ground floor			41.3300	0.1300	5.3729			(28a)
External Wall	93.8000	19.6300	74.1700	0.1800	13.3506			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Bay Roof	1.1800		1.1800	0.1300	0.1534			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8557			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8146	(36)
Total fabric heat loss (33) + (36) =	60.6703	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.0348	40.7907	40.5514	39.4276	39.2174	38.2386	38.2386	38.0573	38.6156	39.2174	39.6427	40.0874	(38)
Heat transfer coeff	101.7051	101.4610	101.2217	100.0979	99.8877	98.9089	98.9089	98.7276	99.2859	99.8877	100.3130	100.7577	(39)
Average = Sum(39)m / 12 =												100.0969	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2481	1.2451	1.2421	1.2283	1.2258	1.2138	1.2138	1.2115	1.2184	1.2258	1.2310	1.2364	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

32.3592	28.3016	29.2047	25.4614	24.4308	21.0819	19.5355	22.4173	22.6850	26.4372	28.8583	31.3382	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	124.5262	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

19.8649	17.6438	14.3489	10.8631	8.1203	6.8555	7.4076	9.6286	12.9236	16.4094	19.1522	20.4170	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

222.5264	224.8355	219.0166	206.6288	190.9914	176.2945	166.4760	164.1669	169.9858	182.3736	198.0110	212.7079	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	35.4526	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)

Water heating gains (Table 5)

43.4936	42.1155	39.2537	35.3630	32.8371	29.2805	26.2574	30.1307	31.5070	35.5339	40.0809	42.1212	(72)

Total internal gains

346.2428	344.9527	332.9771	313.2128	292.3066	272.7883	260.4989	264.2842	274.7742	294.6748	317.6020	335.6041	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
South	3.8900	46.7521	0.6300	0.7000	0.7700	55.5805	(78)
Southwest	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(79)
West	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(80)

Solar gains	148.0265	266.0705	393.3376	523.8722	610.9949	614.7954	589.4873	524.8422	439.4460	302.7056	180.0245	124.8168	(83)
Total gains	494.2693	611.0232	726.3147	837.0850	903.3016	887.5837	849.9862	789.1264	714.2202	597.3804	497.6265	460.4209	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.6416	55.7754	55.9073	56.5349	56.6539	57.2146	57.2146	57.3196	56.9973	56.6539	56.4137	56.1647	
alpha	4.7094	4.7184	4.7272	4.7690	4.7769	4.8143	4.8143	4.8213	4.7998	4.7769	4.7609	4.7443	
util living area	0.9979	0.9939	0.9815	0.9398	0.8383	0.6665	0.5018	0.5578	0.8099	0.9685	0.9952	0.9985	(86)
MIT	19.6353	19.8374	20.1444	20.5177	20.8048	20.9527	20.9902	20.9840	20.8786	20.4768	19.9789	19.6010	(87)
Th 2	19.8817	19.8841	19.8864	19.8974	19.8994	19.9090	19.9090	19.9108	19.9053	19.8994	19.8953	19.8910	(88)
util rest of house	0.9971	0.9918	0.9750	0.9183	0.7841	0.5714	0.3827	0.4345	0.7288	0.9530	0.9932	0.9980	(89)
MIT 2	18.6454	18.8484	19.1532	19.5200	19.7735	19.8885	19.9067	19.9066	19.8417	19.4907	18.9989	18.6185	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.9048	19.1075	19.4129	19.7814	20.0437	20.1673	20.1906	20.1889	20.1134	19.7490	19.2556	18.8759	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9048	19.1075	19.4129	19.7814	20.0437	20.1673	20.1906	20.1889	20.1134	19.7490	19.2556	18.8759	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9899	0.9714	0.9156	0.7920	0.5952	0.4142	0.4671	0.7462	0.9503	0.9917	0.9973	(94)
Useful gains	492.4134	604.8433	705.5249	766.4026	715.4340	528.2718	352.0222	368.6132	532.9209	567.6850	493.4718	459.1689	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W

1485.3811	1441.5073	1307.0678	1089.2031	833.4332	550.6598	355.1374	374.0646	597.0464	913.8735	1219.3689	1478.7094	(97)
Month fracti 1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh

738.7679	562.2382	447.5479	232.4164	87.7914	0.0000	0.0000	0.0000	0.0000	257.5642	522.6459	758.5381	(98)
Space heating											3607.5101	(98)
Space heating per m2										(98) / (4) =	44.2694	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	929.7436	731.9258	750.3300	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8980	0.9455	0.9266	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.8647	692.0290	695.2396	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1130.3814	1084.5033	1014.9237	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling kWh
              0.0000     0.0000     0.0000     0.0000     0.0000   212.7721   292.0009   237.8449     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                          742.6179 (104)
Cooled fraction                                                                                    fC = cooled area / (4) =            1.0000 (105)
Intermittency factor (Table 10b)
              0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
              0.0000     0.0000     0.0000     0.0000     0.0000    53.1930    73.0002    59.4612     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          185.6545 (107)
Space cooling per m2                                                                                                                     2.2782 (108)
Energy for space heating                                                                                                                44.2694 (99)
Energy for space cooling                                                                                                                 2.2782 (108)
Total                                                                                                                                   46.5476 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                  53.5 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3262	0.3029	0.3106	0.2951	0.2951	0.2873	0.2796	0.2718	0.2640	0.2873	0.2718	0.2873	(22b)
Effective ac	0.5532	0.5459	0.5482	0.5435	0.5435	0.5413	0.5391	0.5369	0.5349	0.5413	0.5369	0.5413	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4455	37.9363	38.1019	37.7749	37.7749	37.6178	37.4648	37.3160	37.1714	37.6178	37.3160	37.6178	(38)
Heat transfer coeff	103.2749	102.7657	102.9312	102.6043	102.6043	102.4472	102.2942	102.1454	102.0008	102.4472	102.1454	102.4472	(39)
Average = Sum(39)m / 12 =												102.5090	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2673	1.2611	1.2631	1.2591	1.2591	1.2572	1.2553	1.2535	1.2517	1.2572	1.2535	1.2572	(40)
HLP (average)												1.2579	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408	(61)
Total heat required for water heating calculated for each month													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(64)
								Total per year (kWh/year) = Sum(64)m =				1607.4181	(64)
RHI water heating demand												1607	(64)
Heat gains from water heating, kWh/month													
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.6623	44.1096	35.8723	27.1576	20.3007	17.1387	18.5189	24.0716	32.3089	41.0235	47.8805	51.0425	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	332.1290	335.5754	326.8904	308.4012	285.0618	263.1261	248.4717	245.0252	253.7102	272.1994	295.5388	317.4745	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	559.0722	554.8051	533.3944	500.0904	465.9329	435.2597	417.2491	425.4268	444.5082	478.0255	515.3510	543.6473	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	3.8900	56.7559	0.7200	0.7000	0.7700	77.1124	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	211.1952	323.3066	482.4088	647.7341	719.4669	787.2257	748.5487	681.7042	569.6380	397.0071	256.0608	175.0260	(83)
Total gains	770.2675	878.1117	1015.8032	1147.8244	1185.3998	1222.4854	1165.7977	1107.1310	1014.1463	875.0326	771.4118	718.6733	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7958	55.0673	54.9787	55.1539	55.1539	55.2385	55.3211	55.4017	55.4802	55.2385	55.4017	55.2385	
alpha	4.6531	4.6712	4.6652	4.6769	4.6769	4.6826	4.6881	4.6934	4.6987	4.6826	4.6934	4.6826	
util living area													
	0.9848	0.9725	0.9330	0.8350	0.6796	0.4697	0.3407	0.3579	0.6043	0.8685	0.9666	0.9881	(86)
MIT	19.9798	20.1421	20.4430	20.7497	20.9248	20.9890	20.9980	20.9976	20.9663	20.7473	20.3299	19.9498	(87)
Th 2	19.8665	19.8714	19.8698	19.8730	19.8730	19.8745	19.8760	19.8775	19.8789	19.8745	19.8775	19.8745	(88)
util rest of house													
	0.9800	0.9641	0.9131	0.7914	0.6075	0.3807	0.2433	0.2559	0.5089	0.8208	0.9543	0.9841	(89)
MIT 2	18.5595	18.7946	19.2130	19.6149	19.8129	19.8691	19.8755	19.8769	19.8588	19.6262	19.0701	18.5225	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9571	0.9061	0.7931	0.6231	0.4039	0.2689	0.2827	0.5329	0.8230	0.9475	0.9794	(94)
Useful gains	750.6521	840.4141	920.3904	910.2826	738.6439	493.7162	313.5158	313.0335	540.4114	720.1423	730.9243	703.8754	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1449.1177	1423.0604	1290.2683	1068.3363	780.2235	498.1529	314.0057	313.6377	555.7976	872.8426	1174.6886	1423.6538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	519.6584	391.5383	275.1891	113.7986	30.9352	0.0000	0.0000	0.0000	0.0000	113.6090	319.5103	535.5151	(98)
Space heating												2299.7542	(98)
RHI space heating demand												2300	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3961	0.3883	0.3805	0.3417	0.3339	0.2951	0.2951	0.2873	0.3106	0.3339	0.3495	0.3650	(22b)
Effective ac	0.5784	0.5754	0.5724	0.5584	0.5558	0.5435	0.5435	0.5413	0.5482	0.5558	0.5611	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.1996	39.9879	39.7805	38.8060	38.6237	37.7749	37.7749	37.6178	38.1019	38.6237	38.9925	39.3781	(38)
Heat transfer coeff	105.0290	104.8173	104.6099	103.6354	103.4531	102.6043	102.6043	102.4472	102.9312	103.4531	103.8219	104.2075	(39)
Average = Sum(39)m / 12 =												103.6345	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2889	1.2863	1.2837	1.2718	1.2695	1.2591	1.2591	1.2572	1.2631	1.2695	1.2740	1.2788	(40)
HLP (average)												1.2717	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408 (61)
Total heat required for water heating calculated for each month												
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147 (64)
								Total per year (kWh/year) = Sum(64)m =				1607.4181 (64)
Heat gains from water heating, kWh/month												
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.6623	44.1096	35.8723	27.1576	20.3007	17.1387	18.5189	24.0716	32.3089	41.0235	47.8805	51.0425	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	332.1290	335.5754	326.8904	308.4012	285.0618	263.1261	248.4717	245.0252	253.7102	272.1994	295.5388	317.4745	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	559.0722	554.8051	533.3944	500.0904	465.9329	435.2597	417.2491	425.4268	444.5082	478.0255	515.3510	543.6473	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	3.8900	46.7521	0.7200	0.7000	0.7700	63.5205	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	169.1731	304.0806	449.5287	598.7111	698.2799	702.6234	673.6998	599.8197	502.2241	345.9492	205.7423	142.6478 (83)
Total gains	728.2453	858.8857	982.9231	1098.8015	1164.2128	1137.8830	1090.9489	1025.2464	946.7323	823.9747	721.0933	686.2951 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8806	53.9894	54.0965	54.6052	54.7014	55.1539	55.1539	55.2385	54.9787	54.7014	54.5071	54.3054	
alpha	4.5920	4.5993	4.6064	4.6403	4.6468	4.6769	4.6769	4.6826	4.6652	4.6468	4.6338	4.6204	
util living area													
	0.9896	0.9775	0.9477	0.8724	0.7367	0.5576	0.4099	0.4531	0.6892	0.9129	0.9795	0.9919	(86)
MIT	19.8385	20.0464	20.3415	20.6669	20.8822	20.9749	20.9951	20.9923	20.9348	20.6349	20.1696	19.7952	(87)
Th 2	19.8496	19.8516	19.8536	19.8630	19.8648	19.8730	19.8730	19.8745	19.8698	19.8648	19.8612	19.8575	(88)
util rest of house													
	0.9863	0.9706	0.9318	0.8362	0.6719	0.4677	0.3070	0.3456	0.5987	0.8790	0.9719	0.9893	(89)
MIT 2	18.3433	18.6433	19.0609	19.5041	19.7617	19.8583	19.8715	19.8718	19.8251	19.4778	18.8311	18.2863	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.7350	19.0109	19.3964	19.8087	20.0553	20.1508	20.1659	20.1654	20.1158	19.7810	19.1818	18.6816	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7350	19.0109	19.3964	19.8087	20.0553	20.1508	20.1659	20.1654	20.1158	19.7810	19.1818	18.6816	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9639	0.9240	0.8342	0.6836	0.4905	0.3340	0.3738	0.6197	0.8760	0.9658	0.9855	(94)
Useful gains	714.9739	827.8397	908.2273	916.6314	795.8270	558.1392	364.4006	383.2691	586.7281	721.7646	696.4301	676.3596	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1516.0981	1479.0668	1349.0931	1130.5309	864.3782	569.5391	365.8719	385.7531	619.2159	949.8001	1254.3513	1509.0910	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	596.0364	437.6246	328.0042	154.0077	51.0022	0.0000	0.0000	0.0000	0.0000	169.6584	401.7033	619.5522	(98)
Space heating												2757.5887	(98)
Space heating per m2											(98) / (4) =	33.8396	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2955.6149	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	596.0364	437.6246	328.0042	154.0077	51.0022	0.0000	0.0000	0.0000	0.0000	169.6584	401.7033	619.5522	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.8386	469.0510	351.5586	165.0672	54.6647	0.0000	0.0000	0.0000	0.0000	181.8418	430.5501	664.0431	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4976	89.3817	89.1425	88.6075	87.7035	86.7000	86.7000	86.7000	86.7000	88.6607	89.3054	89.5395	(217)
Fuel for water heating, kWh/month													
	183.3900	160.9680	167.4171	148.0773	144.4771	127.5008	119.5214	135.2002	136.2367	153.6082	164.8780	177.9267	(219)
Water heating fuel used												1819.2014	(219)
Annual totals kWh/year													
Space heating fuel - main system												2955.6149	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4612.3471	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2955.6149	3.4800	102.8554	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1819.2014	3.4800	63.3082	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	350.8204	13.1900	46.2732	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			264.7339	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8790	(257)
SAP value		87.7376	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2955.6149	0.2160	638.4128	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1819.2014	0.2160	392.9475	(264)
Space and water heating			1031.3603	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.8204	0.5190	182.0758	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			947.0388	(272)
CO2 emissions per m2			11.6200	(273)
EI value			89.9673	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8822 = 3.945, stars = 4
Water heating environmental impact	0.216 / 0.8822 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1425	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.3655	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3262	0.3029	0.3106	0.2951	0.2951	0.2873	0.2796	0.2718	0.2640	0.2873	0.2718	0.2873	(22b)
Effective ac	0.5532	0.5459	0.5482	0.5435	0.5435	0.5413	0.5391	0.5369	0.5349	0.5413	0.5369	0.5413	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5186	(36)
Total fabric heat loss					(33) + (36) =		64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4455	37.9363	38.1019	37.7749	37.7749	37.6178	37.4648	37.3160	37.1714	37.6178	37.3160	37.6178	(38)
Heat transfer coeff	103.2749	102.7657	102.9312	102.6043	102.6043	102.4472	102.2942	102.1454	102.0008	102.4472	102.1454	102.4472	(39)
Average = Sum(39)m / 12 =												102.5090	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2673	1.2611	1.2631	1.2591	1.2591	1.2572	1.2553	1.2535	1.2517	1.2572	1.2535	1.2572	(40)
HLP (average)												1.2579	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4905	(42)
Average daily hot water use (litres/day)												93.3500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408	(61)
Total heat required for water heating calculated for each month													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(64)
								Total per year (kWh/year) = Sum(64)m =				1607.4181	(64)
Heat gains from water heating, kWh/month													
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.6623	44.1096	35.8723	27.1576	20.3007	17.1387	18.5189	24.0716	32.3089	41.0235	47.8805	51.0425	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	332.1290	335.5754	326.8904	308.4012	285.0618	263.1261	248.4717	245.0252	253.7102	272.1994	295.5388	317.4745	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	559.0722	554.8051	533.3944	500.0904	465.9329	435.2597	417.2491	425.4268	444.5082	478.0255	515.3510	543.6473	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	3.8900	56.7559	0.7200	0.7000	0.7700	77.1124	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	211.1952	323.3066	482.4088	647.7341	719.4669	787.2257	748.5487	681.7042	569.6380	397.0071	256.0608	175.0260	(83)
Total gains	770.2675	878.1117	1015.8032	1147.8244	1185.3998	1222.4854	1165.7977	1107.1310	1014.1463	875.0326	771.4118	718.6733	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7958	55.0673	54.9787	55.1539	55.1539	55.2385	55.3211	55.4017	55.4802	55.2385	55.4017	55.2385	
alpha	4.6531	4.6712	4.6652	4.6769	4.6769	4.6826	4.6881	4.6934	4.6987	4.6826	4.6934	4.6826	
util living area													
	0.9848	0.9725	0.9330	0.8350	0.6796	0.4697	0.3407	0.3579	0.6043	0.8685	0.9666	0.9881	(86)
MIT	19.9798	20.1421	20.4430	20.7497	20.9248	20.9890	20.9980	20.9976	20.9663	20.7473	20.3299	19.9498	(87)
Th 2	19.8665	19.8714	19.8698	19.8730	19.8730	19.8745	19.8760	19.8775	19.8789	19.8745	19.8775	19.8745	(88)
util rest of house													
	0.9800	0.9641	0.9131	0.7914	0.6075	0.3807	0.2433	0.2559	0.5089	0.8208	0.9543	0.9841	(89)
MIT 2	18.5595	18.7946	19.2130	19.6149	19.8129	19.8691	19.8755	19.8769	19.8588	19.6262	19.0701	18.5225	(90)
Living area fraction										fLA = Living area / (4) =		0.2620	(91)
MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9571	0.9061	0.7931	0.6231	0.4039	0.2689	0.2827	0.5329	0.8230	0.9475	0.9794	(94)
Useful gains	750.6521	840.4141	920.3904	910.2826	738.6439	493.7162	313.5158	313.0335	540.4114	720.1423	730.9243	703.8754	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1449.1177	1423.0604	1290.2683	1068.3363	780.2235	498.1529	314.0057	313.6377	555.7976	872.8426	1174.6886	1423.6538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	519.6584	391.5383	275.1891	113.7986	30.9352	0.0000	0.0000	0.0000	0.0000	113.6090	319.5103	535.5151	(98)
Space heating												2299.7542	(98)
Space heating per m2											(98) / (4) =	28.2213	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2464.9026	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	519.6584	391.5383	275.1891	113.7986	30.9352	0.0000	0.0000	0.0000	0.0000	113.6090	319.5103	535.5151	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	556.9758	419.6552	294.9508	121.9707	33.1567	0.0000	0.0000	0.0000	0.0000	121.7674	342.4548	573.9712	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4089	89.3036	89.0006	88.3357	87.3836	86.7000	86.7000	86.7000	86.7000	88.3010	89.1325	89.4484	(217)
Fuel for water heating, kWh/month													
	183.5720	161.1088	167.6842	148.5328	145.0059	127.5008	119.5214	135.2002	136.2367	154.2339	165.1978	178.1079	(219)
Water heating fuel used												1821.9024	(219)
Annual totals kWh/year													
Space heating fuel - main system												2464.9026	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4044.5261	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2464.9026	7.3800	181.9098	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1821.9024	7.3800	134.4564	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	350.8204	28.6600	100.5451	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			353.9291	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2464.9026	0.2160	532.4190	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1821.9024	0.2160	393.5309	(264)
Space and water heating			925.9499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.8204	0.5190	182.0758	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			800.2071	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2464.9026	1.2200	3007.1812	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1821.9024	1.2200	2222.7209	(264)
Space and water heating			5229.9022	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	350.8204	3.0700	1077.0185	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4486.1058	(272)
Primary energy kWh/m2/year			55.0510	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (23.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.28 kg/m²	B 89	A 92
Total Savings	£58	2.28 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£122	£136	-£14
Mains gas	£423	£351	£72
Space heating	£310	£310	£0
Water heating	£134	£76	£58
Lighting	£101	£101	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£354	£296	£58
Total cost of uses	£354	£296	£58
Delivered energy	50 kWh/m²	38 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	42 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3961	0.3883	0.3805	0.3417	0.3339	0.2951	0.2951	0.2873	0.3106	0.3339	0.3495	0.3650	(22b)
Effective ac	0.5784	0.5754	0.5724	0.5584	0.5558	0.5435	0.5435	0.5413	0.5482	0.5558	0.5611	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.1996	39.9879	39.7805	38.8060	38.6237	37.7749	37.7749	37.6178	38.1019	38.6237	38.9925	39.3781	(38)
Heat transfer coeff	105.0290	104.8173	104.6099	103.6354	103.4531	102.6043	102.6043	102.4472	102.9312	103.4531	103.8219	104.2075	(39)
Average = Sum(39)m / 12 =												103.6345	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2889	1.2863	1.2837	1.2718	1.2695	1.2591	1.2591	1.2572	1.2631	1.2695	1.2740	1.2788	(40)
HLP (average)												1.2717	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408	(61)
Total heat required for water heating calculated for each month													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2348	(H8)
Utilisation factor												0.5551	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												93.3500	(H14)
Volume ratio Veff/V												0.8034	(H15)
Solar storage volume factor												0.9562	(H16)
Solar input												-846.4296	(H17)
Solar input	-24.5448	-40.9582	-69.7564	-93.4874	-115.4958	-113.5508	-112.0501	-97.8988	-76.6744	-52.3596	-29.1136	-20.5398	(63)
								Solar input (sum of months) = Sum(63)m =				-846.4296	(63)
Output from w/h													
	139.5849	102.9178	79.4834	37.7202	11.2156	0.0000	0.0000	19.3198	41.4428	83.8306	118.1313	138.7749	(64)
								Total per year (kWh/year) = Sum(64)m =				772.4212	(64)
Heat gains from water heating, kWh/month													
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.6623	44.1096	35.8723	27.1576	20.3007	17.1387	18.5189	24.0716	32.3089	41.0235	47.8805	51.0425	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	332.1290	335.5754	326.8904	308.4012	285.0618	263.1261	248.4717	245.0252	253.7102	272.1994	295.5388	317.4745	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	559.0722	554.8051	533.3944	500.0904	465.9329	435.2597	417.2491	425.4268	444.5082	478.0255	515.3510	543.6473	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	3.8900	46.7521	0.7200	0.7000	0.7700	63.5205	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	169.1731	304.0806	449.5287	598.7111	698.2799	702.6234	673.6998	599.8197	502.2241	345.9492	205.7423	142.6478	(83)
Total gains	728.2453	858.8857	982.9231	1098.8015	1164.2128	1137.8830	1090.9489	1025.2464	946.7323	823.9747	721.0933	686.2951	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8806	53.9894	54.0965	54.6052	54.7014	55.1539	55.1539	55.2385	54.9787	54.7014	54.5071	54.3054	
alpha	4.5920	4.5993	4.6064	4.6403	4.6468	4.6769	4.6769	4.6826	4.6652	4.6468	4.6338	4.6204	
util living area													
	0.9896	0.9775	0.9477	0.8724	0.7367	0.5576	0.4099	0.4531	0.6892	0.9129	0.9795	0.9919	(86)
MIT	19.8385	20.0464	20.3415	20.6669	20.8822	20.9749	20.9951	20.9923	20.9348	20.6349	20.1696	19.7952	(87)
Th 2	19.8496	19.8516	19.8536	19.8630	19.8648	19.8730	19.8730	19.8745	19.8698	19.8648	19.8612	19.8575	(88)
util rest of house													
	0.9863	0.9706	0.9318	0.8362	0.6719	0.4677	0.3070	0.3456	0.5987	0.8790	0.9719	0.9893	(89)
MIT 2	18.3433	18.6433	19.0609	19.5041	19.7617	19.8583	19.8715	19.8718	19.8251	19.4778	18.8311	18.2863	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.7350	19.0109	19.3964	19.8087	20.0553	20.1508	20.1659	20.1654	20.1158	19.7810	19.1818	18.6816	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7350	19.0109	19.3964	19.8087	20.0553	20.1508	20.1659	20.1654	20.1158	19.7810	19.1818	18.6816	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9639	0.9240	0.8342	0.6836	0.4905	0.3340	0.3738	0.6197	0.8760	0.9658	0.9855	(94)
Useful gains	714.9739	827.8397	908.2273	916.6314	795.8270	558.1392	364.4006	383.2691	586.7281	721.7646	696.4301	676.3596	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1516.0981	1479.0668	1349.0931	1130.5309	864.3782	569.5391	365.8719	385.7531	619.2159	949.8001	1254.3513	1509.0910	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	596.0364	437.6246	328.0042	154.0077	51.0022	0.0000	0.0000	0.0000	0.0000	169.6584	401.7033	619.5522	(98)
Space heating												2757.5887	(98)
Space heating per m2											(98) / (4) =	33.8396	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2955.6149	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	596.0364	437.6246	328.0042	154.0077	51.0022	0.0000	0.0000	0.0000	0.0000	169.6584	401.7033	619.5522	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.8386	469.0510	351.5586	165.0672	54.6647	0.0000	0.0000	0.0000	0.0000	181.8418	430.5501	664.0431	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.5849	102.9178	79.4834	37.7202	11.2156	0.0000	0.0000	19.3198	41.4428	83.8306	118.1313	138.7749	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5941	89.5917	89.5745	89.5683	89.6291	86.7000	86.7000	86.7000	86.7000	89.0768	89.4559	89.6190	(217)
Fuel for water heating, kWh/month													
	155.7970	114.8742	88.7344	42.1133	12.5134	0.0000	0.0000	22.2835	47.8002	94.1104	132.0553	154.8498	(219)
Water heating fuel used												865.1316	(219)
Annual totals kWh/year													
Space heating fuel - main system												2955.6149	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												3708.2773	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2955.6149	3.4800	102.8554	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	865.1316	3.4800	30.1066	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	350.8204	13.1900	46.2732	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			238.1273	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7907	(257)
SAP value	88.9700	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2955.6149	0.2160	638.4128	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	865.1316	0.2160	186.8684 (264)
Space and water heating			825.2812 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.8204	0.5190	182.0758 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			766.9097 (272)
CO2 emissions per m2			9.4100 (273)
EI value			91.8756
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.3300	(1b)	x 2.5400	(2b) =	104.9782	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		210.5990	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3655	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3106	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3262	0.3029	0.3106	0.2951	0.2951	0.2873	0.2796	0.2718	0.2640	0.2873	0.2718	0.2873	(22b)
Effective ac	0.5532	0.5459	0.5482	0.5435	0.5435	0.5413	0.5391	0.5369	0.5349	0.5413	0.5369	0.5413	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			17.5100	1.2357	21.6378			(27)
Opening Type 13			2.1200	1.5000	3.1800			(26a)
Ground floor			41.3300	0.1900	7.8527			(28a)
External Wall	93.8000	19.6300	74.1700	0.2700	20.0259			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Bay Roof	1.1800		1.1800	0.1600	0.1888			(30)
Total net area of external elements Aum(A, m2)			176.4700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.3108			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5186	(36)
Total fabric heat loss (33) + (36) =	64.8294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4455	37.9363	38.1019	37.7749	37.7749	37.6178	37.4648	37.3160	37.1714	37.6178	37.3160	37.6178	(38)
Heat transfer coeff	103.2749	102.7657	102.9312	102.6043	102.6043	102.4472	102.2942	102.1454	102.0008	102.4472	102.1454	102.4472	(39)
Average = Sum(39)m / 12 =												102.5090	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2673	1.2611	1.2631	1.2591	1.2591	1.2572	1.2553	1.2535	1.2517	1.2572	1.2535	1.2572	(40)
HLP (average)												1.2579	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4905 (42)
Average daily hot water use (litres/day)	93.3500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6850	98.9510	95.2170	91.4830	87.7490	84.0150	84.0150	87.7490	91.4830	95.2170	98.9510	102.6850	(44)
Energy conte	152.2788	133.1840	137.4340	119.8183	114.9685	99.2091	91.9318	105.4931	106.7530	124.4103	135.8036	147.4739	(45)
Energy content (annual)										Total = Sum(45)m =		1468.7583	(45)
Distribution loss (46)m = 0.15 x (45)m	22.8418	19.9776	20.6151	17.9727	17.2453	14.8814	13.7898	15.8240	16.0129	18.6615	20.3705	22.1211	(46)
Water storage loss:													
Total storage loss													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8509	10.6919	11.8059	11.3893	11.7429	11.3341	11.6933	11.7255	11.3642	11.7798	11.4413	11.8408	(61)
Total heat required for water heating calculated for each month													
	164.1297	143.8759	149.2399	131.2076	126.7114	110.5432	103.6251	117.2185	118.1172	136.1902	147.2449	159.3147	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3819	(H8)
Utilisation factor												0.5150	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												93.3500	(H14)
Volume ratio Veff/V												0.8034	(H15)
Solar storage volume factor												0.9562	(H16)
Solar input												-878.9097	(H17)
Solar input	-28.6722	-40.7700	-70.0738	-94.5458	-111.0497	-118.6186	-116.1241	-103.9346	-81.3736	-56.2589	-33.9116	-23.5769	(63)
										Solar input (sum of months) = Sum(63)m =		-878.9097	(63)
Output from w/h													
	135.4575	103.1060	79.1661	36.6618	15.6617	0.0000	0.0000	13.2840	36.7436	79.9312	113.3333	135.7378	(64)
										Total per year (kWh/year) = Sum(64)m =		749.0829	(64)
Heat gains from water heating, kWh/month													
	53.5954	46.9567	48.6483	42.6869	41.1628	35.8205	33.4906	38.0078	38.3364	44.3114	48.0150	51.9953	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	149.4315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.6623	44.1096	35.8723	27.1576	20.3007	17.1387	18.5189	24.0716	32.3089	41.0235	47.8805	51.0425	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	332.1290	335.5754	326.8904	308.4012	285.0618	263.1261	248.4717	245.0252	253.7102	272.1994	295.5388	317.4745	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	52.4337	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	-99.6210	(71)
Water heating gains (Table 5)													
	72.0369	69.8760	65.3875	59.2874	55.3263	49.7508	45.0143	51.0858	53.2450	59.5583	66.6875	69.8861	(72)
Total internal gains													
	559.0722	554.8051	533.3944	500.0904	465.9329	435.2597	417.2491	425.4268	444.5082	478.0255	515.3510	543.6473	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	3.8900	56.7559	0.7200	0.7000	0.7700	77.1124	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	211.1952	323.3066	482.4088	647.7341	719.4669	787.2257	748.5487	681.7042	569.6380	397.0071	256.0608	175.0260	(83)
Total gains	770.2675	878.1117	1015.8032	1147.8244	1185.3998	1222.4854	1165.7977	1107.1310	1014.1463	875.0326	771.4118	718.6733	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7958	55.0673	54.9787	55.1539	55.1539	55.2385	55.3211	55.4017	55.4802	55.2385	55.4017	55.2385	
alpha	4.6531	4.6712	4.6652	4.6769	4.6769	4.6826	4.6881	4.6934	4.6987	4.6826	4.6934	4.6826	
util living area													
	0.9848	0.9725	0.9330	0.8350	0.6796	0.4697	0.3407	0.3579	0.6043	0.8685	0.9666	0.9881	(86)
MIT	19.9798	20.1421	20.4430	20.7497	20.9248	20.9890	20.9980	20.9976	20.9663	20.7473	20.3299	19.9498	(87)
Th 2	19.8665	19.8714	19.8698	19.8730	19.8730	19.8745	19.8760	19.8775	19.8789	19.8745	19.8775	19.8745	(88)
util rest of house													
	0.9800	0.9641	0.9131	0.7914	0.6075	0.3807	0.2433	0.2559	0.5089	0.8208	0.9543	0.9841	(89)
MIT 2	18.5595	18.7946	19.2130	19.6149	19.8129	19.8691	19.8755	19.8769	19.8588	19.6262	19.0701	18.5225	(90)
Living area fraction									fLA = Living area / (4) =			0.2620	(91)
MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9317	19.1476	19.5352	19.9122	20.1042	20.1625	20.1696	20.1705	20.1490	19.9199	19.4002	18.8965	(93)

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8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9571	0.9061	0.7931	0.6231	0.4039	0.2689	0.2827	0.5329	0.8230	0.9475	0.9794	(94)
Useful gains	750.6521	840.4141	920.3904	910.2826	738.6439	493.7162	313.5158	313.0335	540.4114	720.1423	730.9243	703.8754	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1449.1177	1423.0604	1290.2683	1068.3363	780.2235	498.1529	314.0057	313.6377	555.7976	872.8426	1174.6886	1423.6538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	519.6584	391.5383	275.1891	113.7986	30.9352	0.0000	0.0000	0.0000	0.0000	113.6090	319.5103	535.5151	(98)
Space heating												2299.7542	(98)
Space heating per m2											(98) / (4) =	28.2213	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2464.9026	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	519.6584	391.5383	275.1891	113.7986	30.9352	0.0000	0.0000	0.0000	0.0000	113.6090	319.5103	535.5151	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	556.9758	419.6552	294.9508	121.9707	33.1567	0.0000	0.0000	0.0000	0.0000	121.7674	342.4548	573.9712	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.4575	103.1060	79.1661	36.6618	15.6617	0.0000	0.0000	13.2840	36.7436	79.9312	113.3333	135.7378	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5313	89.5251	89.4700	89.3955	89.0571	86.7000	86.7000	86.7000	86.7000	88.7776	89.3288	89.5481	(217)
Fuel for water heating, kWh/month													
	151.2962	115.1698	88.4833	41.0107	17.5861	0.0000	0.0000	15.3218	42.3802	90.0354	126.8720	151.5809	(219)
Water heating fuel used												839.7364	(219)
Annual totals kWh/year													
Space heating fuel - main system												2464.9026	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												350.8204	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												3112.3602	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2464.9026	7.3800	181.9098	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	839.7364	7.3800	61.9725	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	350.8204	28.6600	100.5451	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			295.7752	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2464.9026	0.2160	532.4190	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	839.7364	0.2160	181.3831	(264)
Space and water heating			713.8020	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	350.8204	0.5190	182.0758	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			614.0093	(272)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2464.9026	1.2200	3007.1812	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	839.7364	1.2200	1024.4785	(264)
Space and water heating			4031.6597	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	350.8204	3.0700	1077.0185	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3441.3633	(272)
Primary energy kWh/m2/year			42.2305	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		555.98 (P1)
Transmission heat loss coefficient		64.83 (37)
Summer heat loss coefficient		620.81 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	0.850	0.90	1.000	0.765 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	7.9700	125.2818	0.7200	0.7000	0.7650	346.4820
South East	1.0200	127.3119	0.7200	0.7000	0.7650	45.0613
South	3.8900	118.5567	0.7200	0.7000	0.7650	160.0332
South West	1.0200	127.3119	0.7200	0.7000	0.7650	45.0613
West	3.6100	125.2818	0.7200	0.7000	0.7650	156.9385
total:						753.5763

	Jun	Jul	Aug	
Solar gains	806	754	684	(P3)
Internal gains	432	414	422	
Total summer gains	1238	1168	1106	(P5)
Summer gain/loss ratio	1.99	1.88	1.78	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.64	19.43	19.33	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 394 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 394 EPC	**Prop Type Ref**	
Property	37 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.36	**TER**	18.40
Environmental	90 B	**% DER<TER**	27.39		
CO_2 Emissions (t/year)	0.80	**DFEE**	47.31	**TFEE**	53.53
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.62		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.40	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.36	$kgCO_2/m^2$	Pass
	-5.04 (-27.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.53	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.31	$kWh/m^2/yr$	
	-6.2 (-11.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	7.97 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	3.89 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	3.61 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.031	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 395 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 395	**Prop Type Ref**	
Property	38 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.13	**TER**	18.99
Environmental	90 B	**% DER<TER**	25.59		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.78	**TFEE**	55.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.99 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.13 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.17 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.46 m², No overhang
Windows facing East: 7.97 m², No overhang
Windows facing West: 3.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.3530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3826	0.3751	0.3676	0.3300	0.3225	0.2850	0.2850	0.2775	0.3000	0.3225	0.3375	0.3525	(22b)
Effective ac	0.5732	0.5703	0.5675	0.5545	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5570	0.5621	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2721	39.0774	38.8866	37.9903	37.8226	37.0419	37.0419	36.8973	37.3426	37.8226	38.1618	38.5165	(38)
Heat transfer coeff	99.5989	99.4042	99.2134	98.3171	98.1494	97.3687	97.3687	97.2242	97.6694	98.1494	98.4886	98.8433	(39)
Average = Sum(39)m / 12 =												98.3163	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2400	1.2376	1.2352	1.2241	1.2220	1.2123	1.2123	1.2105	1.2160	1.2220	1.2262	1.2306	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411	(83)
Total gains	463.5156	545.6800	644.8470	758.3008	836.8324	830.8265	789.9462	719.8318	630.5555	524.4853	454.9696	436.5931	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0024	56.1121	56.2200	56.7325	56.8295	57.2851	57.2851	57.3703	57.1087	56.8295	56.6337	56.4305	
alpha	4.7335	4.7408	4.7480	4.7822	4.7886	4.8190	4.8190	4.8247	4.8072	4.7886	4.7756	4.7620	
util living area													
	0.9983	0.9960	0.9877	0.9546	0.8611	0.6923	0.5290	0.5960	0.8541	0.9795	0.9965	0.9987	(86)
MIT	19.6188	19.7836	20.0769	20.4626	20.7782	20.9446	20.9878	20.9790	20.8436	20.4148	19.9441	19.5889	(87)
Th 2	19.8881	19.8900	19.8919	19.9008	19.9025	19.9102	19.9102	19.9116	19.9072	19.9025	19.8991	19.8956	(88)
util rest of house													
	0.9977	0.9946	0.9831	0.9372	0.8109	0.5968	0.4048	0.4674	0.7812	0.9688	0.9951	0.9983	(89)
MIT 2	18.0513	18.2931	18.7204	19.2741	19.6886	19.8743	19.9059	19.9032	19.7810	19.2180	18.5345	18.0128	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4450	18.6674	19.0610	19.5726	19.9622	20.1431	20.1776	20.1734	20.0479	19.5186	18.8885	18.4086	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4450	18.6674	19.0610	19.5726	19.9622	20.1431	20.1776	20.1734	20.0479	19.5186	18.8885	18.4086	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9923	0.9784	0.9307	0.8140	0.6186	0.4362	0.4998	0.7922	0.9636	0.9930	0.9974	(94)
Useful gains	461.9004	541.4618	630.9034	705.7798	681.1736	513.9747	344.5451	359.7604	499.5292	505.4106	451.8006	435.4382	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1408.8242	1368.5368	1246.2227	1049.2970	810.9318	539.7212	348.3432	366.8617	580.9246	875.3507	1161.0342	1404.4212	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	704.5113	555.7944	457.7975	247.3324	96.5401	0.0000	0.0000	0.0000	0.0000	275.2354	510.6482	720.9233	(98)
Space heating												3568.7827	(98)
Space heating per m2											(98) / (4) =	44.4321	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3825.0618	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	704.5113	555.7944	457.7975	247.3324	96.5401	0.0000	0.0000	0.0000	0.0000	275.2354	510.6482	720.9233	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	755.1032	595.7068	490.6726	265.0937	103.4728	0.0000	0.0000	0.0000	0.0000	295.0005	547.3185	772.6938	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5999	89.5386	89.3910	89.0230	88.2253	86.7000	86.7000	86.7000	86.7000	89.0798	89.4718	89.6292	(217)
Fuel for water heating, kWh/month													
	182.2438	159.8644	166.1028	146.6430	142.9031	126.8692	118.9361	134.5284	135.5568	152.1144	163.7329	176.8416	(219)
Water heating fuel used												1806.3365	(219)
Annual totals kWh/year													
Space heating fuel - main system												3825.0618	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5473.7755	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3825.0618	0.2160	826.2134	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1806.3365	0.2160	390.1687	(264)
Space and water heating			1216.3820	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1134.5758	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.1300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.5883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.5883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.6300	0.7000	0.7700	7.9943	(74)
East	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(76)
West	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(80)

Solar gains	77.5011	151.2476	249.8836	368.2777	456.4068	469.8453	446.2047	379.5995	291.6448	179.5259	96.5288	63.8235	(83)
Total gains	465.5857	536.9472	621.3979	717.3147	782.6292	774.0779	736.5811	676.6068	600.5256	511.0960	454.0586	440.6205	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9983	0.9962	0.9890	0.9600	0.8746	0.7088	0.5422	0.6064	0.8608	0.9804	0.9965	0.9987	(86)
MIT	19.6829	19.8349	20.1084	20.4745	20.7790	20.9455	20.9884	20.9804	20.8512	20.4449	19.9991	19.6587	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9977	0.9949	0.9849	0.9446	0.8279	0.6161	0.4202	0.4809	0.7911	0.9702	0.9951	0.9983	(89)
MIT 2	18.1711	18.3947	18.7937	19.3233	19.7273	19.9176	19.9494	19.9474	19.8281	19.2914	18.6433	18.1423	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.5508	18.7563	19.1239	19.6124	19.9914	20.1757	20.2103	20.2068	20.0850	19.5811	18.9837	18.5231	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5508	18.7563	19.1239	19.6124	19.9914	20.1757	20.2103	20.2068	20.0850	19.5811	18.9837	18.5231	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9806	0.9385	0.8304	0.6372	0.4510	0.5125	0.8016	0.9654	0.9931	0.9973	(94)
Useful gains	463.9753	533.0671	609.3738	673.1979	649.8615	493.2193	332.1968	346.7474	481.3907	493.4370	450.9425	439.4504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1365.3196	1324.1592	1203.3723	1009.1658	779.3606	518.6586	335.8368	353.4248	558.9843	844.1856	1122.0626	1358.7281	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	670.6002	531.6139	441.9349	241.8968	96.3473	0.0000	0.0000	0.0000	0.0000	260.9569	483.2065	683.9426	(98)
Space heating												3410.4993	(98)
Space heating per m2											(98) / (4) =	42.4614	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3651.4981	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	670.6002	531.6139	441.9349	241.8968	96.3473	0.0000	0.0000	0.0000	0.0000	260.9569	483.2065	683.9426	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	717.9874	569.1798	473.1638	258.9902	103.1556	0.0000	0.0000	0.0000	0.0000	279.3972	517.3517	732.2726	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8385	87.6380	87.1656	86.0277	83.8369	80.3000	80.3000	80.3000	80.3000	86.0982	87.3742	87.9210	(217)
Fuel for water heating, kWh/month													
	230.4229	202.8179	212.1623	190.6665	189.4226	174.1812	166.8789	186.0308	188.0853	199.7495	210.1145	224.7719	(219)
Water heating fuel used												2375.3043	(219)
Annual totals kWh/year													
Space heating fuel - main system												3651.4981	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6457.4692	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3651.4981	0.2160	788.7236	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.3043	0.2160	513.0657	(264)
Space and water heating			1301.7893	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1525.3054	(272)
Emissions per m2 for space and water heating			16.2075	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2075 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.9900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.3530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3826	0.3751	0.3676	0.3300	0.3225	0.2850	0.2850	0.2775	0.3000	0.3225	0.3375	0.3525	(22b)
Effective ac	0.5732	0.5703	0.5675	0.5545	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5570	0.5621	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2721	39.0774	38.8866	37.9903	37.8226	37.0419	37.0419	36.8973	37.3426	37.8226	38.1618	38.5165	(38)
Heat transfer coeff	99.5989	99.4042	99.2134	98.3171	98.1494	97.3687	97.3687	97.2242	97.6694	98.1494	98.4886	98.8433	(39)
Average = Sum(39)m / 12 =												98.3163	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2400	1.2376	1.2352	1.2241	1.2220	1.2123	1.2123	1.2105	1.2160	1.2220	1.2262	1.2306	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411	(83)
Total gains	432.1080	515.0515	615.8362	731.4872	811.4460	807.4478	768.2714	695.9711	605.9161	497.5722	425.4886	405.9596	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0024	56.1121	56.2200	56.7325	56.8295	57.2851	57.2851	57.3703	57.1087	56.8295	56.6337	56.4305	
alpha	4.7335	4.7408	4.7480	4.7822	4.7886	4.8190	4.8190	4.8247	4.8072	4.7886	4.7756	4.7620	
util living area													
	0.9987	0.9969	0.9897	0.9600	0.8721	0.7068	0.5423	0.6132	0.8687	0.9833	0.9974	0.9991	(86)
MIT	19.5830	19.7490	20.0454	20.4376	20.7632	20.9394	20.9864	20.9763	20.8295	20.3866	19.9106	19.5538	(87)
Th 2	19.8881	19.8900	19.8919	19.9008	19.9025	19.9102	19.9102	19.9116	19.9072	19.9025	19.8991	19.8956	(88)
util rest of house													
	0.9983	0.9957	0.9859	0.9443	0.8240	0.6113	0.4158	0.4824	0.7994	0.9744	0.9963	0.9988	(89)
MIT 2	18.5983	18.7653	19.0612	19.4499	19.7450	19.8831	19.9069	19.9051	19.8115	19.4082	18.9342	18.5750	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8456	19.0124	19.3083	19.6980	20.0007	20.1483	20.1780	20.1741	20.0671	19.6539	19.1794	18.8208	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8456	19.0124	19.3083	19.6980	20.0007	20.1483	20.1780	20.1741	20.0671	19.6539	19.1794	18.8208	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9832	0.9407	0.8289	0.6337	0.4479	0.5156	0.8113	0.9716	0.9953	0.9983	(94)
Useful gains	431.1189	512.2230	605.4922	688.1440	672.6090	511.7045	344.1283	358.8307	491.5922	483.4574	423.4688	405.2684	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1448.7234	1402.8285	1270.7590	1061.6236	814.7058	540.2354	348.3837	366.9312	582.8079	888.6373	1189.6841	1445.1719	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	757.0977	598.4869	494.9585	268.9053	105.7200	0.0000	0.0000	0.0000	0.0000	301.4538	551.6750	773.6882	(98)
Space heating												3851.9853	(98)
Space heating per m2											(98) / (4) =	47.9580	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	915.2660	720.5286	738.9036	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8752	0.9298	0.9006	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	801.0053	669.9117	665.4498	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1036.0445	988.3629	905.4637	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	169.2282	236.9277	178.5703	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling                                                                                                584.7262 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   42.3070   59.2319   44.6426    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                146.1815 (107)
Space cooling per m2                                                                                           1.8200 (108)
Energy for space heating                                                                                      47.9580 (99)
Energy for space cooling                                                                                       1.8200 (108)
Total                                                                                                         49.7780 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                      49.8 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.6300	0.7000	0.7700	7.9943	(74)
East	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(76)
West	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(80)

Solar gains	77.5011	151.2476	249.8836	368.2777	456.4068	469.8453	446.2047	379.5995	291.6448	179.5259	96.5288	63.8235	(83)
Total gains	421.0364	493.4447	580.1385	678.8761	746.2451	740.3270	704.5279	641.7426	564.2526	471.9256	411.6987	396.8420	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9989	0.9974	0.9917	0.9674	0.8905	0.7315	0.5642	0.6337	0.8829	0.9858	0.9978	0.9992	(86)
MIT	19.6316	19.7853	20.0628	20.4374	20.7558	20.9372	20.9862	20.9762	20.8294	20.4031	19.9506	19.6081	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9985	0.9965	0.9886	0.9543	0.8474	0.6392	0.4386	0.5052	0.8191	0.9782	0.9968	0.9989	(89)
MIT 2	18.6766	18.8318	19.1097	19.4849	19.7778	19.9247	19.9502	19.9486	19.8517	19.4585	19.0063	18.6605	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9164	19.0712	19.3490	19.7241	20.0234	20.1790	20.2103	20.2067	20.0972	19.6957	19.2434	18.8985	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9164	19.0712	19.3490	19.7241	20.0234	20.1790	20.2103	20.2067	20.0972	19.6957	19.2434	18.8985	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9954	0.9863	0.9510	0.8511	0.6607	0.4705	0.5379	0.8297	0.9757	0.9959	0.9985	(94)
Useful gains	420.2013	491.1904	572.2032	645.5918	635.1593	489.1316	331.4517	345.1658	468.1827	460.4718	410.0172	396.2553	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1400.3522	1354.2532	1224.8361	1019.6923	782.3683	518.9632	335.8368	353.4129	560.1198	854.9601	1146.5807	1394.3413	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	729.2323	579.9782	485.5589	269.3523	109.5235	0.0000	0.0000	0.0000	0.0000	293.4992	530.3257	742.5760	(98)
Space heating												3740.0461	(98)
Space heating per m2											(98) / (4) =	46.5643	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8687	0.9267	0.8978	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.6106	637.9227	633.4518	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.5916	913.8574	842.0797	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	142.5463	205.2955	155.2192	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												503.0609	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   35.6366   51.3239   38.8048    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        125.7652 (107)
Space cooling per m2                                                                                                   1.5658 (108)
Energy for space heating                                                                                              46.5643 (99)
Energy for space cooling                                                                                               1.5658 (108)
Total                                                                                                                 48.1301 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                55.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.3530	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3150	0.2925	0.3000	0.2850	0.2850	0.2775	0.2700	0.2625	0.2550	0.2775	0.2625	0.2775	(22b)
Effective ac	0.5496	0.5428	0.5450	0.5406	0.5406	0.5385	0.5365	0.5345	0.5325	0.5385	0.5345	0.5385	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6587	37.1903	37.3426	37.0419	37.0419	36.8973	36.7566	36.6198	36.4868	36.8973	36.6198	36.8973	(38)
Heat transfer coeff	97.9855	97.5172	97.6694	97.3687	97.3687	97.2242	97.0834	96.9466	96.8136	97.2242	96.9466	97.2242	(39)
Average = Sum(39)m / 12 =												97.2810	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2199	1.2141	1.2160	1.2123	1.2123	1.2105	1.2087	1.2070	1.2053	1.2105	1.2070	1.2105	(40)
HLP (average)												1.2112	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6686	739.4332	843.2137	960.1203	1007.1247	1040.3510	987.7009	923.5218	827.7425	716.2547	652.7960	631.7820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9245	57.1979	57.1087	57.2851	57.2851	57.3703	57.4534	57.5345	57.6136	57.3703	57.5345	57.3703	
alpha	4.7950	4.8132	4.8072	4.8190	4.8190	4.8247	4.8302	4.8356	4.8409	4.8247	4.8356	4.8247	
util living area													
	0.9905	0.9842	0.9601	0.8851	0.7382	0.5204	0.3810	0.4062	0.6837	0.9175	0.9801	0.9923	(86)
MIT	19.9433	20.0716	20.3555	20.6879	20.9027	20.9853	20.9974	20.9965	20.9491	20.6806	20.2707	19.9259	(87)
Th 2	19.9041	19.9087	19.9072	19.9102	19.9102	19.9116	19.9130	19.9144	19.9157	19.9116	19.9144	19.9116	(88)
util rest of house													
	0.9874	0.9791	0.9470	0.8498	0.6689	0.4267	0.2761	0.2949	0.5870	0.8822	0.9723	0.9897	(89)
MIT 2	18.5344	18.7227	19.1252	19.5754	19.8291	19.9041	19.9124	19.9135	19.8834	19.5802	19.0160	18.5150	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9737	0.9399	0.8477	0.6817	0.4500	0.3026	0.3230	0.6094	0.8801	0.9667	0.9861	(94)
Useful gains	657.5312	719.9763	792.4945	813.9393	686.5971	468.1526	298.8304	298.2575	504.4052	630.3490	631.0500	623.0172	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1370.6455	1341.9731	1214.4333	1008.2320	739.8767	474.0295	299.4859	299.1264	527.7327	822.1816	1108.2065	1348.4303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	530.5571	417.9819	313.9224	139.8907	39.6401	0.0000	0.0000	0.0000	0.0000	142.7235	343.5527	539.7074	(98)
Space heating												2467.9758	(98)
RHI space heating demand												2468	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.3530	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3826	0.3751	0.3676	0.3300	0.3225	0.2850	0.2850	0.2775	0.3000	0.3225	0.3375	0.3525	(22b)
Effective ac	0.5732	0.5703	0.5675	0.5545	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5570	0.5621	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2721	39.0774	38.8866	37.9903	37.8226	37.0419	37.0419	36.8973	37.3426	37.8226	38.1618	38.5165	(38)
Heat transfer coeff	99.5989	99.4042	99.2134	98.3171	98.1494	97.3687	97.3687	97.2242	97.6694	98.1494	98.4886	98.8433	(39)
Average = Sum(39)m / 12 =												98.3163	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2400	1.2376	1.2352	1.2241	1.2220	1.2123	1.2123	1.2105	1.2160	1.2220	1.2262	1.2306	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411 (83)
Total gains	643.7629	723.6746	814.9961	917.1138	983.8560	968.7665	923.9424	856.0807	774.6500	679.9160	622.1896	612.8965 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0024	56.1121	56.2200	56.7325	56.8295	57.2851	57.2851	57.3703	57.1087	56.8295	56.6337	56.4305	
alpha	4.7335	4.7408	4.7480	4.7822	4.7886	4.8190	4.8190	4.8247	4.8072	4.7886	4.7756	4.7620	
util living area													
	0.9931	0.9871	0.9697	0.9151	0.7948	0.6136	0.4575	0.5113	0.7656	0.9473	0.9872	0.9945	(86)
MIT	19.8220	19.9803	20.2535	20.5958	20.8491	20.9668	20.9934	20.9890	20.9066	20.5652	20.1296	19.7888	(87)
Th 2	19.8881	19.8900	19.8919	19.9008	19.9025	19.9102	19.9102	19.9116	19.9072	19.9025	19.8991	19.8956	(88)
util rest of house													
	0.9909	0.9830	0.9596	0.8876	0.7354	0.5213	0.3474	0.3960	0.6798	0.9240	0.9823	0.9927	(89)
MIT 2	18.3469	18.5774	18.9702	19.4487	19.7646	19.8899	19.9080	19.9075	19.8385	19.4210	18.8022	18.3040	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7174	18.9297	19.2924	19.7368	20.0370	20.1603	20.1805	20.1791	20.1067	19.7084	19.1355	18.6769	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7174	18.9297	19.2924	19.7368	20.0370	20.1603	20.1805	20.1791	20.1067	19.7084	19.1355	18.6769	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9780	0.9526	0.8827	0.7434	0.5434	0.3752	0.4250	0.6970	0.9188	0.9776	0.9898	(94)
Useful gains	635.7167	707.7803	776.3634	809.5776	731.3914	526.4278	346.6454	363.8498	539.9524	624.6951	608.2415	606.6694	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1435.9536	1394.6076	1269.1805	1065.4390	818.2675	541.4000	348.6331	367.4180	586.6752	893.9796	1185.3643	1430.9446	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	595.3762	461.5479	366.6559	184.2202	64.6358	0.0000	0.0000	0.0000	0.0000	200.3476	415.5284	613.2608	(98)
Space heating												2901.5729	(98)
Space heating per m2											(98) / (4) =	36.1252	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3109.9388	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.3762	461.5479	366.6559	184.2202	64.6358	0.0000	0.0000	0.0000	0.0000	200.3476	415.5284	613.2608	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.1310	494.6923	392.9860	197.4493	69.2774	0.0000	0.0000	0.0000	0.0000	214.7349	445.3681	657.2999	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5001	89.4211	89.2320	88.7713	87.8875	86.7000	86.7000	86.7000	86.7000	88.8122	89.3331	89.5365	(217)
Fuel for water heating, kWh/month													
	182.4470	160.0745	166.3986	147.0588	143.4524	126.8692	118.9361	134.5284	135.5568	152.5727	163.9871	177.0249	(219)
Water heating fuel used												1808.9064	(219)
Annual totals kWh/year													
Space heating fuel - main system												3109.9388	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4761.2225	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3109.9388	3.4800	108.2259	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1808.9064	3.4800	62.9499	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			270.3854	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9062	(257)
SAP value		87.3589	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3109.9388	0.2160	671.7468	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1808.9064	0.2160	390.7238	(264)
Space and water heating			1062.4706	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			980.6644	(272)
CO2 emissions per m2			12.2100	(273)
EI value			89.5141	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8827 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8827 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.3530	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3150	0.2925	0.3000	0.2850	0.2850	0.2775	0.2700	0.2625	0.2550	0.2775	0.2625	0.2775	(22b)
Effective ac	0.5496	0.5428	0.5450	0.5406	0.5406	0.5385	0.5365	0.5345	0.5325	0.5385	0.5345	0.5385	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6587	37.1903	37.3426	37.0419	37.0419	36.8973	36.7566	36.6198	36.4868	36.8973	36.6198	36.8973	(38)
Heat transfer coeff	97.9855	97.5172	97.6694	97.3687	97.3687	97.2242	97.0834	96.9466	96.8136	97.2242	96.9466	97.2242	(39)
Average = Sum(39)m / 12 =												97.2810	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2199	1.2141	1.2160	1.2123	1.2123	1.2105	1.2087	1.2070	1.2053	1.2105	1.2070	1.2105	(40)
HLP (average)												1.2112	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6686	739.4332	843.2137	960.1203	1007.1247	1040.3510	987.7009	923.5218	827.7425	716.2547	652.7960	631.7820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9245	57.1979	57.1087	57.2851	57.2851	57.3703	57.4534	57.5345	57.6136	57.3703	57.5345	57.3703	
alpha	4.7950	4.8132	4.8072	4.8190	4.8190	4.8247	4.8302	4.8356	4.8409	4.8247	4.8356	4.8247	
util living area													
	0.9905	0.9842	0.9601	0.8851	0.7382	0.5204	0.3810	0.4062	0.6837	0.9175	0.9801	0.9923	(86)
MIT	19.9433	20.0716	20.3555	20.6879	20.9027	20.9853	20.9974	20.9965	20.9491	20.6806	20.2707	19.9259	(87)
Th 2	19.9041	19.9087	19.9072	19.9102	19.9102	19.9116	19.9130	19.9144	19.9157	19.9116	19.9144	19.9116	(88)
util rest of house													
	0.9874	0.9791	0.9470	0.8498	0.6689	0.4267	0.2761	0.2949	0.5870	0.8822	0.9723	0.9897	(89)
MIT 2	18.5344	18.7227	19.1252	19.5754	19.8291	19.9041	19.9124	19.9135	19.8834	19.5802	19.0160	18.5150	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9737	0.9399	0.8477	0.6817	0.4500	0.3026	0.3230	0.6094	0.8801	0.9667	0.9861	(94)
Useful gains	657.5312	719.9763	792.4945	813.9393	686.5971	468.1526	298.8304	298.2575	504.4052	630.3490	631.0500	623.0172	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1370.6455	1341.9731	1214.4333	1008.2320	739.8767	474.0295	299.4859	299.1264	527.7327	822.1816	1108.2065	1348.4303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	530.5571	417.9819	313.9224	139.8907	39.6401	0.0000	0.0000	0.0000	0.0000	142.7235	343.5527	539.7074	(98)
Space heating												2467.9758	(98)
Space heating per m2											(98) / (4) =	30.7268	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2645.2045	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	530.5571	417.9819	313.9224	139.8907	39.6401	0.0000	0.0000	0.0000	0.0000	142.7235	343.5527	539.7074	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	568.6571	447.9977	336.4656	149.9364	42.4867	0.0000	0.0000	0.0000	0.0000	152.9727	368.2237	578.4645	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4261	89.3535	89.1119	88.5256	87.5348	86.7000	86.7000	86.7000	86.7000	88.5101	89.1929	89.4568	(217)
Fuel for water heating, kWh/month													
	182.5980	160.1955	166.6231	147.4669	144.0304	126.8692	118.9361	134.5284	135.5568	153.0934	164.2450	177.1825	(219)
Water heating fuel used												1811.3252	(219)
Annual totals kWh/year													
Space heating fuel - main system												2645.2045	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4219.0972	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2645.2045	7.3800	195.2161	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1811.3252	7.3800	133.6758	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			367.8437	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2645.2045	0.2160	571.3642	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.3252	0.2160	391.2463	(264)
Space and water heating			962.6104	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			839.3829	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2645.2045	1.2200	3227.1495	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.3252	1.2200	2209.8168	(264)
Space and water heating			5436.9662	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4708.0483	(272)
Primary energy kWh/m2/year			58.6161	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	B 91
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£436	£364	£72
Space heating	£324	£324	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£368	£311	£58
Total cost of uses	£369	£311	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	46 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.3530	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3826	0.3751	0.3676	0.3300	0.3225	0.2850	0.2850	0.2775	0.3000	0.3225	0.3375	0.3525	(22b)
Effective ac	0.5732	0.5703	0.5675	0.5545	0.5520	0.5406	0.5406	0.5385	0.5450	0.5520	0.5570	0.5621	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2721	39.0774	38.8866	37.9903	37.8226	37.0419	37.0419	36.8973	37.3426	37.8226	38.1618	38.5165	(38)
Heat transfer coeff	99.5989	99.4042	99.2134	98.3171	98.1494	97.3687	97.3687	97.2242	97.6694	98.1494	98.4886	98.8433	(39)
Average = Sum(39)m / 12 =												98.3163	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2400	1.2376	1.2352	1.2241	1.2220	1.2123	1.2123	1.2105	1.2160	1.2220	1.2262	1.2306	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(76)
West	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411	(83)
Total gains	643.7629	723.6746	814.9961	917.1138	983.8560	968.7665	923.9424	856.0807	774.6500	679.9160	622.1896	612.8965	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0024	56.1121	56.2200	56.7325	56.8295	57.2851	57.2851	57.3703	57.1087	56.8295	56.6337	56.4305	
alpha	4.7335	4.7408	4.7480	4.7822	4.7886	4.8190	4.8190	4.8247	4.8072	4.7886	4.7756	4.7620	
util living area													
	0.9931	0.9871	0.9697	0.9151	0.7948	0.6136	0.4575	0.5113	0.7656	0.9473	0.9872	0.9945	(86)
MIT	19.8220	19.9803	20.2535	20.5958	20.8491	20.9668	20.9934	20.9890	20.9066	20.5652	20.1296	19.7888	(87)
Th 2	19.8881	19.8900	19.8919	19.9008	19.9025	19.9102	19.9102	19.9116	19.9072	19.9025	19.8991	19.8956	(88)
util rest of house													
	0.9909	0.9830	0.9596	0.8876	0.7354	0.5213	0.3474	0.3960	0.6798	0.9240	0.9823	0.9927	(89)
MIT 2	18.3469	18.5774	18.9702	19.4487	19.7646	19.8899	19.9080	19.9075	19.8385	19.4210	18.8022	18.3040	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7174	18.9297	19.2924	19.7368	20.0370	20.1603	20.1805	20.1791	20.1067	19.7084	19.1355	18.6769	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7174	18.9297	19.2924	19.7368	20.0370	20.1603	20.1805	20.1791	20.1067	19.7084	19.1355	18.6769	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9780	0.9526	0.8827	0.7434	0.5434	0.3752	0.4250	0.6970	0.9188	0.9776	0.9898	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	635.7167	707.7803	776.3634	809.5776	731.3914	526.4278	346.6454	363.8498	539.9524	624.6951	608.2415	606.6694	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1435.9536	1394.6076	1269.1805	1065.4390	818.2675	541.4000	348.6331	367.4180	586.6752	893.9796	1185.3643	1430.9446	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	595.3762	461.5479	366.6559	184.2202	64.6358	0.0000	0.0000	0.0000	0.0000	200.3476	415.5284	613.2608	(98)
Space heating												2901.5729	(98)
Space heating per m2											(98) / (4) =	36.1252	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3109.9388	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.3762	461.5479	366.6559	184.2202	64.6358	0.0000	0.0000	0.0000	0.0000	200.3476	415.5284	613.2608	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	638.1310	494.6923	392.9860	197.4493	69.2774	0.0000	0.0000	0.0000	0.0000	214.7349	445.3681	657.2999	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5966	89.6249	89.6409	89.6732	89.7638	86.7000	86.7000	86.7000	86.7000	89.2124	89.4812	89.6164	(217)
Fuel for water heating, kWh/month	154.9223	114.1219	88.0110	41.5795	12.1001	0.0000	0.0000	21.8860	47.3352	93.3398	131.2587	154.0029	(219)
Water heating fuel used												858.5574	(219)

Annual totals kWh/year		
Space heating fuel - main system	3109.9388	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =	-588.2895	(233)
Total delivered energy for all uses	3860.8735	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3109.9388	3.4800	108.2259	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	858.5574	3.4800	29.8778	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			243.9082	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8174	(257)
SAP value		88.5967	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3109.9388	0.2160	671.7468	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	858.5574	0.2160	185.4484	(264)
Space and water heating			857.1952	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			801.3390 (272)
CO2 emissions per m2			9.9800 (273)
EI value			91.4316
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.1700	
Infiltration rate			0.3530	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3000	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3150	0.2925	0.3000	0.2850	0.2850	0.2775	0.2700	0.2625	0.2550	0.2775	0.2625	0.2775	(22b)
Effective ac	0.5496	0.5428	0.5450	0.5406	0.5406	0.5385	0.5365	0.5345	0.5325	0.5385	0.5345	0.5385	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6587	37.1903	37.3426	37.0419	37.0419	36.8973	36.7566	36.6198	36.4868	36.8973	36.6198	36.8973	(38)
Heat transfer coeff	97.9855	97.5172	97.6694	97.3687	97.3687	97.2242	97.0834	96.9466	96.8136	97.2242	96.9466	97.2242	(39)
Average = Sum(39)m / 12 =												97.2810	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2199	1.2141	1.2160	1.2123	1.2123	1.2105	1.2087	1.2070	1.2053	1.2105	1.2070	1.2105	(40)
HLP (average)												1.2112	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(76)
West	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6686	739.4332	843.2137	960.1203	1007.1247	1040.3510	987.7009	923.5218	827.7425	716.2547	652.7960	631.7820	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9245	57.1979	57.1087	57.2851	57.2851	57.3703	57.4534	57.5345	57.6136	57.3703	57.5345	57.3703	
alpha	4.7950	4.8132	4.8072	4.8190	4.8190	4.8247	4.8302	4.8356	4.8409	4.8247	4.8356	4.8247	
util living area													
	0.9905	0.9842	0.9601	0.8851	0.7382	0.5204	0.3810	0.4062	0.6837	0.9175	0.9801	0.9923	(86)
MIT	19.9433	20.0716	20.3555	20.6879	20.9027	20.9853	20.9974	20.9965	20.9491	20.6806	20.2707	19.9259	(87)
Th 2	19.9041	19.9087	19.9072	19.9102	19.9102	19.9116	19.9130	19.9144	19.9157	19.9116	19.9144	19.9116	(88)
util rest of house													
	0.9874	0.9791	0.9470	0.8498	0.6689	0.4267	0.2761	0.2949	0.5870	0.8822	0.9723	0.9897	(89)
MIT 2	18.5344	18.7227	19.1252	19.5754	19.8291	19.9041	19.9124	19.9135	19.8834	19.5802	19.0160	18.5150	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8882	19.0614	19.4341	19.8548	20.0987	20.1756	20.1848	20.1855	20.1510	19.8566	19.3311	18.8693	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9737	0.9399	0.8477	0.6817	0.4500	0.3026	0.3230	0.6094	0.8801	0.9667	0.9861	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	657.5312	719.9763	792.4945	813.9393	686.5971	468.1526	298.8304	298.2575	504.4052	630.3490	631.0500	623.0172 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1370.6455	1341.9731	1214.4333	1008.2320	739.8767	474.0295	299.4859	299.1264	527.7327	822.1816	1108.2065	1348.4303 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	530.5571	417.9819	313.9224	139.8907	39.6401	0.0000	0.0000	0.0000	0.0000	142.7235	343.5527	539.7074 (98)

Space heating 2467.9758 (98)
Space heating per m2 (98) / (4) = 30.7268 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2645.2045 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	530.5571	417.9819	313.9224	139.8907	39.6401	0.0000	0.0000	0.0000	0.0000	142.7235	343.5527	539.7074	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	568.6571	447.9977	336.4656	149.9364	42.4867	0.0000	0.0000	0.0000	0.0000	152.9727	368.2237	578.4645	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5472	89.5677	89.5555	89.5349	89.2670	86.7000	86.7000	86.7000	86.7000	88.9794	89.3834	89.5560	(217)
Fuel for water heating, kWh/month	150.4156	114.4124	87.7554	40.4832	17.1580	0.0000	0.0000	14.9625	41.9449	89.2238	126.0542	150.7284	(219)

Water heating fuel used 833.1385 (219)
Annual totals kWh/year
Space heating fuel - main system 2645.2045 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) = -668.0993 -668.0993 (233)
Total delivered energy for all uses 3290.9104 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2645.2045	7.3800	195.2161	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.1385	7.3800	61.4856	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			309.9835	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2645.2045	0.2160	571.3642	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.1385	0.2160	179.9579	(264)
Space and water heating			751.3221	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			654.0446	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2645.2045	1.2200	3227.1495	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.1385	1.2200	1016.4289	(264)
Space and water heating			4243.5784	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3668.1605	(272)
Primary energy kWh/m2/year			45.6693	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.4600	87.1704	0.7200	0.7000	0.7650	74.4113
East	7.9700	125.2818	0.7200	0.7000	0.7650	346.4820
West	3.6100	125.2818	0.7200	0.7000	0.7650	156.9385
total:						577.8319

	Jun	Jul	Aug	
Solar gains	623	578	503	(P3)
Internal gains	429	411	419	
Total summer gains	1052	989	923	(P5)
Summer gain/loss ratio	1.73	1.63	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.38	19.18	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 395 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 395	**Prop Type Ref**	
Property	38 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.13	**TER**	18.99
Environmental	90 B	**% DER<TER**	25.59		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.78	**TFEE**	55.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.99	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.13	$kgCO_2/m^2$	Pass
	-4.86 (-25.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.78	$kWh/m^2/yr$	
	-5.5 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.46 m², No overhang 7.97 m², No overhang 3.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 396 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 396	**Prop Type Ref**	
Property	39 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.45	**TER**	18.70
Environmental	89 B	**% DER<TER**	22.73		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.81	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.70 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.45 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.76 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.47 m², No overhang
Windows facing South: 0.50 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.7600	
Infiltration rate		0.4825	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4102	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5229	0.5127	0.5024	0.4512	0.4409	0.3896	0.3896	0.3794	0.4102	0.4409	0.4614	0.4819	(22b)
Effective ac	0.6367	0.6314	0.6262	0.6018	0.5972	0.5759	0.5759	0.5720	0.5841	0.5972	0.6065	0.6161	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9645	42.6062	42.2550	40.6055	40.2969	38.8603	38.8603	38.5943	39.4137	40.2969	40.9213	41.5739	(38)
Heat transfer coeff	100.3001	99.9418	99.5907	97.9412	97.6326	96.1960	96.1960	95.9299	96.7493	97.6326	98.2569	98.9096	(39)
Average = Sum(39)m / 12 =												97.9397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2680	1.2635	1.2590	1.2382	1.2343	1.2161	1.2161	1.2128	1.2231	1.2343	1.2422	1.2504	(40)
HLP (average)												1.2382	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	372.0450	369.8669	356.3317	334.5838	312.5424	291.3538	277.6440	283.6867	294.9194	316.8780	342.0512	360.8913	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	457.1765	533.8020	621.3214	715.4648	775.7943	764.3446	728.4336	673.0238	601.0962	509.9568	447.6977	431.2401	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7662	54.9625	55.1563	56.0852	56.2625	57.1028	57.1028	57.2611	56.7762	56.2625	55.9050	55.5361	
alpha	4.6511	4.6642	4.6771	4.7390	4.7508	4.8069	4.8069	4.8174	4.7851	4.7508	4.7270	4.7024	
util living area													
	0.9983	0.9961	0.9889	0.9616	0.8842	0.7280	0.5624	0.6233	0.8675	0.9808	0.9965	0.9987	(86)
MIT	19.5836	19.7468	20.0341	20.4191	20.7404	20.9306	20.9840	20.9745	20.8288	20.3975	19.9262	19.5647	(87)
Th 2	19.8660	19.8695	19.8731	19.8896	19.8927	19.9071	19.9071	19.9098	19.9015	19.8927	19.8864	19.8799	(88)
util rest of house													
	0.9977	0.9947	0.9847	0.9465	0.8385	0.6327	0.4321	0.4912	0.7976	0.9706	0.9951	0.9982	(89)
MIT 2	17.9846	18.2252	18.6454	19.2064	19.6368	19.8608	19.9013	19.8993	19.7611	19.1865	18.4996	17.9665	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2942	18.5199	18.9143	19.4413	19.8506	20.0680	20.1110	20.1076	19.9679	19.4210	18.7759	18.2760	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2942	18.5199	18.9143	19.4413	19.8506	20.0680	20.1110	20.1076	19.9679	19.4210	18.7759	18.2760	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9922	0.9797	0.9385	0.8364	0.6480	0.4574	0.5166	0.8027	0.9644	0.9928	0.9972	(94)
Useful gains	455.5021	529.6605	608.6955	671.4702	648.9047	495.2824	333.1906	347.7050	482.4955	491.8131	444.4889	430.0357	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1403.6246	1361.2011	1236.3519	1032.4243	795.7608	525.9992	337.7462	355.6657	567.7144	861.2206	1147.2388	1392.2543	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	705.4031	558.7953	466.9763	259.8869	109.2609	0.0000	0.0000	0.0000	0.0000	274.8392	505.9800	715.8906	(98)
Space heating												3597.0323	(98)
Space heating per m2											(98) / (4) =	45.4745	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3855.3401	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	705.4031	558.7953	466.9763	259.8869	109.2609	0.0000	0.0000	0.0000	0.0000	274.8392	505.9800	715.8906	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	756.0590	598.9231	500.5106	278.5498	117.1071	0.0000	0.0000	0.0000	0.0000	294.5757	542.3151	767.2996	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6038	89.5451	89.4081	89.0679	88.3399	86.7000	86.7000	86.7000	86.7000	89.0830	89.4695	89.6284	(217)
Fuel for water heating, kWh/month													
	181.2246	158.9658	165.1544	145.7671	141.9421	126.1873	118.3042	133.8032	134.8228	151.2761	162.8320	175.8640	(219)
Water heating fuel used												1796.1435	(219)
Annual totals kWh/year													
Space heating fuel - main system												3855.3401	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5501.2047	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3855.3401	0.2160	832.7535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1796.1435	0.2160	387.9670	(264)
Space and water heating			1220.7204	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1142.7257	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.4500	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.9942	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.9942	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	459.6774	526.0846	600.3505	679.3876	728.7972	715.5082	682.3785	635.2717	574.3655	497.9833	447.2713	435.5922	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9983	0.9963	0.9895	0.9635	0.8867	0.7279	0.5581	0.6165	0.8636	0.9804	0.9965	0.9987	(86)
MIT	19.7308	19.8772	20.1372	20.4832	20.7753	20.9433	20.9882	20.9808	20.8578	20.4696	20.0389	19.7075	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9977	0.9950	0.9856	0.9494	0.8433	0.6374	0.4365	0.4928	0.7958	0.9703	0.9951	0.9983	(89)
MIT 2	18.2608	18.4764	18.8560	19.3581	19.7490	19.9440	19.9779	19.9761	19.8612	19.3477	18.7213	18.2337	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5455	18.7477	19.1041	19.5760	19.9478	20.1375	20.1736	20.1707	20.0542	19.5650	18.9765	18.5191	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9812	0.9424	0.8421	0.6523	0.4601	0.5166	0.8017	0.9648	0.9930	0.9973	(94)
Useful gains	458.0554	522.2711	589.0734	640.2623	613.6941	466.7357	313.9674	328.2108	460.4959	480.4618	444.1185	434.4112	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1304.6257	1264.8403	1148.2584	960.7034	740.4706	491.7722	317.3589	334.1897	531.0060	804.8636	1071.2668	1297.9090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating												3205.2717	(98)
Space heating per m2											(98) / (4) =	40.5218	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3431.7684	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	629.8484	499.0065	416.0336	230.7176	94.3217	0.0000	0.0000	0.0000	0.0000	241.3549	451.5467	642.4423	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	674.3558	534.2682	445.4321	247.0209	100.9868	0.0000	0.0000	0.0000	0.0000	258.4100	483.4547	687.8398	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7257	87.5215	87.0449	85.9249	83.8019	80.3000	80.3000	80.3000	80.3000	85.9192	87.2417	87.8106	(217)
Fuel for water heating, kWh/month													
	229.6885	201.8751	211.1880	189.7546	188.3700	173.1411	165.8823	184.9199	186.9622	198.9702	209.1771	224.0570	(219)
Water heating fuel used												2363.9861	(219)
Annual totals kWh/year													
Space heating fuel - main system												3431.7684	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6233.7652	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3431.7684	0.2160	741.2620	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.9861	0.2160	510.6210	(264)
Space and water heating			1251.8830	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1479.2105	(272)
Emissions per m2 for space and water heating			15.8266	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8266 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.7600	
Infiltration rate		0.3847	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3270	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4169	0.4088	0.4006	0.3597	0.3515	0.3107	0.3107	0.3025	0.3270	0.3515	0.3679	0.3842	(22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5483	0.5483	0.5457	0.5535	0.5618	0.5677	0.5738	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6031	39.3753	39.1521	38.1036	37.9074	36.9942	36.9942	36.8251	37.3459	37.9074	38.3043	38.7192	(38)
Heat transfer coeff	96.9387	96.7110	96.4878	95.4392	95.2431	94.3298	94.3298	94.1607	94.6816	95.2431	95.6399	96.0548	(39)
Average = Sum(39)m / 12 =												95.4383	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2255	1.2226	1.2198	1.2066	1.2041	1.1925	1.1925	1.1904	1.1970	1.2041	1.2091	1.2143	(40)
HLP (average)												1.2066	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Average daily hot water use (litres/day)												92.2821	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	425.9154	503.3159	592.4432	688.7707	750.5189	741.0648	706.8475	649.2649	576.5633	483.1638	418.3523	400.7485	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6652	56.7987	56.9301	57.5555	57.6741	58.2324	58.2324	58.3370	58.0161	57.6741	57.4348	57.1867	
alpha	4.7777	4.7866	4.7953	4.8370	4.8449	4.8822	4.8822	4.8891	4.8677	4.8449	4.8290	4.8124	
util living area													
	0.9987	0.9970	0.9906	0.9652	0.8897	0.7354	0.5683	0.6333	0.8770	0.9839	0.9974	0.9991	(86)
MIT	19.6022	19.7634	20.0478	20.4241	20.7437	20.9308	20.9843	20.9741	20.8261	20.3944	19.9286	19.5761	(87)
Th 2	19.8996	19.9019	19.9042	19.9148	19.9167	19.9260	19.9260	19.9277	19.9224	19.9167	19.9127	19.9085	(88)
util rest of house													
	0.9983	0.9959	0.9870	0.9513	0.8458	0.6415	0.4391	0.5020	0.8105	0.9753	0.9963	0.9988	(89)
MIT 2	18.6265	18.7892	19.0734	19.4493	19.7429	19.8942	19.9220	19.9203	19.8235	19.4275	18.9629	18.6075	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8155	18.9779	19.2621	19.6381	19.9368	20.0949	20.1278	20.1244	20.0177	19.6148	19.1499	18.7951	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8155	18.9779	19.2621	19.6381	19.9368	20.0949	20.1278	20.1244	20.0177	19.6148	19.1499	18.7951	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9842	0.9468	0.8467	0.6576	0.4644	0.5276	0.8175	0.9721	0.9952	0.9983	(94)
Useful gains	424.9302	500.5985	583.1042	652.1258	635.4849	487.3503	328.2705	342.5391	471.3361	469.6607	416.3491	400.0572	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.1137	1361.4846	1231.3912	1024.8385	784.4944	518.3369	332.7751	350.6946	560.2984	858.5940	1152.4543	1401.9292	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	730.7445	578.5154	482.3255	268.3531	110.8631	0.0000	0.0000	0.0000	0.0000	289.3663	529.9957	745.3928	(98)
Space heating												3735.5566	(98)
Space heating per m2											(98) / (4) =	47.2257	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	886.7005	698.0408	715.6215	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8603	0.9208	0.8931	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.8603	642.7862	639.1432	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.7972	915.9608	850.3385	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	140.3545	203.2419	157.1293	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												500.7257 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.0886	50.8105	39.2823	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												125.1814 (107)
Space cooling per m2												1.5826 (108)
Energy for space heating												47.2257 (99)
Energy for space cooling												1.5826 (108)
Total												48.8083 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.8 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
South	0.5000	46.7521	0.6300	0.7000	0.7700	7.1440	(78)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	74.4900	143.4432	231.8660	333.2709	405.3454	413.8669	394.4408	340.6699	267.9047	168.9439	92.4407	61.5552	(83)
Total gains	415.2740	482.8240	559.3195	641.1606	692.6124	681.9410	650.4988	600.5977	538.2912	459.0289	405.1465	391.9549	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9989	0.9975	0.9922	0.9708	0.9028	0.7523	0.5823	0.6459	0.8867	0.9860	0.9978	0.9992	(86)
MIT	19.6785	19.8268	20.0908	20.4450	20.7504	20.9339	20.9857	20.9764	20.8354	20.4272	19.9896	19.6560	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9985	0.9966	0.9893	0.9590	0.8632	0.6626	0.4570	0.5192	0.8250	0.9785	0.9968	0.9989	(89)
MIT 2	18.7458	18.8958	19.1603	19.5165	19.8000	19.9512	19.9786	19.9772	19.8829	19.5053	19.0678	18.7310	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9265	19.0761	19.3405	19.6963	19.9840	20.1415	20.1737	20.1707	20.0674	19.6839	19.2464	18.9102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9955	0.9870	0.9550	0.8637	0.6780	0.4815	0.5439	0.8314	0.9757	0.9959	0.9985	(94)
Useful gains	414.4514	480.6553	552.0451	612.3297	598.2419	462.3329	313.2042	326.6667	447.5476	447.8568	403.4790	391.3762	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1339.5148	1294.8339	1169.7945	971.5266	743.7278	492.1263	317.3670	334.1920	532.1796	815.5373	1095.6064	1333.3522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2471	547.1280	459.6055	258.6218	108.2415	0.0000	0.0000	0.0000	0.0000	273.5543	498.3317	700.8301	(98)
Space heating												3534.5602	(98)
Space heating per m2											(98) / (4) =	44.6847	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8617	0.9235	0.8971	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.3441	606.8899	604.2870	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	888.6914	850.0987	793.4548	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	121.9301	180.9473	140.7409	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.6182	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   30.4825   45.2368   35.1852    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          110.9046 (107)
Space cooling per m2                                                                                                     1.4021 (108)
Energy for space heating                                                                                                44.6847 (99)
Energy for space cooling                                                                                                 1.4021 (108)
Total                                                                                                                   46.0868 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    53.0 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.7600
Infiltration rate		0.4825 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4102 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4307	0.3999	0.4102	0.3896	0.3896	0.3794	0.3691	0.3589	0.3486	0.3794	0.3589	0.3794	(22b)
Effective ac	0.5927	0.5800	0.5841	0.5759	0.5759	0.5720	0.5681	0.5644	0.5608	0.5720	0.5644	0.5720	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss	(33) + (36) = 57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9954	39.1335	39.4137	38.8603	38.8603	38.5943	38.3353	38.0835	37.8387	38.5943	38.0835	38.5943	(38)
Heat transfer coeff	97.3311	96.4691	96.7493	96.1960	96.1960	95.9299	95.6710	95.4191	95.1744	95.9299	95.4191	95.9299	(39)
Average = Sum(39)m / 12 =												96.0346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2305	1.2196	1.2231	1.2161	1.2161	1.2128	1.2095	1.2063	1.2032	1.2128	1.2063	1.2128	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
RHI water heating demand												1591 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0126	724.9076	815.0372	909.8434	940.0334	961.8942	915.4521	866.5581	791.2026	697.6584	642.8630	624.5827	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4368	56.9411	56.7762	57.1028	57.1028	57.2611	57.4161	57.5677	57.7157	57.2611	57.5677	57.2611	
alpha	4.7625	4.7961	4.7851	4.8069	4.8069	4.8174	4.8277	4.8378	4.8477	4.8174	4.8378	4.8174	
util living area													
	0.9905	0.9846	0.9630	0.8978	0.7655	0.5517	0.4044	0.4253	0.6982	0.9206	0.9801	0.9922	(86)
MIT	19.9313	20.0610	20.3326	20.6604	20.8849	20.9811	20.9966	20.9958	20.9445	20.6729	20.2715	19.9257	(87)
Th 2	19.8957	19.9044	19.9015	19.9071	19.9071	19.9098	19.9124	19.9150	19.9174	19.9098	19.9150	19.9098	(88)
util rest of house													
	0.9874	0.9795	0.9507	0.8648	0.6975	0.4538	0.2934	0.3092	0.6015	0.8861	0.9723	0.9895	(89)
MIT 2	18.5111	18.7044	19.0891	19.5390	19.8093	19.9000	19.9115	19.9139	19.8818	19.5692	19.0175	18.5132	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9425	0.8595	0.7050	0.4723	0.3150	0.3318	0.6178	0.8812	0.9659	0.9856	(94)
Useful gains	648.7117	705.7867	768.1433	782.0206	662.6907	454.2936	288.3283	287.5479	488.8303	614.7973	620.9359	615.5892	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1351.5561	1318.4544	1192.9170	986.6016	723.1681	461.3611	289.0868	288.4901	512.7638	804.1737	1083.9931	1322.5671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	522.9162	411.7127	316.0316	147.2983	44.9952	0.0000	0.0000	0.0000	0.0000	140.8961	333.4011	525.9916	(98)
Space heating												2443.2428	(98)
RHI space heating demand												2443	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.7600
Infiltration rate		0.4825 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4102 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5229	0.5127	0.5024	0.4512	0.4409	0.3896	0.3896	0.3794	0.4102	0.4409	0.4614	0.4819	(22b)
Effective ac	0.6367	0.6314	0.6262	0.6018	0.5972	0.5759	0.5759	0.5720	0.5841	0.5972	0.6065	0.6161	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss (33) + (36) =	57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9645	42.6062	42.2550	40.6055	40.2969	38.8603	38.8603	38.5943	39.4137	40.2969	40.9213	41.5739	(38)
Heat transfer coeff	100.3001	99.9418	99.5907	97.9412	97.6326	96.1960	96.1960	95.9299	96.7493	97.6326	98.2569	98.9096	(39)
Average = Sum(39)m / 12 =												97.9397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2680	1.2635	1.2590	1.2382	1.2343	1.2161	1.2161	1.2128	1.2231	1.2343	1.2422	1.2504	(40)
HLP (average)												1.2382	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488 (83)
Total gains	636.5071	710.7971	790.4005	873.1685	921.7111	901.2214	861.4395	808.3652	744.3536	664.5897	614.1175	606.6999 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7662	54.9625	55.1563	56.0852	56.2625	57.1028	57.1028	57.2611	56.7762	56.2625	55.9050	55.5361	
alpha	4.6511	4.6642	4.6771	4.7390	4.7508	4.8069	4.8069	4.8174	4.7851	4.7508	4.7270	4.7024	
util living area													
	0.9931	0.9875	0.9721	0.9251	0.8199	0.6442	0.4830	0.5321	0.7793	0.9495	0.9873	0.9944	(86)
MIT	19.7878	19.9448	20.2133	20.5591	20.8219	20.9588	20.9916	20.9869	20.8974	20.5505	20.1132	19.7660	(87)
Th 2	19.8660	19.8695	19.8731	19.8896	19.8927	19.9071	19.9071	19.9098	19.9015	19.8927	19.8864	19.8799	(88)
util rest of house													
	0.9908	0.9834	0.9626	0.8998	0.7629	0.5499	0.3674	0.4129	0.6944	0.9268	0.9824	0.9926	(89)
MIT 2	18.2817	18.5115	18.8995	19.3921	19.7270	19.8814	19.9042	19.9048	19.8253	19.3937	18.7695	18.2598	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5734	18.7891	19.1540	19.6181	19.9391	20.0901	20.1148	20.1144	20.0329	19.6178	19.0297	18.5515	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5734	18.7891	19.1540	19.6181	19.9391	20.0901	20.1148	20.1144	20.0329	19.6178	19.0297	18.5515	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9547	0.8923	0.7656	0.5665	0.3898	0.4360	0.7057	0.9196	0.9770	0.9894	(94)
Useful gains	628.2737	695.1563	754.6208	779.1280	705.6380	510.5843	335.8103	352.4360	525.2939	611.1612	600.0013	600.2686	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1431.6251	1388.1052	1260.2168	1049.7461	804.4043	528.1243	338.1125	356.3198	574.0071	880.4294	1172.1781	1419.4985	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	597.6934	465.6617	376.1634	194.8450	73.4822	0.0000	0.0000	0.0000	0.0000	200.3355	411.9673	609.5071	(98)
Space heating												2929.6555	(98)
Space heating per m2											(98) / (4) =	37.0374	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3140.0381	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	597.6934	465.6617	376.1634	194.8450	73.4822	0.0000	0.0000	0.0000	0.0000	200.3355	411.9673	609.5071	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	640.6146	499.1015	403.1762	208.8371	78.7590	0.0000	0.0000	0.0000	0.0000	214.7219	441.5513	653.2766	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5060	89.4306	89.2553	88.8251	87.9962	86.7000	86.7000	86.7000	86.7000	88.8169	89.3310	89.5361	(217)
Fuel for water heating, kWh/month													
	181.4226	159.1693	165.4372	146.1655	142.4964	126.1873	118.3042	133.8032	134.8228	151.7294	163.0845	176.0454	(219)
Water heating fuel used												1798.6677	(219)
Annual totals kWh/year													
Space heating fuel - main system												3140.0381	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4788.4269	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3140.0381	3.4800	109.2733	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1798.6677	3.4800	62.5936	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			272.0452	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9207	(257)
SAP value		87.1562	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3140.0381	0.2160	678.2482	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1798.6677	0.2160	388.5122	(264)
Space and water heating			1066.7605	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			988.7657	(272)
CO2 emissions per m2			12.5000	(273)
EI value			89.3236	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8829 = 3.941, stars = 4
Water heating environmental impact	0.216 / 0.8829 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.7600	
Infiltration rate		0.4825	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4102	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4307	0.3999	0.4102	0.3896	0.3896	0.3794	0.3691	0.3589	0.3486	0.3794	0.3589	0.3794	(22b)
Effective ac	0.5927	0.5800	0.5841	0.5759	0.5759	0.5720	0.5681	0.5644	0.5608	0.5720	0.5644	0.5720	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9954	39.1335	39.4137	38.8603	38.8603	38.5943	38.3353	38.0835	37.8387	38.5943	38.0835	38.5943	(38)
Heat transfer coeff	97.3311	96.4691	96.7493	96.1960	96.1960	95.9299	95.6710	95.4191	95.1744	95.9299	95.4191	95.9299	(39)
Average = Sum(39)m / 12 =												96.0346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2305	1.2196	1.2231	1.2161	1.2161	1.2128	1.2095	1.2063	1.2032	1.2128	1.2063	1.2128	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317	(83)
Total gains	660.0126	724.9076	815.0372	909.8434	940.0334	961.8942	915.4521	866.5581	791.2026	697.6584	642.8630	624.5827	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4368	56.9411	56.7762	57.1028	57.1028	57.2611	57.4161	57.5677	57.7157	57.2611	57.5677	57.2611	
alpha	4.7625	4.7961	4.7851	4.8069	4.8069	4.8174	4.8277	4.8378	4.8477	4.8174	4.8378	4.8174	
util living area													
	0.9905	0.9846	0.9630	0.8978	0.7655	0.5517	0.4044	0.4253	0.6982	0.9206	0.9801	0.9922	(86)
MIT	19.9313	20.0610	20.3326	20.6604	20.8849	20.9811	20.9966	20.9958	20.9445	20.6729	20.2715	19.9257	(87)
Th 2	19.8957	19.9044	19.9015	19.9071	19.9071	19.9098	19.9124	19.9150	19.9174	19.9098	19.9150	19.9098	(88)
util rest of house													
	0.9874	0.9795	0.9507	0.8648	0.6975	0.4538	0.2934	0.3092	0.6015	0.8861	0.9723	0.9895	(89)
MIT 2	18.5111	18.7044	19.0891	19.5390	19.8093	19.9000	19.9115	19.9139	19.8818	19.5692	19.0175	18.5132	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9425	0.8595	0.7050	0.4723	0.3150	0.3318	0.6178	0.8812	0.9659	0.9856	(94)
Useful gains	648.7117	705.7867	768.1433	782.0206	662.6907	454.2936	288.3283	287.5479	488.8303	614.7973	620.9359	615.5892	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1351.5561	1318.4544	1192.9170	986.6016	723.1681	461.3611	289.0868	288.4901	512.7638	804.1737	1083.9931	1322.5671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	522.9162	411.7127	316.0316	147.2983	44.9952	0.0000	0.0000	0.0000	0.0000	140.8961	333.4011	525.9916	(98)
Space heating												2443.2428	(98)
Space heating per m2											(98) / (4) =	30.8880	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2618.6954 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	522.9162	411.7127	316.0316	147.2983	44.9952	0.0000	0.0000	0.0000	0.0000	140.8961	333.4011	525.9916	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	560.4675	441.2783	338.7263	157.8760	48.2264	0.0000	0.0000	0.0000	0.0000	151.0140	357.3431	563.7637	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4202	89.3469	89.1216	88.5769	87.6225	86.7000	86.7000	86.7000	86.7000	88.5035	89.1740	89.4437	(217)
Fuel for water heating, kWh/month													
	181.5966	159.3185	165.6855	146.5751	143.1042	126.1873	118.3042	133.8032	134.8228	152.2668	163.3715	176.2273	(219)
Water heating fuel used												1801.2629	(219)
Annual totals kWh/year													
Space heating fuel - main system												2618.6954	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4189.8696	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2618.6954	7.3800	193.2597	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1801.2629	7.3800	132.9332	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			367.2495	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2618.6954	0.2160	565.6382	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.2629	0.2160	389.0728	(264)
Space and water heating			954.7110	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			835.2950	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2618.6954	1.2200	3194.8084	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.2629	1.2200	2197.5407	(264)
Space and water heating			5392.3491	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4685.9770	(272)
Primary energy kWh/m2/year			59.2412	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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Current energy efficiency rating:                                   B 87
Current environmental impact rating:                                B 89

_____________________________________________________________________________

(For testing purposes):
A                                                                     Not considered
B                                                                     Not considered
C                                                                     Not considered
D                                                                     Not considered
E  Low energy lighting                                               Already installed
F                                                                     Not considered
G                                                                     Not considered
H                                                                     Not considered
I                                                                     Not considered
J                                                                     Not considered
K                                                                     Not considered
M                                                                     Not considered
N  Solar water heating                                               Recommended
O                                                                     Not considered
P                                                                     Not considered
R                                                                     Not considered
S                                                                     Not considered
T                                                                     Not considered
U  Solar photovoltaic panels                                         Already installed
A2                                                                    Not considered
A3                                                                    Not considered
T2                                                                    Not considered
W                                                                     Not considered
X                                                                     Not considered
Y                                                                     Not considered
J2                                                                    Not considered
Q2                                                                    Not considered
Z1                                                                    Not considered
Z2                                                                    Not considered
Z3                                                                    Not considered
Z4                                                                    Not considered
Z5                                                                    Not considered
V2 Wind turbine                                                      Not applicable
L2                                                                    Not considered
Q3                                                                    Not considered
O3                                                                    Not considered

Recommended measures:                    SAP change   Cost change     CO2 change
N  Solar water heating                    + 1.2        -£  58          -185 kg (22.1%)
_____________________________________________________________________________

                                                                      Energy  Environmental
                                         Typical annual savings       efficiency  impact
Recommended measures
Solar water heating                      £58              2.33 kg/m²  B 88     B 91
                           Total Savings £58              2.33 kg/m²

Potential energy efficiency rating:                                 B 88
Potential environmental impact rating:                                    B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):
                                  Current        Potential      Saving
  Electricity                      £126          £140         -£14
  Mains gas                        £433          £361         £72

  Space heating                    £322          £322         £0
  Water heating                    £133          £75          £58
  Lighting                         £104          £104         £0
  Generated (PV)                  -£191         -£191         £0

  Total cost of fuels              £368           £310           £58
  Total cost of uses               £368           £310           £58
  Delivered energy                 53 kWh/m²      41 kWh/m²      12 kWh/m²
  Carbon dioxide emissions         0.8 tonnes     0.7 tonnes     0.2 tonnes
  CO2 emissions per m²             11 kg/m²       8 kg/m²        2 kg/m²
  Primary energy                   59 kWh/m²      46 kWh/m²      13 kWh/m²
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.7600	
Infiltration rate			0.4825	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4102	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5229	0.5127	0.5024	0.4512	0.4409	0.3896	0.3896	0.3794	0.4102	0.4409	0.4614	0.4819	(22b)
Effective ac	0.6367	0.6314	0.6262	0.6018	0.5972	0.5759	0.5759	0.5720	0.5841	0.5972	0.6065	0.6161	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9645	42.6062	42.2550	40.6055	40.2969	38.8603	38.8603	38.5943	39.4137	40.2969	40.9213	41.5739	(38)
Heat transfer coeff	100.3001	99.9418	99.5907	97.9412	97.6326	96.1960	96.1960	95.9299	96.7493	97.6326	98.2569	98.9096	(39)
Average = Sum(39)m / 12 =												97.9397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2680	1.2635	1.2590	1.2382	1.2343	1.2161	1.2161	1.2128	1.2231	1.2343	1.2422	1.2504	(40)
HLP (average)												1.2382	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2491	(H8)
Utilisation factor												0.5509	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-842.1367	(H17)
Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
								Total per year (kWh/year) = Sum(64)m =				760.9040	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
South	0.5000	46.7521	0.7200	0.7000	0.7700	8.1646	(78)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	85.1315	163.9351	264.9897	380.8810	463.2519	472.9908	450.7895	389.3371	306.1769	193.0788	105.6465	70.3488	(83)
Total gains	636.5071	710.7971	790.4005	873.1685	921.7111	901.2214	861.4395	808.3652	744.3536	664.5897	614.1175	606.6999	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7662	54.9625	55.1563	56.0852	56.2625	57.1028	57.1028	57.2611	56.7762	56.2625	55.9050	55.5361	
alpha	4.6511	4.6642	4.6771	4.7390	4.7508	4.8069	4.8069	4.8174	4.7851	4.7508	4.7270	4.7024	
util living area													
	0.9931	0.9875	0.9721	0.9251	0.8199	0.6442	0.4830	0.5321	0.7793	0.9495	0.9873	0.9944	(86)
MIT	19.7878	19.9448	20.2133	20.5591	20.8219	20.9588	20.9916	20.9869	20.8974	20.5505	20.1132	19.7660	(87)
Th 2	19.8660	19.8695	19.8731	19.8896	19.8927	19.9071	19.9071	19.9098	19.9015	19.8927	19.8864	19.8799	(88)
util rest of house													
	0.9908	0.9834	0.9626	0.8998	0.7629	0.5499	0.3674	0.4129	0.6944	0.9268	0.9824	0.9926	(89)
MIT 2	18.2817	18.5115	18.8995	19.3921	19.7270	19.8814	19.9042	19.9048	19.8253	19.3937	18.7695	18.2598	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5734	18.7891	19.1540	19.6181	19.9391	20.0901	20.1148	20.1144	20.0329	19.6178	19.0297	18.5515	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5734	18.7891	19.1540	19.6181	19.9391	20.0901	20.1148	20.1144	20.0329	19.6178	19.0297	18.5515	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9780	0.9547	0.8923	0.7656	0.5665	0.3898	0.4360	0.7057	0.9196	0.9770	0.9894	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	628.2737	695.1563	754.6208	779.1280	705.6380	510.5843	335.8103	352.4360	525.2939	611.1612	600.0013	600.2686	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1431.6251	1388.1052	1260.2168	1049.7461	804.4043	528.1243	338.1125	356.3198	574.0071	880.4294	1172.1781	1419.4985	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	597.6934	465.6617	376.1634	194.8450	73.4822	0.0000	0.0000	0.0000	0.0000	200.3355	411.9673	609.5071	(98)
Space heating												2929.6555	(98)
Space heating per m2											(98) / (4) =	37.0374	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3140.0381	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.6934	465.6617	376.1634	194.8450	73.4822	0.0000	0.0000	0.0000	0.0000	200.3355	411.9673	609.5071	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	640.6146	499.1015	403.1762	208.8371	78.7590	0.0000	0.0000	0.0000	0.0000	214.7219	441.5513	653.2766	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6023	89.6334	89.6589	89.7080	89.8344	86.7000	86.7000	86.7000	86.7000	89.2179	89.4797	89.6163	(217)
Fuel for water heating, kWh/month	153.9735	113.3458	87.2851	41.0426	11.6675	0.0000	0.0000	21.4592	46.8349	92.6578	130.4418	153.0843	(219)
Water heating fuel used												851.7925	(219)
Annual totals kWh/year													
Space heating fuel - main system												3140.0381	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												3891.5517	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3140.0381	3.4800	109.2733	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	851.7925	3.4800	29.6424	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			245.6889	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8315	(257)
SAP value		88.4006	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3140.0381	0.2160	678.2482	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	851.7925	0.2160	183.9872	(264)
Space and water heating			862.2354	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			810.1907 (272)
CO2 emissions per m2			10.2400 (273)
EI value			91.2518
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.7600	
Infiltration rate		0.4825	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4102	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4307	0.3999	0.4102	0.3896	0.3896	0.3794	0.3691	0.3589	0.3486	0.3794	0.3589	0.3794	(22b)
Effective ac	0.5927	0.5800	0.5841	0.5759	0.5759	0.5720	0.5681	0.5644	0.5608	0.5720	0.5644	0.5720	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9954	39.1335	39.4137	38.8603	38.8603	38.5943	38.3353	38.0835	37.8387	38.5943	38.0835	38.5943	(38)
Heat transfer coeff	97.3311	96.4691	96.7493	96.1960	96.1960	95.9299	95.6710	95.4191	95.1744	95.9299	95.4191	95.9299	(39)
Average = Sum(39)m / 12 =												96.0346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2305	1.2196	1.2231	1.2161	1.2161	1.2128	1.2095	1.2063	1.2032	1.2128	1.2063	1.2128	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755 (64)
								Total per year (kWh/year) = Sum(64)m =				737.9213 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
South	0.5000	56.7559	0.7200	0.7000	0.7700	9.9116	(78)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	108.6369	178.0455	289.6264	417.5560	481.5742	533.6636	504.8021	447.5300	353.0259	226.1475	134.3920	88.2317 (83)
Total gains	660.0126	724.9076	815.0372	909.8434	940.0334	961.8942	915.4521	866.5581	791.2026	697.6584	642.8630	624.5827 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4368	56.9411	56.7762	57.1028	57.1028	57.2611	57.4161	57.5677	57.7157	57.2611	57.5677	57.2611	
alpha	4.7625	4.7961	4.7851	4.8069	4.8069	4.8174	4.8277	4.8378	4.8477	4.8174	4.8378	4.8174	
util living area													
	0.9905	0.9846	0.9630	0.8978	0.7655	0.5517	0.4044	0.4253	0.6982	0.9206	0.9801	0.9922	(86)
MIT	19.9313	20.0610	20.3326	20.6604	20.8849	20.9811	20.9966	20.9958	20.9445	20.6729	20.2715	19.9257	(87)
Th 2	19.8957	19.9044	19.9015	19.9071	19.9071	19.9098	19.9124	19.9150	19.9174	19.9098	19.9150	19.9098	(88)
util rest of house													
	0.9874	0.9795	0.9507	0.8648	0.6975	0.4538	0.2934	0.3092	0.6015	0.8861	0.9723	0.9895	(89)
MIT 2	18.5111	18.7044	19.0891	19.5390	19.8093	19.9000	19.9115	19.9139	19.8818	19.5692	19.0175	18.5132	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7862	18.9671	19.3300	19.7562	20.0177	20.1094	20.1217	20.1234	20.0876	19.7829	19.2603	18.7868	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9736	0.9425	0.8595	0.7050	0.4723	0.3150	0.3318	0.6178	0.8812	0.9659	0.9856	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	648.7117	705.7867	768.1433	782.0206	662.6907	454.2936	288.3283	287.5479	488.8303	614.7973	620.9359	615.5892	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1351.5561	1318.4544	1192.9170	986.6016	723.1681	461.3611	289.0868	288.4901	512.7638	804.1737	1083.9931	1322.5671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	522.9162	411.7127	316.0316	147.2983	44.9952	0.0000	0.0000	0.0000	0.0000	140.8961	333.4011	525.9916	(98)
Space heating												2443.2428	(98)
Space heating per m2											(98) / (4) =	30.8880	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2618.6954	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	522.9162	411.7127	316.0316	147.2983	44.9952	0.0000	0.0000	0.0000	0.0000	140.8961	333.4011	525.9916	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	560.4675	441.2783	338.7263	157.8760	48.2264	0.0000	0.0000	0.0000	0.0000	151.0140	357.3431	563.7637	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5422	89.5628	89.5641	89.5728	89.3747	86.7000	86.7000	86.7000	86.7000	88.9748	89.3672	89.5443	(217)
Fuel for water heating, kWh/month	149.5026	113.6610	87.0537	39.9678	16.7227	0.0000	0.0000	14.5769	41.4769	88.5739	125.2785	149.8426	(219)
Water heating fuel used												826.6566	(219)
Annual totals kWh/year													
Space heating fuel - main system												2618.6954	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												3265.2634	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2618.6954	7.3800	193.2597	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	826.6566	7.3800	61.0073	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			309.6536	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2618.6954	0.2160	565.6382	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	826.6566	0.2160	178.5578	(264)
Space and water heating			744.1960	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			650.7300	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2618.6954	1.2200	3194.8084	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	826.6566	1.2200	1008.5211	(264)
Space and water heating			4203.3295	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3650.4574	(272)
Primary energy kWh/m2/year			46.1499	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
South	0.5000	118.5567	0.7200	0.7000	0.7650	20.5698
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						508.3400

	Jun	Jul	Aug	
Solar gains	546	508	449	(P3)
Internal gains	425	408	416	
Total summer gains	971	916	865	(P5)
Summer gain/loss ratio	1.63	1.53	1.45	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.28	19.08	19.00	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 396 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 396	**Prop Type Ref**	
Property	39 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.45	**TER**	18.70
Environmental	89 B	**% DER<TER**	22.73		
CO_2 Emissions (t/year)	0.84	**DFEE**	48.81	**TFEE**	53.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.70	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.45	$kgCO_2/m^2$	Pass
	-4.25 (-22.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.00	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.81	$kWh/m^2/yr$	
	-4.2 (-7.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.76 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	6.47 m², No overhang 0.50 m², No overhang 4.75 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.76 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 397 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 397	**Prop Type Ref**	
Property	40 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.60	**TER**	18.79
Environmental	89 B	**% DER<TER**	22.30		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.43	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.60 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.96 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.50 m², No overhang
Windows facing East: 6.47 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5338	0.5233	0.5128	0.4605	0.4500	0.3977	0.3977	0.3873	0.4187	0.4500	0.4710	0.4919	(22b)
Effective ac	0.6425	0.6369	0.6315	0.6060	0.6013	0.5791	0.5791	0.5750	0.5876	0.6013	0.6109	0.6210	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3508	42.9776	42.6117	40.8931	40.5716	39.0748	39.0748	38.7976	39.6514	40.5716	41.2221	41.9021	(38)
Heat transfer coeff	100.6865	100.3132	99.9473	98.2288	97.9073	96.4105	96.4105	96.1333	96.9870	97.9073	98.5577	99.2377	(39)
Average = Sum(39)m / 12 =												98.2273	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2729	1.2682	1.2636	1.2418	1.2378	1.2188	1.2188	1.2153	1.2261	1.2378	1.2460	1.2546	(40)
HLP (average)												1.2418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	372.0450	369.8669	356.3317	334.5838	312.5424	291.3538	277.6440	283.6867	294.9194	316.8780	342.0512	360.8913	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	450.8689	523.9793	610.3187	705.9000	768.7817	759.0073	722.6120	665.0520	590.5536	499.7587	440.3107	425.7332	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5560	54.7590	54.9595	55.9210	56.1047	56.9757	56.9757	57.1400	56.6370	56.1047	55.7344	55.3525	
alpha	4.6371	4.6506	4.6640	4.7281	4.7403	4.7984	4.7984	4.8093	4.7758	4.7403	4.7156	4.6902	
util living area													
	0.9984	0.9964	0.9897	0.9636	0.8877	0.7324	0.5673	0.6304	0.8742	0.9823	0.9968	0.9988	(86)
MIT	19.5700	19.7297	20.0168	20.4063	20.7334	20.9283	20.9833	20.9731	20.8209	20.3837	19.9135	19.5529	(87)
Th 2	19.8621	19.8658	19.8695	19.8867	19.8899	19.9050	19.9050	19.9077	19.8992	19.8899	19.8834	19.8766	(88)
util rest of house													
	0.9978	0.9951	0.9858	0.9490	0.8427	0.6371	0.4361	0.4973	0.8061	0.9728	0.9954	0.9983	(89)
MIT 2	17.9622	18.1978	18.6179	19.1867	19.6263	19.8570	19.8989	19.8966	19.7510	19.1652	18.4792	17.9471	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.2736	18.4945	18.8888	19.4229	19.8408	20.0645	20.1089	20.1051	19.9582	19.4012	18.7570	18.2581	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2736	18.4945	18.8888	19.4229	19.8408	20.0645	20.1089	20.1051	19.9582	19.4012	18.7570	18.2581	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9809	0.9411	0.8404	0.6522	0.4616	0.5229	0.8105	0.9668	0.9933	0.9973	(94)
Useful gains	449.3014	520.1879	598.6870	664.3428	646.0496	495.0613	333.5224	347.7497	478.6491	483.1640	437.3490	424.6010	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1406.9503	1363.7072	1238.2320	1033.6499	797.0394	526.8339	338.2961	356.1850	568.1683	861.7019	1148.8851	1395.0952	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	712.4908	566.8449	475.8215	265.9011	112.3364	0.0000	0.0000	0.0000	0.0000	281.6322	512.3059	722.0476	(98)
Space heating												3649.3805	(98)
Space heating per m2											(98) / (4) =	46.1363	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3911.4475 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	712.4908	566.8449	475.8215	265.9011	112.3364	0.0000	0.0000	0.0000	0.0000	281.6322	512.3059	722.0476	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	763.6558	607.5508	509.9909	284.9958	120.4034	0.0000	0.0000	0.0000	0.0000	301.8566	549.0953	773.8988	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6094	89.5536	89.4206	89.0864	88.3647	86.7000	86.7000	86.7000	86.7000	89.1026	89.4774	89.6331	(217)
Fuel for water heating, kWh/month	181.2132	158.9507	165.1313	145.7368	141.9022	126.1873	118.3042	133.8032	134.8228	151.2429	162.8176	175.8548	(219)
Water heating fuel used												1795.9670	(219)
Annual totals kWh/year													
Space heating fuel - main system												3911.4475	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5557.1356	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3911.4475	0.2160	844.8727	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1795.9670	0.2160	387.9289	(264)
Space and water heating			1232.8015	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1154.8068	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.6000	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		33.1442	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.1442	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	454.1583	517.4898	590.7231	671.0184	722.6612	710.8381	677.2846	628.2964	565.1407	489.0600	440.8077	430.7737	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9965	0.9902	0.9652	0.8895	0.7313	0.5618	0.6222	0.8697	0.9818	0.9967	0.9988	(86)
MIT	19.7243	19.8673	20.1264	20.4750	20.7712	20.9421	20.9878	20.9800	20.8523	20.4600	20.0313	19.7019	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9978	0.9953	0.9866	0.9516	0.8467	0.6408	0.4396	0.4979	0.8033	0.9724	0.9954	0.9983	(89)
MIT 2	18.2514	18.4618	18.8404	19.3468	19.7443	19.9430	19.9778	19.9757	19.8558	19.3343	18.7104	18.2254	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5366	18.7340	19.0895	19.5653	19.9432	20.1365	20.1734	20.1703	20.0488	19.5524	18.9662	18.5113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9932	0.9823	0.9447	0.8453	0.6557	0.4634	0.5219	0.8087	0.9670	0.9934	0.9974	(94)
Useful gains	452.6357	513.9821	580.2826	633.8910	610.8462	466.0713	313.8404	327.8942	457.0336	472.9141	437.8813	429.6606	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1303.8118	1263.5926	1146.9261	959.7421	740.0585	491.6845	317.3422	334.1484	530.5203	803.7285	1070.3374	1297.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating												3236.2880	(98)
Space heating per m2											(98) / (4) =	40.9139	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3464.9765	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	633.2751	503.7382	421.5827	234.6128	96.1340	0.0000	0.0000	0.0000	0.0000	246.1259	455.3684	645.4509	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	678.0247	539.3343	451.3734	251.1914	102.9272	0.0000	0.0000	0.0000	0.0000	263.5181	487.5465	691.0610	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7363	87.5409	87.0745	85.9666	83.8456	80.3000	80.3000	80.3000	80.3000	85.9680	87.2600	87.8196	(217)
Fuel for water heating, kWh/month													
	229.6607	201.8304	211.1162	189.6625	188.2719	173.1411	165.8823	184.9199	186.9622	198.8573	209.1333	224.0341	(219)
Water heating fuel used												2363.4720	(219)
Annual totals kWh/year													
Space heating fuel - main system												3464.9765	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6266.4591	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3464.9765	0.2160	748.4349	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2363.4720	0.2160	510.5099	(264)
Space and water heating			1258.9449	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1486.2724	(272)
Emissions per m2 for space and water heating			15.9159	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9159 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.3947	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3355	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4278	0.4194	0.4110	0.3691	0.3607	0.3187	0.3187	0.3103	0.3355	0.3607	0.3774	0.3942	(22b)
Effective ac	0.5915	0.5879	0.5845	0.5681	0.5650	0.5508	0.5508	0.5482	0.5563	0.5650	0.5712	0.5777	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9119	39.6722	39.4372	38.3335	38.1270	37.1657	37.1657	36.9876	37.5359	38.1270	38.5447	38.9815	(38)
Heat transfer coeff	97.2476	97.0079	96.7729	95.6691	95.4626	94.5013	94.5013	94.3233	94.8716	95.4626	95.8804	96.3171	(39)
Average = Sum(39)m / 12 =												95.6681	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2294	1.2264	1.2234	1.2095	1.2069	1.1947	1.1947	1.1925	1.1994	1.2069	1.2121	1.2177	(40)
HLP (average)												1.2095	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	419.6078	493.4932	581.4405	679.2059	743.5063	735.7275	701.0260	641.2931	566.0207	472.9657	410.9653	395.2416	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4853	56.6248	56.7623	57.4172	57.5414	58.1268	58.1268	58.2365	57.8999	57.5414	57.2907	57.0309	
alpha	4.7657	4.7750	4.7842	4.8278	4.8361	4.8751	4.8751	4.8824	4.8600	4.8361	4.8194	4.8021	
util living area													
	0.9988	0.9972	0.9913	0.9670	0.8931	0.7398	0.5733	0.6405	0.8836	0.9853	0.9976	0.9991	(86)
MIT	19.5898	19.7474	20.0313	20.4118	20.7370	20.9287	20.9836	20.9727	20.8182	20.3809	19.9167	19.5653	(87)
Th 2	19.8965	19.8989	19.9013	19.9124	19.9145	19.9242	19.9242	19.9260	19.9205	19.9145	19.9103	19.9059	(88)
util rest of house													
	0.9984	0.9962	0.9880	0.9537	0.8499	0.6459	0.4431	0.5083	0.8189	0.9773	0.9966	0.9988	(89)
MIT 2	18.6117	18.7708	19.0549	19.4358	19.7356	19.8913	19.9201	19.9182	19.8162	19.4128	18.9491	18.5947	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8011	18.9599	19.2440	19.6249	19.9296	20.0922	20.1261	20.1225	20.0102	19.6003	19.1365	18.7827	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8011	18.9599	19.2440	19.6249	19.9296	20.0922	20.1261	20.1225	20.0102	19.6003	19.1365	18.7827	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9950	0.9853	0.9493	0.8506	0.6619	0.4686	0.5340	0.8254	0.9741	0.9955	0.9984	(94)
Useful gains	418.6937	491.0314	572.9106	644.7616	632.4624	487.0003	328.5061	342.4748	467.2056	460.7391	409.1348	394.5971	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1410.2016	1363.9242	1233.2729	1026.0372	785.6161	519.0237	333.2210	351.1149	560.7136	859.1928	1154.0672	1404.5616	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	737.6819	586.5840	491.3095	274.5185	113.9464	0.0000	0.0000	0.0000	0.0000	296.4495	536.3513	751.4136	(98)
Space heating												3788.2547	(98)
Space heating per m2											(98) / (4) =	47.8920	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	888.3123	699.3097	716.8570	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9183	0.8889	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	761.2916	642.1751	637.2194	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.5588	909.1564	841.0208	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	136.9923	198.6341	151.6282	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												487.2547 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.2481	49.6585	37.9071	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												121.8137 (107)
Space cooling per m2												1.5400 (108)
Energy for space heating												47.8920 (99)
Energy for space cooling												1.5400 (108)
Total												49.4320 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	6.4700	19.6403	0.6300	0.7000	0.7700	38.8350	(76)
West	4.7500	19.6403	0.6300	0.7000	0.7700	28.5110	(80)

Solar gains	68.9709	134.8483	222.2386	324.9017	399.2094	409.1968	389.3470	333.6946	258.6800	160.0206	85.9770	56.7367	(83)
Total gains	409.7548	474.2291	549.6922	632.7914	686.4764	677.2708	645.4050	593.6224	529.0664	450.1056	398.6828	387.1364	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9990	0.9977	0.9928	0.9722	0.9055	0.7557	0.5863	0.6520	0.8924	0.9871	0.9979	0.9993	(86)
MIT	19.6720	19.8167	20.0798	20.4364	20.7460	20.9325	20.9853	20.9754	20.8293	20.4174	19.9820	19.6503	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9986	0.9968	0.9901	0.9610	0.8665	0.6663	0.4604	0.5248	0.8324	0.9802	0.9971	0.9990	(89)
MIT 2	18.7393	18.8857	19.1495	19.5084	19.7964	19.9504	19.9785	19.9769	19.8785	19.4958	19.0603	18.7253	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9200	19.0661	19.3297	19.6881	19.9803	20.1406	20.1735	20.1703	20.0626	19.6743	19.2388	18.9045	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9879	0.9570	0.8669	0.6815	0.4850	0.5496	0.8383	0.9774	0.9962	0.9986	(94)
Useful gains	408.9897	472.2560	543.0206	605.6016	595.1005	461.5536	313.0474	326.2660	443.5413	439.9348	397.1521	386.5956	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1338.9200	1293.9186	1168.8068	970.7914	743.3907	492.0467	317.3502	334.1500	531.7563	814.6767	1094.9241	1332.8361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	691.8682	552.1573	465.5849	262.9366	110.3279	0.0000	0.0000	0.0000	0.0000	278.8080	502.3958	704.0029	(98)
Space heating												3568.0816	(98)
Space heating per m2											(98) / (4) =	45.1085	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8594	0.9217	0.8939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.3769	605.7087	602.0755	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.2328	844.1448	785.3018	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.4162	177.3965	136.3204	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												433.1331	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   29.8541   44.3491   34.0801    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        108.2833 (107)
Space cooling per m2                                                                                                   1.3689 (108)
Energy for space heating                                                                                              45.1085 (99)
Energy for space cooling                                                                                               1.3689 (108)
Total                                                                                                                 46.4774 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   53.4 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4396	0.4082	0.4187	0.3977	0.3977	0.3873	0.3768	0.3663	0.3559	0.3873	0.3663	0.3873	(22b)
Effective ac	0.5966	0.5833	0.5876	0.5791	0.5791	0.5750	0.5710	0.5671	0.5633	0.5750	0.5671	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2575	39.3594	39.6514	39.0748	39.0748	38.7976	38.5278	38.2654	38.0104	38.7976	38.2654	38.7976	(38)
Heat transfer coeff	97.5931	96.6950	96.9870	96.4105	96.4105	96.1333	95.8635	95.6011	95.3461	96.1333	95.6011	96.1333	(39)
Average = Sum(39)m / 12 =												96.2423	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2338	1.2224	1.2261	1.2188	1.2188	1.2153	1.2119	1.2086	1.2054	1.2153	1.2086	1.2153	(40)
HLP (average)												1.2167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
RHI water heating demand												1591 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4557	715.0153	804.1234	900.6215	933.8570	956.9241	910.0037	858.6122	780.2948	686.6635	634.0707	618.0775	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2853	56.8080	56.6370	56.9757	56.9757	57.1400	57.3008	57.4581	57.6118	57.1400	57.4581	57.1400	
alpha	4.7524	4.7872	4.7758	4.7984	4.7984	4.8093	4.8201	4.8305	4.8408	4.8093	4.8305	4.8093	
util living area													
	0.9910	0.9854	0.9649	0.9012	0.7694	0.5552	0.4075	0.4298	0.7060	0.9247	0.9812	0.9925	(86)
MIT	19.9186	20.0467	20.3185	20.6516	20.8816	20.9804	20.9964	20.9956	20.9415	20.6622	20.2596	19.9150	(87)
Th 2	19.8931	19.9021	19.8992	19.9050	19.9050	19.9077	19.9105	19.9131	19.9157	19.9077	19.9131	19.9077	(88)
util rest of house													
	0.9880	0.9806	0.9531	0.8689	0.7016	0.4567	0.2955	0.3124	0.6092	0.8915	0.9738	0.9900	(89)
MIT 2	18.4909	18.6821	19.0679	19.5261	19.8041	19.8976	19.9095	19.9119	19.8779	19.5543	18.9994	18.4964	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9449	0.8634	0.7089	0.4753	0.3173	0.3353	0.6254	0.8863	0.9675	0.9862	(94)
Useful gains	641.7521	697.0636	759.8514	777.5596	662.0208	454.8221	288.7210	287.8937	488.0045	608.6042	613.4609	609.5234	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1353.3636	1319.5410	1193.9183	987.6397	724.3125	462.1409	289.5127	288.8895	513.3332	804.5244	1084.4510	1323.8660	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	529.4390	418.3048	322.9458	151.2577	46.3451	0.0000	0.0000	0.0000	0.0000	145.7646	339.1129	531.4708	(98)
Space heating												2484.6407	(98)
RHI space heating demand												2485	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5338	0.5233	0.5128	0.4605	0.4500	0.3977	0.3977	0.3873	0.4187	0.4500	0.4710	0.4919	(22b)
Effective ac	0.6425	0.6369	0.6315	0.6060	0.6013	0.5791	0.5791	0.5750	0.5876	0.6013	0.6109	0.6210	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3508	42.9776	42.6117	40.8931	40.5716	39.0748	39.0748	38.7976	39.6514	40.5716	41.2221	41.9021	(38)
Heat transfer coeff	100.6865	100.3132	99.9473	98.2288	97.9073	96.4105	96.4105	96.1333	96.9870	97.9073	98.5577	99.2377	(39)
Average = Sum(39)m / 12 =												98.2273	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2729	1.2682	1.2636	1.2418	1.2378	1.2188	1.2188	1.2153	1.2261	1.2378	1.2460	1.2546	(40)
HLP (average)												1.2418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1995	700.9744	779.3978	863.6037	914.6985	895.8841	855.6179	800.3933	733.8110	654.3916	606.7305	601.1930	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5560	54.7590	54.9595	55.9210	56.1047	56.9757	56.9757	57.1400	56.6370	56.1047	55.7344	55.3525	
alpha	4.6371	4.6506	4.6640	4.7281	4.7403	4.7984	4.7984	4.8093	4.7758	4.7403	4.7156	4.6902	
util living area													
	0.9934	0.9882	0.9736	0.9281	0.8239	0.6483	0.4870	0.5378	0.7867	0.9523	0.9879	0.9946	(86)
MIT	19.7743	19.9280	20.1969	20.5480	20.8166	20.9575	20.9912	20.9862	20.8924	20.5383	20.1008	19.7542	(87)
Th 2	19.8621	19.8658	19.8695	19.8867	19.8899	19.9050	19.9050	19.9077	19.8992	19.8899	19.8834	19.8766	(88)
util rest of house													
	0.9912	0.9844	0.9646	0.9034	0.7674	0.5536	0.3704	0.4175	0.7024	0.9306	0.9832	0.9929	(89)
MIT 2	18.2594	18.4848	18.8738	19.3752	19.7189	19.8783	19.9019	19.9025	19.8185	19.3754	18.7496	18.2404	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5528	18.7643	19.1300	19.6024	19.9315	20.0873	20.1129	20.1124	20.0265	19.6007	19.0113	18.5336	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5528	18.7643	19.1300	19.6024	19.9315	20.0873	20.1129	20.1124	20.0265	19.6007	19.0113	18.5336	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9791	0.9568	0.8958	0.7698	0.5703	0.3930	0.4408	0.7134	0.9233	0.9780	0.9898	(94)
Useful gains	622.3420	686.3020	745.7450	773.5741	704.1083	510.8822	336.2731	352.7780	523.4785	604.2071	593.3817	595.0343	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1435.0684	1390.7732	1262.3376	1051.2803	805.9229	529.0370	338.6812	356.8810	574.7956	881.2311	1173.9545	1422.4341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	604.6685	473.4047	384.3449	199.9485	75.7501	0.0000	0.0000	0.0000	0.0000	206.1059	418.0124	615.5855	(98)
Space heating												2977.8204	(98)
Space heating per m2											(98) / (4) =	37.6463	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3191.6617	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	604.6685	473.4047	384.3449	199.9485	75.7501	0.0000	0.0000	0.0000	0.0000	206.1059	418.0124	615.5855	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	648.0906	507.4005	411.9452	214.3071	81.1898	0.0000	0.0000	0.0000	0.0000	220.9066	448.0304	659.7915	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5132	89.4415	89.2712	88.8476	88.0216	86.7000	86.7000	86.7000	86.7000	88.8416	89.3413	89.5421	(217)
Fuel for water heating, kWh/month													
	181.4081	159.1501	165.4078	146.1285	142.4554	126.1873	118.3042	133.8032	134.8228	151.6872	163.0658	176.0336	(219)
Water heating fuel used												1798.4539	(219)
Annual totals kWh/year													
Space heating fuel - main system												3191.6617	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4839.8367	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3191.6617	3.4800	111.0698	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1798.4539	3.4800	62.5862	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			273.8342	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9268	(257)
SAP value		87.0718	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3191.6617	0.2160	689.3989	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1798.4539	0.2160	388.4660	(264)
Space and water heating			1077.8650	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			999.8702	(272)
CO2 emissions per m2			12.6400	(273)
EI value			89.2037	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8830 = 3.941, stars = 4
Water heating environmental impact	0.216 / 0.8830 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4396	0.4082	0.4187	0.3977	0.3977	0.3873	0.3768	0.3663	0.3559	0.3873	0.3663	0.3873	(22b)
Effective ac	0.5966	0.5833	0.5876	0.5791	0.5791	0.5750	0.5710	0.5671	0.5633	0.5750	0.5671	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2575	39.3594	39.6514	39.0748	39.0748	38.7976	38.5278	38.2654	38.0104	38.7976	38.2654	38.7976	(38)
Heat transfer coeff	97.5931	96.6950	96.9870	96.4105	96.4105	96.1333	95.8635	95.6011	95.3461	96.1333	95.6011	96.1333	(39)
Average = Sum(39)m / 12 =												96.2423	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2338	1.2224	1.2261	1.2188	1.2188	1.2153	1.2119	1.2086	1.2054	1.2153	1.2086	1.2153	(40)
HLP (average)												1.2167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264	(83)
Total gains	652.4557	715.0153	804.1234	900.6215	933.8570	956.9241	910.0037	858.6122	780.2948	686.6635	634.0707	618.0775	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2853	56.8080	56.6370	56.9757	56.9757	57.1400	57.3008	57.4581	57.6118	57.1400	57.4581	57.1400	
alpha	4.7524	4.7872	4.7758	4.7984	4.7984	4.8093	4.8201	4.8305	4.8408	4.8093	4.8305	4.8093	
util living area													
	0.9910	0.9854	0.9649	0.9012	0.7694	0.5552	0.4075	0.4298	0.7060	0.9247	0.9812	0.9925	(86)
MIT	19.9186	20.0467	20.3185	20.6516	20.8816	20.9804	20.9964	20.9956	20.9415	20.6622	20.2596	19.9150	(87)
Th 2	19.8931	19.9021	19.8992	19.9050	19.9050	19.9077	19.9105	19.9131	19.9157	19.9077	19.9131	19.9077	(88)
util rest of house													
	0.9880	0.9806	0.9531	0.8689	0.7016	0.4567	0.2955	0.3124	0.6092	0.8915	0.9738	0.9900	(89)
MIT 2	18.4909	18.6821	19.0679	19.5261	19.8041	19.8976	19.9095	19.9119	19.8779	19.5543	18.9994	18.4964	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9449	0.8634	0.7089	0.4753	0.3173	0.3353	0.6254	0.8863	0.9675	0.9862	(94)
Useful gains	641.7521	697.0636	759.8514	777.5596	662.0208	454.8221	288.7210	287.8937	488.0045	608.6042	613.4609	609.5234	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1353.3636	1319.5410	1193.9183	987.6397	724.3125	462.1409	289.5127	288.8895	513.3332	804.5244	1084.4510	1323.8660	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	529.4390	418.3048	322.9458	151.2577	46.3451	0.0000	0.0000	0.0000	0.0000	145.7646	339.1129	531.4708	(98)
Space heating												2484.6407	(98)
Space heating per m2											(98) / (4) =	31.4114	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2663.0661	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	529.4390	418.3048	322.9458	151.2577	46.3451	0.0000	0.0000	0.0000	0.0000	145.7646	339.1129	531.4708	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	567.4587	448.3439	346.1369	162.1197	49.6732	0.0000	0.0000	0.0000	0.0000	156.2322	363.4651	569.6365	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4284	89.3580	89.1387	88.6008	87.6429	86.7000	86.7000	86.7000	86.7000	88.5340	89.1871	89.4504	(217)
Fuel for water heating, kWh/month													
	181.5799	159.2988	165.6537	146.5357	143.0708	126.1873	118.3042	133.8032	134.8228	152.2142	163.3475	176.2140	(219)
Water heating fuel used												1801.0320	(219)
Annual totals kWh/year													
Space heating fuel - main system												2663.0661	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4234.0095	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2663.0661	7.3800	196.5343	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1801.0320	7.3800	132.9162	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			370.5070	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2663.0661	0.2160	575.2223	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.0320	0.2160	389.0229	(264)
Space and water heating			964.2452	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			844.8292	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2663.0661	1.2200	3248.9407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.0320	1.2200	2197.2591	(264)
Space and water heating			5446.1997	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4739.8276	(272)
Primary energy kWh/m2/year			59.9220	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.8%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.33 kg/m²	B 88	B 91
Total Savings	£58	2.33 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£436	£365	£72
Space heating	£325	£325	£0
Water heating	£133	£75	£58
Lighting	£104	£104	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£371	£314	£58
Total cost of uses	£371	£313	£58
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	47 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5338	0.5233	0.5128	0.4605	0.4500	0.3977	0.3977	0.3873	0.4187	0.4500	0.4710	0.4919	(22b)
Effective ac	0.6425	0.6369	0.6315	0.6060	0.6013	0.5791	0.5791	0.5750	0.5876	0.6013	0.6109	0.6210	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.3508	42.9776	42.6117	40.8931	40.5716	39.0748	39.0748	38.7976	39.6514	40.5716	41.2221	41.9021	(38)
Heat transfer coeff	100.6865	100.3132	99.9473	98.2288	97.9073	96.4105	96.4105	96.1333	96.9870	97.9073	98.5577	99.2377	(39)
Average = Sum(39)m / 12 =												98.2273	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2729	1.2682	1.2636	1.2418	1.2378	1.2188	1.2188	1.2153	1.2261	1.2378	1.2460	1.2546	(40)
HLP (average)												1.2418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m2	1079.5246	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1813.6014	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.2491	(H8)
Utilisation factor	0.5509	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	92.2821	(H14)
Volume ratio Veff/V	0.8127	(H15)
Solar storage volume factor	0.9585	(H16)
Solar input	-842.1367	(H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
								Total per year (kWh/year) = Sum(64)m =				760.9040	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	10.6334	0.7200	0.7000	0.7700	1.8570	(74)
East	6.4700	19.6403	0.7200	0.7000	0.7700	44.3829	(76)
West	4.7500	19.6403	0.7200	0.7000	0.7700	32.5840	(80)

Solar gains	78.8239	154.1123	253.9870	371.3162	456.2394	467.6535	444.9680	381.3653	295.6342	182.8807	98.2595	64.8419	(83)
Total gains	630.1995	700.9744	779.3978	863.6037	914.6985	895.8841	855.6179	800.3933	733.8110	654.3916	606.7305	601.1930	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5560	54.7590	54.9595	55.9210	56.1047	56.9757	56.9757	57.1400	56.6370	56.1047	55.7344	55.3525	
alpha	4.6371	4.6506	4.6640	4.7281	4.7403	4.7984	4.7984	4.8093	4.7758	4.7403	4.7156	4.6902	
util living area													
	0.9934	0.9882	0.9736	0.9281	0.8239	0.6483	0.4870	0.5378	0.7867	0.9523	0.9879	0.9946	(86)
MIT	19.7743	19.9280	20.1969	20.5480	20.8166	20.9575	20.9912	20.9862	20.8924	20.5383	20.1008	19.7542	(87)
Th 2	19.8621	19.8658	19.8695	19.8867	19.8899	19.9050	19.9050	19.9077	19.8992	19.8899	19.8834	19.8766	(88)
util rest of house													
	0.9912	0.9844	0.9646	0.9034	0.7674	0.5536	0.3704	0.4175	0.7024	0.9306	0.9832	0.9929	(89)
MIT 2	18.2594	18.4848	18.8738	19.3752	19.7189	19.8783	19.9019	19.9025	19.8185	19.3754	18.7496	18.2404	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5528	18.7643	19.1300	19.6024	19.9315	20.0873	20.1129	20.1124	20.0265	19.6007	19.0113	18.5336	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5528	18.7643	19.1300	19.6024	19.9315	20.0873	20.1129	20.1124	20.0265	19.6007	19.0113	18.5336	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9791	0.9568	0.8958	0.7698	0.5703	0.3930	0.4408	0.7134	0.9233	0.9780	0.9898	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	622.3420	686.3020	745.7450	773.5741	704.1083	510.8822	336.2731	352.7780	523.4785	604.2071	593.3817	595.0343	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1435.0684	1390.7732	1262.3376	1051.2803	805.9229	529.0370	338.6812	356.8810	574.7956	881.2311	1173.9545	1422.4341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	604.6685	473.4047	384.3449	199.9485	75.7501	0.0000	0.0000	0.0000	0.0000	206.1059	418.0124	615.5855	(98)

Space heating 2977.8204 (98)
Space heating per m2 (98) / (4) = 37.6463 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3191.6617 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	604.6685	473.4047	384.3449	199.9485	75.7501	0.0000	0.0000	0.0000	0.0000	206.1059	418.0124	615.5855	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	648.0906	507.4005	411.9452	214.3071	81.1898	0.0000	0.0000	0.0000	0.0000	220.9066	448.0304	659.7915	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6088	89.6423	89.6701	89.7207	89.8465	86.7000	86.7000	86.7000	86.7000	89.2392	89.4889	89.6218	(217)
Fuel for water heating, kWh/month	153.9624	113.3345	87.2741	41.0368	11.6659	0.0000	0.0000	21.4592	46.8349	92.6356	130.4284	153.0749	(219)

Water heating fuel used 851.7067 (219)
Annual totals kWh/year
Space heating fuel - main system 3191.6617 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) = -588.2895 -588.2895 (233)
Total delivered energy for all uses 3943.0896 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3191.6617	3.4800	111.0698	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	851.7067	3.4800	29.6394	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			247.4824	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8376 (257)
SAP value 88.3159
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3191.6617	0.2160	689.3989	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	851.7067	0.2160	183.9687	(264)
Space and water heating			873.3676	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			821.3228 (272)
CO2 emissions per m2			10.3800 (273)
EI value			91.1316
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.9600	
Infiltration rate		0.4925	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4187	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4396	0.4082	0.4187	0.3977	0.3977	0.3873	0.3768	0.3663	0.3559	0.3873	0.3663	0.3873	(22b)
Effective ac	0.5966	0.5833	0.5876	0.5791	0.5791	0.5750	0.5710	0.5671	0.5633	0.5750	0.5671	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2575	39.3594	39.6514	39.0748	39.0748	38.7976	38.5278	38.2654	38.0104	38.7976	38.2654	38.7976	(38)
Heat transfer coeff	97.5931	96.6950	96.9870	96.4105	96.4105	96.1333	95.8635	95.6011	95.3461	96.1333	95.6011	96.1333	(39)
Average = Sum(39)m / 12 =												96.2423	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2338	1.2224	1.2261	1.2188	1.2188	1.2153	1.2119	1.2086	1.2054	1.2153	1.2086	1.2153	(40)
HLP (average)												1.2167	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755 (64)
								Total per year (kWh/year) = Sum(64)m =				737.9213 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.5000	13.4839	0.7200	0.7000	0.7700	2.3548	(74)
East	6.4700	25.1925	0.7200	0.7000	0.7700	56.9298	(76)
West	4.7500	25.1925	0.7200	0.7000	0.7700	41.7955	(80)

Solar gains	101.0801	168.1532	278.7126	408.3341	475.3978	528.6935	499.3537	439.5841	342.1180	215.1526	125.5997	81.7264 (83)
Total gains	652.4557	715.0153	804.1234	900.6215	933.8570	956.9241	910.0037	858.6122	780.2948	686.6635	634.0707	618.0775 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2853	56.8080	56.6370	56.9757	56.9757	57.1400	57.3008	57.4581	57.6118	57.1400	57.4581	57.1400	
alpha	4.7524	4.7872	4.7758	4.7984	4.7984	4.8093	4.8201	4.8305	4.8408	4.8093	4.8305	4.8093	
util living area													
	0.9910	0.9854	0.9649	0.9012	0.7694	0.5552	0.4075	0.4298	0.7060	0.9247	0.9812	0.9925	(86)
MIT	19.9186	20.0467	20.3185	20.6516	20.8816	20.9804	20.9964	20.9956	20.9415	20.6622	20.2596	19.9150	(87)
Th 2	19.8931	19.9021	19.8992	19.9050	19.9050	19.9077	19.9105	19.9131	19.9157	19.9077	19.9131	19.9077	(88)
util rest of house													
	0.9880	0.9806	0.9531	0.8689	0.7016	0.4567	0.2955	0.3124	0.6092	0.8915	0.9738	0.9900	(89)
MIT 2	18.4909	18.6821	19.0679	19.5261	19.8041	19.8976	19.9095	19.9119	19.8779	19.5543	18.9994	18.4964	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7674	18.9464	19.3101	19.7441	20.0128	20.1073	20.1201	20.1218	20.0839	19.7688	19.2435	18.7711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9836	0.9749	0.9449	0.8634	0.7089	0.4753	0.3173	0.3353	0.6254	0.8863	0.9675	0.9862	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	641.7521	697.0636	759.8514	777.5596	662.0208	454.8221	288.7210	287.8937	488.0045	608.6042	613.4609	609.5234 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1353.3636	1319.5410	1193.9183	987.6397	724.3125	462.1409	289.5127	288.8895	513.3332	804.5244	1084.4510	1323.8660 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	529.4390	418.3048	322.9458	151.2577	46.3451	0.0000	0.0000	0.0000	0.0000	145.7646	339.1129	531.4708 (98)

Space heating 2484.6407 (98)
Space heating per m2 (98) / (4) = 31.4114 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2663.0661 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	529.4390	418.3048	322.9458	151.2577	46.3451	0.0000	0.0000	0.0000	0.0000	145.7646	339.1129	531.4708	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	567.4587	448.3439	346.1369	162.1197	49.6732	0.0000	0.0000	0.0000	0.0000	156.2322	363.4651	569.6365	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5496	89.5720	89.5767	89.5881	89.3949	86.7000	86.7000	86.7000	86.7000	89.0031	89.3789	89.5505	(217)
Fuel for water heating, kWh/month													
	149.4903	113.6492	87.0415	39.9610	16.7189	0.0000	0.0000	14.5769	41.4769	88.5458	125.2621	149.8323	(219)
Water heating fuel used												826.5548	(219)

Annual totals kWh/year
Space heating fuel - main system 2663.0661 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) = -668.0993 -668.0993 (233)
Total delivered energy for all uses 3309.5323 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2663.0661	7.3800	196.5343	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	826.5548	7.3800	60.9997	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			312.9206	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2663.0661	0.2160	575.2223	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	826.5548	0.2160	178.5358	(264)
Space and water heating			753.7581	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			660.2921	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2663.0661	1.2200	3248.9407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	826.5548	1.2200	1008.3969	(264)
Space and water heating			4257.3376	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3704.4654	(272)
Primary energy kWh/m2/year			46.8327	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.5000	87.1704	0.7200	0.7000	0.7650	15.1242
East	6.4700	125.2818	0.7200	0.7000	0.7650	281.2721
West	4.7500	125.2818	0.7200	0.7000	0.7650	206.4981
total:						502.8945

	Jun	Jul	Aug	
Solar gains	541	503	441	(P3)
Internal gains	425	408	416	
Total summer gains	966	911	857	(P5)
Summer gain/loss ratio	1.62	1.52	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.07	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 397 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 397	**Prop Type Ref**	
Property	40 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	14.60	**TER**	18.79
Environmental	89 B	**% DER<TER**	22.30		
CO_2 Emissions (t/year)	0.84	**DFEE**	49.43	**TFEE**	53.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.52		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.79	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.60	$kgCO_2/m^2$	Pass
	-4.19 (-22.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.45	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.43	$kWh/m^2/yr$	
	-4.0 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.96 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	0.50 m², No overhang 6.47 m², No overhang 4.75 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.96 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 398 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	41 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	15.10	**TER**	19.12
Environmental	88 B	**% DER<TER**	21.01		
CO_2 Emissions (t/year)	1.12	**DFEE**	56.93	**TFEE**	61.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.12 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.10 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.9 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.84 (measured in this dwelling)
Maximum                                 10.0                                            OK
-------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
-------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
-------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   6.67 m², No overhang
Windows facing East:                    7.18 m², No overhang
Windows facing South:                   1.30 m², No overhang
Windows facing South West:              1.02 m², No overhang
Windows facing West:                    5.23 m², No overhang
Windows facing North West:              1.02 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
-------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.025 W/m²K
Photovoltaic array                      0.81 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4354	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3415	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.4168	49.1110	48.8113	47.4036	47.1403	45.9142	45.9142	45.6872	46.3865	47.1403	47.6731	48.2301	(38)
Heat transfer coeff	139.3785	139.0727	138.7730	137.3653	137.1020	135.8759	135.8759	135.6489	136.3482	137.1020	137.6348	138.1918	(39)
Average = Sum(39)m / 12 =												137.3641	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4307	1.4276	1.4245	1.4100	1.4073	1.3947	1.3947	1.3924	1.3996	1.4073	1.4128	1.4185	(40)
HLP (average)												1.4100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584	(61)
Total heat required for water heating calculated for each month													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(64)
									Total per year (kWh/year) = Sum(64)m =			1691.3171	(64)
Heat gains from water heating, kWh/month													
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	417.1947	415.0151	399.9551	375.5305	350.5256	326.5517	311.0470	317.3617	329.9638	354.6139	382.9634	404.4233	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
East	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(76)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	565.4524	694.1640	844.2307	1016.8428	1141.8818	1141.6729	1084.8337	976.4453	842.9563	680.7460	565.5906	527.9246	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5389	48.6456	48.7507	49.2503	49.3449	49.7901	49.7901	49.8735	49.6177	49.3449	49.1538	48.9557	
alpha	4.2359	4.2430	4.2500	4.2834	4.2897	4.3193	4.3193	4.3249	4.3078	4.2897	4.2769	4.2637	
util living area													
	0.9981	0.9952	0.9854	0.9489	0.8528	0.6885	0.5314	0.6024	0.8533	0.9776	0.9962	0.9986	(86)
MIT	19.3829	19.5793	19.9163	20.3582	20.7226	20.9228	20.9803	20.9670	20.7957	20.2998	19.7583	19.3508	(87)
Th 2	19.7399	19.7423	19.7446	19.7557	19.7577	19.7674	19.7674	19.7692	19.7636	19.7577	19.7535	19.7492	(88)
util rest of house													
	0.9974	0.9935	0.9798	0.9289	0.7973	0.5836	0.3923	0.4585	0.7744	0.9655	0.9945	0.9981	(89)
MIT 2	17.6068	17.8949	18.3854	19.0187	19.4957	19.7190	19.7608	19.7566	19.6024	18.9508	18.1647	17.5660	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	17.9677	18.2372	18.6965	19.2909	19.7450	19.9636	20.0087	20.0026	19.8449	19.2250	18.4886	17.9287	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9677	18.2372	18.6965	19.2909	19.7450	19.9636	20.0087	20.0026	19.8449	19.2250	18.4886	17.9287	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9903	0.9732	0.9193	0.7966	0.6018	0.4207	0.4876	0.7807	0.9580	0.9918	0.9969	(94)
Useful gains	563.1309	687.4146	821.6342	934.7338	909.6680	687.0346	456.3656	476.1439	658.0749	652.1701	560.9482	526.2923	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1904.9882	1854.8431	1692.5499	1427.3550	1102.9878	728.7907	463.1589	488.6894	783.3077	1182.5015	1567.4696	1897.1940	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	998.3418	784.5120	647.9613	354.6873	143.8299	0.0000	0.0000	0.0000	0.0000	394.5666	724.6954	1019.9508	(98)
Space heating												5068.5450	(98)
Space heating per m2											(98) / (4) =	52.0278	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5432.5242	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	998.3418	784.5120	647.9613	354.6873	143.8299	0.0000	0.0000	0.0000	0.0000	394.5666	724.6954	1019.9508	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1070.0341	840.8488	694.4923	380.1578	154.1585	0.0000	0.0000	0.0000	0.0000	422.9009	776.7368	1093.1949	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7501	89.6972	89.5742	89.2616	88.5319	86.7000	86.7000	86.7000	86.7000	89.3120	89.6442	89.7736	(217)
Fuel for water heating, kWh/month													
	192.5552	168.8771	175.3802	154.6655	150.5473	134.0399	125.5808	142.1545	143.2752	160.4503	172.9021	186.8359	(219)
Water heating fuel used												1907.2639	(219)
Annual totals kWh/year													
Space heating fuel - main system												5432.5242	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												7119.5733	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5432.5242	0.2160	1173.4252	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.2639	0.2160	411.9690	(264)
Space and water heating			1585.3942	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1471.1028	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.1000	ZC1
Total Floor Area	TFA	97.4200	
Assumed number of occupants	N	2.7143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3338	ZC2
CO2 emissions from cooking, equation (L16)		1.8902	ZC3
Total CO2 emissions		32.3240	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.3240	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1192	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3692	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6837	47.2620	43.7911	45.2508	47.2620	47.6837	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (64)
								Total per year (kWh/year) = Sum(64)m =				2130.4990 (64)
Heat gains from water heating, kWh/month												
	66.2554	58.3120	61.0384	54.0289	52.2191	45.8130	43.6205	48.8892	49.4374	56.4615	60.0545	64.5668 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	89.0530	86.7738	82.0409	75.0402	70.1870	63.6292	58.6297	65.7112	68.6630	75.8891	83.4090	86.7833	(72)
Total internal gains													
	430.4164	428.2307	413.1638	388.1707	362.4878	337.8443	322.3490	329.3371	342.6228	367.8413	396.1910	417.6510	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(76)
South	1.1700	46.7521	0.6300	0.7000	0.7700	16.7170	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(80)
Northwest	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(81)

Solar gains	116.6585	219.6404	349.5456	504.5533	622.5964	641.2941	608.7739	518.5325	403.6038	256.6016	143.7003	97.1802	(83)
Total gains	547.0750	647.8711	762.7095	892.7240	985.0843	979.1384	931.1229	847.8695	746.2266	624.4429	539.8913	514.8313	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area													
	0.9984	0.9963	0.9893	0.9619	0.8821	0.7269	0.5644	0.6328	0.8744	0.9820	0.9968	0.9988	(86)
MIT	19.5308	19.6980	19.9925	20.3846	20.7252	20.9230	20.9813	20.9689	20.8067	20.3551	19.8690	19.4998	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house													
	0.9979	0.9950	0.9852	0.9467	0.8351	0.6286	0.4292	0.4950	0.8049	0.9722	0.9955	0.9984	(89)
MIT 2	17.8916	18.1368	18.5662	19.1314	19.5861	19.8116	19.8558	19.8511	19.7007	19.0996	18.3930	17.8508	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.2247	18.4541	18.8561	19.3861	19.8176	20.0375	20.0846	20.0783	19.9254	19.3547	18.6930	18.1859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2247	18.4541	18.8561	19.3861	19.8176	20.0375	20.0846	20.0783	19.9254	19.3547	18.6930	18.1859	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9926	0.9802	0.9385	0.8332	0.6452	0.4568	0.5228	0.8097	0.9661	0.9933	0.9975	(94)
Useful gains	545.2606	643.1049	747.6065	837.8644	820.8114	631.7209	425.2957	443.2597	604.2346	603.2844	536.2995	513.5297	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1760.3739	1710.6065	1556.8081	1310.8402	1013.2615	674.0410	431.9515	455.3851	724.0644	1092.7890	1451.4016	1756.4560	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	904.0443	717.3610	602.0460	340.5426	143.1828	0.0000	0.0000	0.0000	0.0000	364.1915	658.8735	924.7371	(98)
Space heating												4654.9789	(98)
Space heating per m2											(98) / (4) =	47.7826	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4983.9174	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	904.0443	717.3610	602.0460	340.5426	143.1828	0.0000	0.0000	0.0000	0.0000	364.1915	658.8735	924.7371	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	967.9275	768.0525	644.5889	364.6066	153.3007	0.0000	0.0000	0.0000	0.0000	389.9266	705.4320	990.0826	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2912	88.1104	87.6889	86.7075	84.6403	80.3000	80.3000	80.3000	80.3000	86.7578	87.8968	88.3684	(217)
Fuel for water heating, kWh/month													
	240.0105	212.0007	223.7663	201.0487	199.4045	185.1171	177.3563	197.7107	199.8942	210.3015	219.4064	234.0540	(219)
Water heating fuel used												2500.0711	(219)
Annual totals kWh/year													
Space heating fuel - main system												4983.9174	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.4259	(232)
Total delivered energy for all uses												7957.4144	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4983.9174	0.2160	1076.5262	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2500.0711	0.2160	540.0153	(264)
Space and water heating			1616.5415	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.4259	0.5190	206.7830	(268)
Total CO2, kg/m2/year			1862.2496	(272)
Emissions per m2 for space and water heating			16.5935	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1226	(272b)
Emissions per m2 for pumps and fans			0.3996	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5935 * 1.00) + 2.1226 + 0.3996, rounded to 2 d.p.			19.1200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.3612	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2799	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3569	0.3499	0.3429	0.3079	0.3009	0.2659	0.2659	0.2589	0.2799	0.3009	0.3149	0.3289	(22b)
Effective ac	0.5637	0.5612	0.5588	0.5474	0.5453	0.5354	0.5354	0.5335	0.5392	0.5453	0.5496	0.5541	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8335	46.6280	46.4266	45.4808	45.3038	44.4800	44.4800	44.3275	44.7974	45.3038	45.6618	46.0361	(38)
Heat transfer coeff	136.7952	136.5897	136.3884	135.4425	135.2655	134.4418	134.4418	134.2892	134.7591	135.2655	135.6235	135.9978	(39)
Average = Sum(39)m / 12 =												135.4417	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4042	1.4021	1.4000	1.3903	1.3885	1.3800	1.3800	1.3785	1.3833	1.3885	1.3922	1.3960	(40)
HLP (average)												1.3903	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.2469	382.8934	369.5490	347.4597	323.9722	302.1328	288.4394	292.4302	304.2044	326.4377	352.0614	372.2982 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
East	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(76)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	532.5046	662.0423	813.8246	988.7721	1115.3285	1117.2540	1062.2262	951.5138	817.1968	652.5698	534.6886	495.7995	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4555	49.5299	49.6030	49.9494	50.0148	50.3213	50.3213	50.3784	50.2028	50.0148	49.8828	49.7455	
alpha	4.2970	4.3020	4.3069	4.3300	4.3343	4.3548	4.3548	4.3586	4.3469	4.3343	4.3255	4.3164	
util living area	0.9985	0.9960	0.9870	0.9523	0.8579	0.6948	0.5367	0.6108	0.8614	0.9805	0.9969	0.9989	(86)
MIT	19.3851	19.5808	19.9172	20.3560	20.7218	20.9221	20.9802	20.9661	20.7911	20.2914	19.7516	19.3489	(87)
Th 2	19.7601	19.7617	19.7633	19.7708	19.7722	19.7787	19.7787	19.7799	19.7762	19.7722	19.7694	19.7664	(88)
util rest of house	0.9980	0.9946	0.9821	0.9335	0.8038	0.5906	0.3977	0.4669	0.7852	0.9698	0.9956	0.9985	(89)
MIT 2	18.3012	18.4976	18.8323	19.2634	19.5917	19.7451	19.7742	19.7710	19.6622	19.2106	18.6744	18.2699	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5215	18.7178	19.0528	19.4854	19.8214	19.9843	20.0193	20.0139	19.8916	19.4303	18.8933	18.4892	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5215	18.7178	19.0528	19.4854	19.8214	19.9843	20.0193	20.0139	19.8916	19.4303	18.8933	18.4892	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9928	0.9783	0.9280	0.8063	0.6097	0.4263	0.4964	0.7938	0.9656	0.9942	0.9979	(94)
Useful gains	531.0256	657.2814	796.1314	917.5321	899.3135	681.1914	452.8216	472.3159	648.7065	630.1272	531.5678	494.7830	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1945.4301	1887.3630	1712.0594	1433.7172	1098.5406	723.8720	459.6943	485.3081	780.4725	1194.4299	1599.4492	1943.2959	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1052.3170	826.6148	681.4504	371.6533	148.2250	0.0000	0.0000	0.0000	0.0000	419.8412	768.8746	1077.6936	(98)
Space heating												5346.6699	(98)
Space heating per m2										(98) / (4) =		54.8827	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1263.7525	994.8690	1020.5979	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8547	0.9122	0.8768	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1080.1825	907.5179	894.8850	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1409.4443	1342.8965	1215.2994	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	237.0685	323.9217	238.3883	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												799.3784 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	59.2671	80.9804	59.5971	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												199.8446 (107)
Space cooling per m2												2.0514 (108)
Energy for space heating												54.8827 (99)
Energy for space cooling												2.0514 (108)
Total												56.9340 (109)
Dwelling Fabric Energy Efficiency (DFEE)												56.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.3336	382.9704	369.6116	347.5071	324.0076	302.1627	288.4717	292.4722	304.2607	326.5093	352.1450	372.3873 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(76)
South	1.1700	46.7521	0.6300	0.7000	0.7700	16.7170	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	4.7000	19.6403	0.6300	0.7000	0.7700	28.2109	(80)
Northwest	0.9200	11.2829	0.6300	0.7000	0.7700	3.1724	(81)

Solar gains	116.6585	219.6404	349.5456	504.5533	622.5964	641.2941	608.7739	518.5325	403.6038	256.6016	143.7003	97.1802	(83)
Total gains	500.9921	602.6108	719.1573	852.0604	946.6041	943.4568	897.2457	811.0047	707.8645	583.1109	495.8453	469.5675	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area	0.9989	0.9973	0.9915	0.9677	0.8944	0.7449	0.5827	0.6553	0.8912	0.9861	0.9978	0.9992	(86)
MIT	19.4878	19.6561	19.9535	20.3524	20.7042	20.9146	20.9787	20.9641	20.7863	20.3192	19.8282	19.4574	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house	0.9985	0.9963	0.9882	0.9544	0.8504	0.6474	0.4445	0.5155	0.8269	0.9784	0.9968	0.9989	(89)
MIT 2	18.4677	18.6369	18.9339	19.3306	19.6549	19.8233	19.8572	19.8536	19.7368	19.3049	18.8154	18.4425	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.6750	18.8441	19.1411	19.5383	19.8682	20.0451	20.0851	20.0793	19.9501	19.5111	19.0212	18.6488	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6750	18.8441	19.1411	19.5383	19.8682	20.0451	20.0851	20.0793	19.9501	19.5111	19.0212	18.6488	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9951	0.9854	0.9497	0.8509	0.6647	0.4729	0.5441	0.8332	0.9752	0.9958	0.9985	(94)
Useful gains	499.9826	599.6572	708.6927	809.1694	805.5060	627.0989	424.3493	441.2455	589.7891	568.6240	493.7642	468.8654	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1817.2981	1759.8260	1592.7277	1329.8607	1019.5747	674.9838	432.0253	455.5073	727.1270	1112.3026	1492.4954	1814.5897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	980.0827	779.6334	657.7221	374.8977	159.2671	0.0000	0.0000	0.0000	0.0000	404.4969	719.0864	1001.2189	(98)
Space heating												5076.4053	(98)
Space heating per m2										(98) / (4) =		52.1085	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1165.2410	917.3174	940.8984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8366	0.9016	0.8651	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	974.8369	827.0624	813.9840	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1206.3446	1150.1052	1051.1239	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	166.6855	240.3438	176.4320	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												583.4614 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	41.6714	60.0860	44.1080	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												145.8653 (107)
Space cooling per m2												1.4973 (108)
Energy for space heating												52.1085 (99)
Energy for space cooling												1.4973 (108)
Total												53.6057 (109)
Target Fabric Energy Efficiency (TFEE)												61.6 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982 (1b) - (3b)	
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3585	0.3329	0.3415	0.3244	0.3244	0.3158	0.3073	0.2988	0.2902	0.3158	0.2988	0.3158	(22b)
Effective ac	0.5643	0.5554	0.5583	0.5526	0.5526	0.5499	0.5472	0.5446	0.5421	0.5499	0.5446	0.5499	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8829	46.1473	46.3865	45.9142	45.9142	45.6872	45.4662	45.2512	45.0424	45.6872	45.2512	45.6872	(38)
Heat transfer coeff	136.8446	136.1090	136.3482	135.8759	135.8759	135.6489	135.4279	135.2130	135.0041	135.6489	135.2130	135.6489	(39)
Average = Sum(39)m / 12 =												135.7382	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4047	1.3971	1.3996	1.3947	1.3947	1.3924	1.3901	1.3879	1.3858	1.3924	1.3879	1.3924	(40)
HLP (average)												1.3933	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584 (61)
Total heat required for water heating calculated for each month												
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.3171 (64)
RHI water heating demand												1691 (64)
Heat gains from water heating, kWh/month												
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	619.6401	614.9798	591.0816	553.8294	515.4448	481.1241	461.0779	469.8734	491.3138	528.7914	570.5206	602.3273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
East	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(76)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539	(83)
Total gains	807.3218	916.5727	1076.2826	1259.1917	1342.2442	1405.7133	1332.1265	1230.6625	1083.4094	909.4071	801.1552	755.8811	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4377	49.7048	49.6177	49.7901	49.7901	49.8735	49.9548	50.0342	50.1117	49.8735	50.0342	49.8735	
alpha	4.2958	4.3137	4.3078	4.3193	4.3193	4.3249	4.3303	4.3356	4.3408	4.3249	4.3356	4.3249	
util living area													
	0.9915	0.9850	0.9612	0.8881	0.7465	0.5306	0.3921	0.4222	0.7037	0.9251	0.9822	0.9932	(86)
MIT	19.7076	19.8616	20.1937	20.5899	20.8588	20.9747	20.9946	20.9929	20.9185	20.5744	20.0904	19.6893	(87)
Th 2	19.7597	19.7655	19.7636	19.7674	19.7674	19.7692	19.7709	19.7726	19.7742	19.7692	19.7726	19.7692	(88)
util rest of house													
	0.9885	0.9799	0.9478	0.8511	0.6715	0.4247	0.2708	0.2926	0.5975	0.8900	0.9748	0.9908	(89)
MIT 2	18.0927	18.3188	18.7909	19.3303	19.6509	19.7567	19.7696	19.7709	19.7232	19.3285	18.6569	18.0727	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9733	0.9380	0.8447	0.6801	0.4457	0.2956	0.3192	0.6157	0.8833	0.9677	0.9867	(94)
Useful gains	794.2549	892.0921	1009.5986	1063.6407	912.8728	626.5099	393.8156	392.7781	667.0631	803.2523	775.2924	745.8619	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1850.2658	1814.6548	1646.5481	1370.4839	1004.9949	638.1320	395.2602	394.7199	710.9509	1109.8411	1493.8712	1817.8666	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	785.6721	619.9621	473.8904	220.9271	68.5389	0.0000	0.0000	0.0000	0.0000	228.1021	517.3767	797.5715	(98)
Space heating												3712.0409	(98)
RHI space heating demand												3712	(98)

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4354	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3415	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.4168	49.1110	48.8113	47.4036	47.1403	45.9142	45.9142	45.6872	46.3865	47.1403	47.6731	48.2301	(38)
Heat transfer coeff	139.3785	139.0727	138.7730	137.3653	137.1020	135.8759	135.8759	135.6489	136.3482	137.1020	137.6348	138.1918	(39)
Average = Sum(39)m / 12 =												137.3641	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4307	1.4276	1.4245	1.4100	1.4073	1.3947	1.3947	1.3924	1.3996	1.4073	1.4128	1.4185	(40)
HLP (average)												1.4100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584 (61)
Total heat required for water heating calculated for each month												
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293 (64)
								Total per year (kWh/year) = Sum(64)m =				1691.3171 (64)
Heat gains from water heating, kWh/month												
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	619.6401	614.9798	591.0816	553.8294	515.4448	481.1241	461.0779	469.8734	491.3138	528.7914	570.5206	602.3273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
East	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(76)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	767.8978	894.1287	1035.3571	1195.1418	1306.8010	1296.2453	1234.8647	1128.9570	1004.3062	854.9235	753.1478	725.8286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5389	48.6456	48.7507	49.2503	49.3449	49.7901	49.7901	49.8735	49.6177	49.3449	49.1538	48.9557	
alpha	4.2359	4.2430	4.2500	4.2834	4.2897	4.3193	4.3193	4.3249	4.3078	4.2897	4.2769	4.2637	
util living area													
	0.9939	0.9877	0.9703	0.9171	0.8008	0.6261	0.4730	0.5328	0.7842	0.9522	0.9887	0.9952	(86)
MIT	19.5652	19.7557	20.0749	20.4790	20.7896	20.9465	20.9873	20.9793	20.8587	20.4366	19.9250	19.5301	(87)
Th 2	19.7399	19.7423	19.7446	19.7557	19.7577	19.7674	19.7674	19.7692	19.7636	19.7577	19.7535	19.7492	(88)
util rest of house													
	0.9918	0.9835	0.9599	0.8884	0.7374	0.5234	0.3461	0.4000	0.6928	0.9294	0.9841	0.9935	(89)
MIT 2	17.8722	18.1499	18.6095	19.1767	19.5673	19.7354	19.7634	19.7617	19.6603	19.1360	18.4055	17.8274	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.2163	18.4763	18.9073	19.4414	19.8158	19.9815	20.0121	20.0092	19.9039	19.4003	18.7143	18.1734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2163	18.4763	18.9073	19.4414	19.8158	19.9815	20.0121	20.0092	19.9039	19.4003	18.7143	18.1734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9880	0.9775	0.9507	0.8796	0.7407	0.5423	0.3720	0.4270	0.7046	0.9207	0.9784	0.9903	(94)
Useful gains	758.6675	873.9881	984.2989	1051.1944	967.9390	702.9926	459.3942	482.0193	707.6023	787.1221	736.9073	718.8018	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1939.6282	1888.0905	1721.8021	1448.0231	1112.6864	731.2177	463.6252	489.5827	791.3506	1206.5392	1598.5355	1931.0131	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	878.6348	681.4768	548.7024	285.7167	107.6920	0.0000	0.0000	0.0000	0.0000	312.0463	620.3723	901.8852	(98)
Space heating												4336.5266	(98)
Space heating per m2											(98) / (4) =	44.5137	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4647.9384	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	878.6348	681.4768	548.7024	285.7167	107.6920	0.0000	0.0000	0.0000	0.0000	312.0463	620.3723	901.8852	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	941.7308	730.4146	588.1054	306.2344	115.4255	0.0000	0.0000	0.0000	0.0000	334.4548	664.9221	966.6508	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6879	89.6232	89.4731	89.0948	88.2727	86.7000	86.7000	86.7000	86.7000	89.1352	89.5566	89.7158	(217)
Fuel for water heating, kWh/month													
	192.6887	169.0166	175.5784	154.9550	150.9893	134.0399	125.5808	142.1545	143.2752	160.7684	173.0710	186.9562	(219)
Water heating fuel used												1909.0739	(219)
Annual totals kWh/year													
Space heating fuel - main system												4647.9384	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6336.7977	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4647.9384	3.4800	161.7483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1909.0739	3.4800	66.4358	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			319.1377	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9411	(257)
SAP value		86.8710	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4647.9384	0.2160	1003.9547	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1909.0739	0.2160	412.3600	(264)
Space and water heating			1416.3147	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total kg/year			1302.0232	(272)
CO2 emissions per m2			13.3700	(273)
EI value			87.7495	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8845 = 3.935, stars = 4
Water heating environmental impact	0.216 / 0.8845 = 0.2442, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3585	0.3329	0.3415	0.3244	0.3244	0.3158	0.3073	0.2988	0.2902	0.3158	0.2988	0.3158	(22b)
Effective ac	0.5643	0.5554	0.5583	0.5526	0.5526	0.5499	0.5472	0.5446	0.5421	0.5499	0.5446	0.5499	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8829	46.1473	46.3865	45.9142	45.9142	45.6872	45.4662	45.2512	45.0424	45.6872	45.2512	45.6872	(38)
Heat transfer coeff	136.8446	136.1090	136.3482	135.8759	135.8759	135.6489	135.4279	135.2130	135.0041	135.6489	135.2130	135.6489	(39)
Average = Sum(39)m / 12 =												135.7382	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4047	1.3971	1.3996	1.3947	1.3947	1.3924	1.3901	1.3879	1.3858	1.3924	1.3879	1.3924	(40)
HLP (average)												1.3933	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584	(61)
Total heat required for water heating calculated for each month													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(64)
									Total per year (kWh/year) = Sum(64)m =			1691.3171	(64)
Heat gains from water heating, kWh/month													
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	619.6401	614.9798	591.0816	553.8294	515.4448	481.1241	461.0779	469.8734	491.3138	528.7914	570.5206	602.3273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
East	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(76)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539	(83)
Total gains	807.3218	916.5727	1076.2826	1259.1917	1342.2442	1405.7133	1332.1265	1230.6625	1083.4094	909.4071	801.1552	755.8811	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4377	49.7048	49.6177	49.7901	49.7901	49.8735	49.9548	50.0342	50.1117	49.8735	50.0342	49.8735	
alpha	4.2958	4.3137	4.3078	4.3193	4.3193	4.3249	4.3303	4.3356	4.3408	4.3249	4.3356	4.3249	
util living area													
	0.9915	0.9850	0.9612	0.8881	0.7465	0.5306	0.3921	0.4222	0.7037	0.9251	0.9822	0.9932	(86)
MIT	19.7076	19.8616	20.1937	20.5899	20.8588	20.9747	20.9946	20.9929	20.9185	20.5744	20.0904	19.6893	(87)
Th 2	19.7597	19.7655	19.7636	19.7674	19.7674	19.7692	19.7709	19.7726	19.7742	19.7692	19.7726	19.7692	(88)
util rest of house													
	0.9885	0.9799	0.9478	0.8511	0.6715	0.4247	0.2708	0.2926	0.5975	0.8900	0.9748	0.9908	(89)
MIT 2	18.0927	18.3188	18.7909	19.3303	19.6509	19.7567	19.7696	19.7709	19.7232	19.3285	18.6569	18.0727	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9733	0.9380	0.8447	0.6801	0.4457	0.2956	0.3192	0.6157	0.8833	0.9677	0.9867	(94)
Useful gains	794.2549	892.0921	1009.5986	1063.6407	912.8728	626.5099	393.8156	392.7781	667.0631	803.2523	775.2924	745.8619	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1850.2658	1814.6548	1646.5481	1370.4839	1004.9949	638.1320	395.2602	394.7199	710.9509	1109.8411	1493.8712	1817.8666	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	785.6721	619.9621	473.8904	220.9271	68.5389	0.0000	0.0000	0.0000	0.0000	228.1021	517.3767	797.5715	(98)
Space heating												3712.0409	(98)
Space heating per m2											(98) / (4) =	38.1035	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3978.6076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	785.6721	619.9621	473.8904	220.9271	68.5389	0.0000	0.0000	0.0000	0.0000	228.1021	517.3767	797.5715	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	842.0923	664.4825	507.9211	236.7922	73.4607	0.0000	0.0000	0.0000	0.0000	244.4824	554.5303	854.8462	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6290	89.5697	89.3760	88.8807	87.8899	86.7000	86.7000	86.7000	86.7000	88.8761	89.4439	89.6532	(217)
Fuel for water heating, kWh/month													
	192.8154	169.1176	175.7690	155.3283	151.6469	134.0399	125.5808	142.1545	143.2752	161.2371	173.2893	187.0869	(219)
Water heating fuel used												1911.3408	(219)
Annual totals kWh/year													
Space heating fuel - main system												3978.6076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												5592.9666	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3978.6076	7.3800	293.6212	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1911.3408	7.3800	141.0569	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			456.5632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3978.6076	0.2160	859.3792	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.3408	0.2160	412.8496	(264)
Space and water heating			1272.2288	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			1118.0953	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3978.6076	1.2200	4853.9012	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.3408	1.2200	2331.8357	(264)
Space and water heating			7185.7370	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			6274.0031	(272)
Primary energy kWh/m2/year			64.4016	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-192 kg (17.2%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£60	1.97 kg/m²	B 88	B 89
	Total Savings	£60	1.97 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£135	£150	-£14
Mains gas	£542	£467	£75
Space heating	£422	£422	£0
Water heating	£141	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£457	£397	£61
Total cost of uses	£457	£397	£60
Delivered energy	57 kWh/m²	48 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	10 kg/m²	2 kg/m²
Primary energy	64 kWh/m²	53 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4354	0.4268	0.4183	0.3756	0.3671	0.3244	0.3244	0.3158	0.3415	0.3671	0.3841	0.4012	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5705	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.4168	49.1110	48.8113	47.4036	47.1403	45.9142	45.9142	45.6872	46.3865	47.1403	47.6731	48.2301	(38)
Heat transfer coeff	139.3785	139.0727	138.7730	137.3653	137.1020	135.8759	135.8759	135.6489	136.3482	137.1020	137.6348	138.1918	(39)
Average = Sum(39)m / 12 =												137.3641	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4307	1.4276	1.4245	1.4100	1.4073	1.3947	1.3947	1.3924	1.3996	1.4073	1.4128	1.4185	(40)
HLP (average)												1.4100	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584	(61)
Total heat required for water heating calculated for each month													
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1683	(H8)
Utilisation factor												0.5751	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-866.8465	(H17)
Solar input	-25.1368	-41.9461	-71.4391	-95.7424	-118.2817	-116.2897	-114.7529	-100.2602	-78.5238	-53.6225	-29.8159	-21.0352	(63)
								Solar input (sum of months) = Sum(63)m =				-866.8465	(63)
Output from w/h													
	147.6816	109.5320	85.6564	42.3144	15.0007	0.0000	0.0000	22.9877	45.6957	89.6788	125.1807	146.6941	(64)
								Total per year (kWh/year) = Sum(64)m =				830.4222	(64)
Heat gains from water heating, kWh/month													
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	619.6401	614.9798	591.0816	553.8294	515.4448	481.1241	461.0779	469.8734	491.3138	528.7914	570.5206	602.3273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	10.6334	0.7200	0.7000	0.7700	24.7720	(74)
East	7.1800	19.6403	0.7200	0.7000	0.7700	49.2533	(76)
South	1.3000	46.7521	0.7200	0.7000	0.7700	21.2279	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	5.2300	19.6403	0.7200	0.7000	0.7700	35.8767	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	148.2577	279.1489	444.2755	641.3124	791.3563	815.1212	773.7868	659.0836	512.9925	326.1321	182.6272	123.5013	(83)
Total gains	767.8978	894.1287	1035.3571	1195.1418	1306.8010	1296.2453	1234.8647	1128.9570	1004.3062	854.9235	753.1478	725.8286	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.5389	48.6456	48.7507	49.2503	49.3449	49.7901	49.7901	49.8735	49.6177	49.3449	49.1538	48.9557	
alpha	4.2359	4.2430	4.2500	4.2834	4.2897	4.3193	4.3193	4.3249	4.3078	4.2897	4.2769	4.2637	
util living area													
	0.9939	0.9877	0.9703	0.9171	0.8008	0.6261	0.4730	0.5328	0.7842	0.9522	0.9887	0.9952	(86)
MIT	19.5652	19.7557	20.0749	20.4790	20.7896	20.9465	20.9873	20.9793	20.8587	20.4366	19.9250	19.5301	(87)
Th 2	19.7399	19.7423	19.7446	19.7557	19.7577	19.7674	19.7674	19.7692	19.7636	19.7577	19.7535	19.7492	(88)
util rest of house													
	0.9918	0.9835	0.9599	0.8884	0.7374	0.5234	0.3461	0.4000	0.6928	0.9294	0.9841	0.9935	(89)
MIT 2	17.8722	18.1499	18.6095	19.1767	19.5673	19.7354	19.7634	19.7617	19.6603	19.1360	18.4055	17.8274	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2163	18.4763	18.9073	19.4414	19.8158	19.9815	20.0121	20.0092	19.9039	19.4003	18.7143	18.1734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2163	18.4763	18.9073	19.4414	19.8158	19.9815	20.0121	20.0092	19.9039	19.4003	18.7143	18.1734	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9880	0.9775	0.9507	0.8796	0.7407	0.5423	0.3720	0.4270	0.7046	0.9207	0.9784	0.9903	(94)
Useful gains	758.6675	873.9881	984.2989	1051.1944	967.9390	702.9926	459.3942	482.0193	707.6023	787.1221	736.9073	718.8018	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1939.6282	1888.0905	1721.8021	1448.0231	1112.6864	731.2177	463.6252	489.5827	791.3506	1206.5392	1598.5355	1931.0131	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	878.6348	681.4768	548.7024	285.7167	107.6920	0.0000	0.0000	0.0000	0.0000	312.0463	620.3723	901.8852	(98)
Space heating												4336.5266	(98)
Space heating per m2											(98) / (4) =	44.5137	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4647.9384	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	878.6348	681.4768	548.7024	285.7167	107.6920	0.0000	0.0000	0.0000	0.0000	312.0463	620.3723	901.8852	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	941.7308	730.4146	588.1054	306.2344	115.4255	0.0000	0.0000	0.0000	0.0000	334.4548	664.9221	966.6508	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.6816	109.5320	85.6564	42.3144	15.0007	0.0000	0.0000	22.9877	45.6957	89.6788	125.1807	146.6941	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7637	89.7838	89.7965	89.8189	89.8439	86.7000	86.7000	86.7000	86.7000	89.4707	89.6748	89.7785	(217)
Fuel for water heating, kWh/month	164.5227	121.9953	95.3894	47.1108	16.6964	0.0000	0.0000	26.5141	52.7056	100.2326	139.5941	163.3956	(219)
Water heating fuel used												928.1566	(219)
Annual totals kWh/year													
Space heating fuel - main system												4647.9384	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												5405.8803	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4647.9384	3.4800	161.7483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	928.1566	3.4800	32.2998	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			291.5968	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8599	(257)
SAP value	88.0040	
SAP rating (Section 12)	88	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4647.9384	0.2160	1003.9547	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.1566	0.2160	200.4818 (264)
Space and water heating			1204.4365 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.8950	0.5190	205.9885 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1116.0951 (272)
CO2 emissions per m2			11.4600 (273)
EI value			89.4989
EI rating			89 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.8400	
Infiltration rate		0.4406	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3585	0.3329	0.3415	0.3244	0.3244	0.3158	0.3073	0.2988	0.2902	0.3158	0.2988	0.3158	(22b)
Effective ac	0.5643	0.5554	0.5583	0.5526	0.5526	0.5499	0.5472	0.5446	0.5421	0.5499	0.5446	0.5499	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8829	46.1473	46.3865	45.9142	45.9142	45.6872	45.4662	45.2512	45.0424	45.6872	45.2512	45.6872	(38)
Heat transfer coeff	136.8446	136.1090	136.3482	135.8759	135.8759	135.6489	135.4279	135.2130	135.0041	135.6489	135.2130	135.6489	(39)
Average = Sum(39)m / 12 =												135.7382	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4047	1.3971	1.3996	1.3947	1.3947	1.3924	1.3901	1.3879	1.3858	1.3924	1.3879	1.3924	(40)
HLP (average)												1.3933	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8691	10.7108	11.8361	11.4162	11.7677	11.3546	11.7123	11.7482	11.3882	11.8072	11.4605	11.8584 (61)
Total heat required for water heating calculated for each month												
	172.8185	151.4781	157.0954	138.0568	133.2824	116.2126	108.8785	123.2480	124.2196	143.3013	154.9966	167.7293 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3075 (H8)
Utilisation factor												0.5346 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6652 (H14)
Volume ratio Veff/V												0.7601 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-901.7521 (H17)
Solar input	-29.4173	-41.8296	-71.8950	-97.0030	-113.9358	-121.7015	-119.1421	-106.6358	-83.4884	-57.7210	-34.7930	-24.1896 (63)
								Solar input (sum of months) = Sum(63)m =				-901.7521 (63)
Output from w/h												
	143.4011	109.6486	85.2004	41.0538	19.3466	0.0000	0.0000	16.6122	40.7311	85.5803	120.2037	143.5397 (64)
									Total per year (kWh/year) = Sum(64)m =			805.3175 (64)
Heat gains from water heating, kWh/month												
	56.4829	49.4828	51.2578	44.9621	43.3456	37.7039	35.2359	40.0107	40.3635	46.6736	50.5909	54.7917 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9179	73.6352	68.8948	62.4473	58.2602	52.3665	47.3600	53.7778	56.0604	62.7333	70.2651	73.6447	(72)
Total internal gains													
	619.6401	614.9798	591.0816	553.8294	515.4448	481.1241	461.0779	469.8734	491.3138	528.7914	570.5206	602.3273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.6700	13.4839	0.7200	0.7000	0.7700	31.4127	(74)
East	7.1800	25.1925	0.7200	0.7000	0.7700	63.1772	(76)
South	1.3000	56.7559	0.7200	0.7000	0.7700	25.7702	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	5.2300	25.1925	0.7200	0.7000	0.7700	46.0190	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	187.6817	301.5929	485.2010	705.3623	826.7994	924.5892	871.0486	760.7891	592.0957	380.6157	230.6346	153.5539 (83)
Total gains	807.3218	916.5727	1076.2826	1259.1917	1342.2442	1405.7133	1332.1265	1230.6625	1083.4094	909.4071	801.1552	755.8811 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4377	49.7048	49.6177	49.7901	49.7901	49.8735	49.9548	50.0342	50.1117	49.8735	50.0342	49.8735	
alpha	4.2958	4.3137	4.3078	4.3193	4.3193	4.3249	4.3303	4.3356	4.3408	4.3249	4.3356	4.3249	
util living area													
	0.9915	0.9850	0.9612	0.8881	0.7465	0.5306	0.3921	0.4222	0.7037	0.9251	0.9822	0.9932	(86)
MIT	19.7076	19.8616	20.1937	20.5899	20.8588	20.9747	20.9946	20.9929	20.9185	20.5744	20.0904	19.6893	(87)
Th 2	19.7597	19.7655	19.7636	19.7674	19.7674	19.7692	19.7709	19.7726	19.7742	19.7692	19.7726	19.7692	(88)
util rest of house													
	0.9885	0.9799	0.9478	0.8511	0.6715	0.4247	0.2708	0.2926	0.5975	0.8900	0.9748	0.9908	(89)
MIT 2	18.0927	18.3188	18.7909	19.3303	19.6509	19.7567	19.7696	19.7709	19.7232	19.3285	18.6569	18.0727	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4209	18.6324	19.0761	19.5863	19.8964	20.0043	20.0186	20.0192	19.9661	19.5817	18.9483	18.4013	(93)

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8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9733	0.9380	0.8447	0.6801	0.4457	0.2956	0.3192	0.6157	0.8833	0.9677	0.9867	(94)
Useful gains	794.2549	892.0921	1009.5986	1063.6407	912.8728	626.5099	393.8156	392.7781	667.0631	803.2523	775.2924	745.8619	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1850.2658	1814.6548	1646.5481	1370.4839	1004.9949	638.1320	395.2602	394.7199	710.9509	1109.8411	1493.8712	1817.8666	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	785.6721	619.9621	473.8904	220.9271	68.5389	0.0000	0.0000	0.0000	0.0000	228.1021	517.3767	797.5715	(98)
Space heating												3712.0409	(98)
Space heating per m2											(98) / (4) =	38.1035	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3978.6076	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	785.6721	619.9621	473.8904	220.9271	68.5389	0.0000	0.0000	0.0000	0.0000	228.1021	517.3767	797.5715	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	842.0923	664.4825	507.9211	236.7922	73.4607	0.0000	0.0000	0.0000	0.0000	244.4824	554.5303	854.8462	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.4011	109.6486	85.2004	41.0538	19.3466	0.0000	0.0000	16.6122	40.7311	85.5803	120.2037	143.5397	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7250	89.7400	89.7322	89.7162	89.4821	86.7000	86.7000	86.7000	86.7000	89.2885	89.5986	89.7317	(217)
Fuel for water heating, kWh/month	159.8230	122.1847	94.9497	45.7597	21.6206	0.0000	0.0000	19.1605	46.9794	95.8469	134.1580	159.9654	(219)
Water heating fuel used												900.4478	(219)
Annual totals kWh/year													
Space heating fuel - main system												3978.6076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												4632.0737	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3978.6076	7.3800	293.6212	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	900.4478	7.3800	66.4530	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			396.2893	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3978.6076	0.2160	859.3792	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	900.4478	0.2160	194.4967	(264)
Space and water heating			1053.8760	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			925.6925	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3978.6076	1.2200	4853.9012	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	900.4478	1.2200	1098.5463	(264)
Space and water heating			5952.4476	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			5194.2137	(272)
Primary energy kWh/m2/year			53.3177	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		664.69 (P1)
Transmission heat loss coefficient		89.96 (37)
Summer heat loss coefficient		754.65 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
South West	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)
North West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.6700	87.1704	0.7200	0.7000	0.8865	233.8013
East	7.1800	125.2818	0.7200	0.7000	0.8865	361.7130
South	1.3000	118.5567	0.7200	0.7000	0.8865	61.9757
South West	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
West	5.2300	125.2818	0.7200	0.7000	0.8865	263.4762
North West	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
total:						1016.6817

	Jun	Jul	Aug	
Solar gains	1097	1017	885	(P3)
Internal gains	478	458	467	
Total summer gains	1575	1475	1352	(P5)
Summer gain/loss ratio	2.09	1.95	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.74	19.50	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 398 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	41 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	87 B	**DER**	15.10	**TER**	19.12
Environmental	88 B	**% DER<TER**	21.01		
CO_2 Emissions (t/year)	1.12	**DFEE**	56.93	**TFEE**	61.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.64		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.12	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.10	$kgCO_2/m^2$	Pass
	-4.02 (-21.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.65	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	56.93	$kWh/m^2/yr$	
	-4.7 (-7.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.84 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.67 m², No overhang
Windows facing East	7.18 m², No overhang
Windows facing South	1.30 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	5.23 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.84 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 399 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	86 B	**DER**	15.38	**TER**	18.75
Environmental	87 B	**% DER<TER**	17.98		
CO_2 Emissions (t/year)	1.11	**DFEE**	54.59	**TFEE**	59.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.56		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 97 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.75 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.18 m², No overhang
Windows facing East: 6.67 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 5.23 m², No overhang
Windows facing South West: 1.02 m², No overhang
Windows facing West: 1.30 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4206	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4156	0.4074	0.3993	0.3586	0.3504	0.3097	0.3097	0.3015	0.3260	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5864	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5455	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.7181	48.4395	48.1664	46.8836	46.6436	45.5264	45.5264	45.3195	45.9567	46.6436	47.1291	47.6367	(38)
Heat transfer coeff	138.6798	138.4012	138.1281	136.8453	136.6053	135.4881	135.4881	135.2812	135.9184	136.6053	137.0908	137.5984	(39)
Average = Sum(39)m / 12 =												136.8442	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4235	1.4207	1.4179	1.4047	1.4022	1.3908	1.3908	1.3886	1.3952	1.4022	1.4072	1.4124	(40)
HLP (average)												1.4047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	417.1807	415.0021	399.9443	375.5234	350.5213	326.5507	311.0480	317.3593	329.9595	354.6058	382.9520	404.4103	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	610.1372	757.4353	901.9360	1048.5658	1147.3383	1135.5266	1083.6009	995.4744	891.1960	742.3866	616.6493	567.8310	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7834	48.8816	48.9783	49.4374	49.5243	49.9326	49.9326	50.0090	49.7745	49.5243	49.3489	49.1668	
alpha	4.2522	4.2588	4.2652	4.2958	4.3016	4.3288	4.3288	4.3339	4.3183	4.3016	4.2899	4.2778	
util living area													
	0.9975	0.9933	0.9814	0.9434	0.8503	0.6900	0.5307	0.5918	0.8321	0.9698	0.9946	0.9981	(86)
MIT	19.4322	19.6440	19.9727	20.3859	20.7282	20.9227	20.9806	20.9694	20.8189	20.3541	19.8100	19.3946	(87)
Th 2	19.7453	19.7475	19.7497	19.7597	19.7616	19.7704	19.7704	19.7721	19.7670	19.7616	19.7578	19.7538	(88)
util rest of house													
	0.9966	0.9910	0.9746	0.9219	0.7944	0.5853	0.3920	0.4497	0.7485	0.9541	0.9924	0.9975	(89)
MIT 2	17.6823	17.9924	18.4692	19.0588	19.5054	19.7219	19.7640	19.7605	19.6276	19.0283	18.2427	17.6331	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.0379	18.3281	18.7747	19.3285	19.7539	19.9659	20.0112	20.0062	19.8697	19.2978	18.5612	17.9911	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0379	18.3281	18.7747	19.3285	19.7539	19.9659	20.0112	20.0062	19.8697	19.2978	18.5612	17.9911	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9869	0.9671	0.9123	0.7940	0.6034	0.4203	0.4785	0.7567	0.9459	0.9889	0.9960	(94)
Useful gains	606.8554	747.5321	872.2728	956.5878	910.9622	685.1778	455.4833	476.2855	674.3842	702.2313	609.8239	565.5454	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1905.1748	1858.4606	1695.4870	1427.0915	1100.2050	727.0198	462.1833	487.8514	784.2055	1188.1613	1571.2292	1897.6320	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	965.9497	746.5440	612.4714	338.7627	140.7966	0.0000	0.0000	0.0000	0.0000	361.5319	692.2119	991.0724	(98)
Space heating												4849.3405	(98)
Space heating per m2											(98) / (4) =	49.7777	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5219.9574	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	965.9497	746.5440	612.4714	338.7627	140.7966	0.0000	0.0000	0.0000	0.0000	361.5319	692.2119	991.0724	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1039.7736	803.5995	659.2803	364.6530	151.5572	0.0000	0.0000	0.0000	0.0000	389.1624	745.1150	1066.8164	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3994	89.3439	89.2278	88.9495	88.3150	86.7000	86.7000	86.7000	86.7000	88.9680	89.2971	89.4224	(217)
Fuel for water heating, kWh/month													
	193.2640	169.5060	176.0248	155.1851	150.9027	134.0367	125.5844	142.1462	143.2609	161.0436	173.5370	187.5265	(219)
Water heating fuel used												1912.0180	(219)
Annual totals kWh/year													
Space heating fuel - main system												5219.9574	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												7051.1070	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5219.9574	0.2160	1127.5108	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1912.0180	0.2160	412.9959	(264)
Space and water heating			1540.5067	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total CO2, kg/year			1498.5360	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.3800	ZC1
Total Floor Area	TFA	97.4200	
Assumed number of occupants	N	2.7143	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3338	ZC2
CO2 emissions from cooking, equation (L16)		1.8902	ZC3
Total CO2 emissions		32.6040	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6040	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1192	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3692	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.6837	47.2620	43.7911	45.2508	47.2620	47.6837	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298 (64)
								Total per year (kWh/year) = Sum(64)m =				2130.4990 (64)
Heat gains from water heating, kWh/month												
	66.2554	58.3120	61.0384	54.0289	52.2191	45.8130	43.6205	48.8892	49.4374	56.4615	60.0545	64.5668 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	89.0530	86.7738	82.0409	75.0402	70.1870	63.6292	58.6297	65.7112	68.6630	75.8891	83.4090	86.7833	(72)
Total internal gains													
	430.4164	428.2307	413.1638	388.1707	362.4878	337.8443	322.3490	329.3371	342.6228	367.8413	396.1910	417.6510	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4500	10.6334	0.6300	0.7000	0.7700	20.9606	(74)
East	6.0000	19.6403	0.6300	0.7000	0.7700	36.0139	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	4.7000	46.7521	0.6300	0.7000	0.7700	67.1538	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	1.1700	19.6403	0.6300	0.7000	0.7700	7.0227	(80)

Solar gains	151.8412	269.4692	395.0300	529.6270	627.0155	636.5769	607.9186	533.6148	441.6496	305.1549	183.9014	128.5986 (83)
Total gains	582.2576	697.6999	808.1939	917.7977	989.5033	974.4212	930.2676	862.9519	784.2724	672.9962	580.0924	546.2496 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area													
	0.9980	0.9950	0.9865	0.9581	0.8807	0.7292	0.5649	0.6239	0.8570	0.9762	0.9957	0.9985	(86)
MIT	19.5635	19.7437	20.0327	20.4040	20.7275	20.9219	20.9812	20.9707	20.8252	20.3963	19.9061	19.5291	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house													
	0.9973	0.9933	0.9816	0.9416	0.8333	0.6311	0.4295	0.4870	0.7829	0.9637	0.9940	0.9980	(89)
MIT 2	17.9393	18.2033	18.6238	19.1577	19.5888	19.8108	19.8558	19.8519	19.7191	19.1568	18.4469	17.8936	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2695	18.5164	18.9101	19.4110	19.8202	20.0366	20.0845	20.0793	19.9439	19.4087	18.7435	18.2260	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2695	18.5164	18.9101	19.4110	19.8202	20.0366	20.0845	20.0793	19.9439	19.4087	18.7435	18.2260	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9903	0.9759	0.9334	0.8316	0.6475	0.4571	0.5147	0.7894	0.9570	0.9913	0.9968	(94)
Useful gains	579.7959	690.9414	788.6933	856.6628	822.8584	630.9823	425.2685	444.1289	619.1150	644.0383	575.0363	544.5030	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1766.0269	1718.4715	1563.6231	1313.9557	1013.5865	673.9341	431.9476	455.5089	726.3630	1099.5248	1457.7245	1761.4934	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	882.5559	690.5002	576.5477	329.2509	141.9017	0.0000	0.0000	0.0000	0.0000	338.8820	635.5355	905.4408	(98)
Space heating												4500.6147	(98)
Space heating per m2											(98) / (4) =	46.1981	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4818.6453	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	882.5559	690.5002	576.5477	329.2509	141.9017	0.0000	0.0000	0.0000	0.0000	338.8820	635.5355	905.4408	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	944.9206	739.2936	617.2888	352.5170	151.9290	0.0000	0.0000	0.0000	0.0000	362.8287	680.4449	969.4227	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.9083	186.7948	196.2182	174.3243	168.7766	148.6490	142.4171	158.7617	160.5150	182.4530	192.8512	206.8298	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2508	88.0422	87.6022	86.6281	84.6181	80.3000	80.3000	80.3000	80.3000	86.5885	87.8282	88.3340	(217)
Fuel for water heating, kWh/month													
	240.1205	212.1651	223.9877	201.2329	199.4569	185.1171	177.3563	197.7107	199.8942	210.7128	219.5776	234.1452	(219)
Water heating fuel used												2501.4771	(219)
Annual totals kWh/year													
Space heating fuel - main system												4818.6453	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.4259	(232)
Total delivered energy for all uses												7793.5483	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4818.6453	0.2160	1040.8274	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2501.4771	0.2160	540.3191	(264)
Space and water heating			1581.1464	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.4259	0.5190	206.7830	(268)
Total CO2, kg/m2/year			1826.8545	(272)
Emissions per m2 for space and water heating			16.2302	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1226	(272b)
Emissions per m2 for pumps and fans			0.3996	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2302 * 1.00) + 2.1226 + 0.3996, rounded to 2 d.p.			18.7500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982 (1b) - (3b)	
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3412	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2644	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3371	0.3305	0.3239	0.2908	0.2842	0.2512	0.2512	0.2446	0.2644	0.2842	0.2974	0.3107	(22b)
Effective ac	0.5568	0.5546	0.5525	0.5423	0.5404	0.5315	0.5315	0.5299	0.5350	0.5404	0.5442	0.5483	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.2637	46.0804	45.9007	45.0567	44.8988	44.1637	44.1637	44.0276	44.4469	44.8988	45.2183	45.5522	(38)
Heat transfer coeff	136.2254	136.0421	135.8624	135.0184	134.8605	134.1254	134.1254	133.9893	134.4086	134.8605	135.1800	135.5139	(39)
Average = Sum(39)m / 12 =												135.0177	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3983	1.3964	1.3946	1.3859	1.3843	1.3768	1.3768	1.3754	1.3797	1.3843	1.3876	1.3910	(40)
HLP (average)												1.3859	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.4738	19.9611	16.2334	12.2897	9.1867	7.7558	8.3804	10.8932	14.6209	18.5645	21.6675	23.0985 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.2469	382.8934	369.5490	347.4597	323.9722	302.1328	288.4394	292.4302	304.2044	326.4377	352.0614	372.2982 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	577.2034	725.3266	871.5407	1020.5022	1120.7892	1111.1086	1060.9923	970.5453	865.4409	714.2185	585.7588	535.7189	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6624	49.7293	49.7951	50.1063	50.1650	50.4399	50.4399	50.4912	50.3337	50.1650	50.0464	49.9231	
alpha	4.3108	4.3153	4.3197	4.3404	4.3443	4.3627	4.3627	4.3661	4.3556	4.3443	4.3364	4.3282	
util living area	0.9980	0.9943	0.9833	0.9470	0.8555	0.6965	0.5363	0.6001	0.8403	0.9731	0.9956	0.9985	(86)
MIT	19.4331	19.6446	19.9728	20.3832	20.7270	20.9218	20.9804	20.9686	20.8147	20.3458	19.8026	19.3916	(87)
Th 2	19.7646	19.7661	19.7675	19.7741	19.7754	19.7812	19.7812	19.7823	19.7789	19.7754	19.7729	19.7702	(88)
util rest of house	0.9973	0.9923	0.9771	0.9266	0.8010	0.5925	0.3976	0.4578	0.7590	0.9590	0.9937	0.9980	(89)
MIT 2	18.3525	18.5642	18.8898	19.2911	19.5985	19.7474	19.7767	19.7741	19.6804	19.2646	18.7277	18.3154	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.5721	18.7838	19.1099	19.5130	19.8279	19.9860	20.0214	20.0168	19.9110	19.4843	18.9462	18.5341	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5721	18.7838	19.1099	19.5130	19.8279	19.9860	20.0214	20.0168	19.9110	19.4843	18.9462	18.5341	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9900	0.9727	0.9212	0.8037	0.6116	0.4261	0.4870	0.7693	0.9545	0.9919	0.9973	(94)
Useful gains	575.0385	718.0963	847.7845	940.0618	900.8156	679.5116	452.0902	472.6333	665.8147	681.6891	580.9950	534.2467	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1944.2252	1888.7775	1713.2183	1432.9564	1096.1302	722.4051	458.8904	484.6189	781.0438	1198.1463	1601.3671	1942.4760	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1018.6750	786.6978	643.8827	354.8841	145.3141	0.0000	0.0000	0.0000	0.0000	384.2441	734.6679	1047.7226	(98)
Space heating												5116.0884	(98)
Space heating per m2										(98) / (4) =		52.5158	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1260.7792	992.5283	1018.3189	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8541	0.9128	0.8834	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1076.7710	905.9574	899.6243	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1402.2614	1341.4542	1237.5440	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	234.3531	324.0097	251.4123	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												809.7750 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.5883	81.0024	62.8531	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												202.4438 (107)
Space cooling per m2												2.0781 (108)
Energy for space heating												52.5158 (99)
Energy for space cooling												2.0781 (108)
Total												54.5938 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1192	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2861	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3648	0.3576	0.3505	0.3147	0.3076	0.2718	0.2718	0.2646	0.2861	0.3076	0.3219	0.3362	(22b)
Effective ac	0.5665	0.5639	0.5614	0.5495	0.5473	0.5369	0.5369	0.5350	0.5409	0.5473	0.5518	0.5565	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.1600	1.3258	26.7273			(27)
Ground floor			49.3300	0.1300	6.4129			(28a)
External Wall	147.2700	24.4000	122.8700	0.1800	22.1166			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7577			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.5925	(36)
Total fabric heat loss (33) + (36) =	79.3502	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0704	46.8558	46.6454	45.6572	45.4723	44.6116	44.6116	44.4522	44.9431	45.4723	45.8463	46.2374	(38)
Heat transfer coeff	126.4206	126.2060	125.9956	125.0074	124.8225	123.9618	123.9618	123.8024	124.2933	124.8225	125.1965	125.5876	(39)
Average = Sum(39)m / 12 =												125.0065	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2977	1.2955	1.2933	1.2832	1.2813	1.2724	1.2724	1.2708	1.2759	1.2813	1.2851	1.2891	(40)
HLP (average)												1.2832	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2017	29.9131	30.8676	26.9111	25.8219	22.2823	20.6478	23.6937	23.9767	27.9425	30.5014	33.1226 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	135.7162	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5605	20.0381	16.2960	12.3372	9.2222	7.7857	8.4128	10.9352	14.6772	18.6361	21.7511	23.1876 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.0881	254.7040	248.1120	234.0785	216.3638	199.7144	188.5917	185.9758	192.5677	206.6012	224.3159	240.9653 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716	36.5716 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730 (71)

Water heating gains (Table 5)

	45.9701	44.5135	41.4887	37.3766	34.7068	30.9476	27.7525	31.8464	33.3009	37.5571	42.3631	44.5196 (72)

Total internal gains

	384.3336	382.9704	369.6116	347.5071	324.0076	302.1627	288.4717	292.4722	304.2607	326.5093	352.1450	372.3873 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4500	10.6334	0.6300	0.7000	0.7700	20.9606	(74)
East	6.0000	19.6403	0.6300	0.7000	0.7700	36.0139	(76)
Southeast	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(77)
South	4.7000	46.7521	0.6300	0.7000	0.7700	67.1538	(78)
Southwest	0.9200	36.7938	0.6300	0.7000	0.7700	10.3451	(79)
West	1.1700	19.6403	0.6300	0.7000	0.7700	7.0227	(80)

Solar gains	151.8412	269.4692	395.0300	529.6270	627.0155	636.5769	607.9186	533.6148	441.6496	305.1549	183.9014	128.5986 (83)
Total gains	536.1748	652.4396	764.6416	877.1341	951.0231	938.7396	896.3904	826.0870	745.9103	631.6642	536.0464	500.9858 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5140	53.6050	53.6946	54.1190	54.1992	54.5755	54.5755	54.6458	54.4299	54.1992	54.0373	53.8690	
alpha	4.5676	4.5737	4.5796	4.6079	4.6133	4.6384	4.6384	4.6431	4.6287	4.6133	4.6025	4.5913	
util living area	0.9986	0.9962	0.9891	0.9642	0.8930	0.7473	0.5832	0.6460	0.8745	0.9812	0.9969	0.9990	(86)
MIT	19.5207	19.7022	19.9942	20.3724	20.7066	20.9134	20.9786	20.9662	20.8065	20.3613	19.8655	19.4868	(87)
Th 2	19.8426	19.8444	19.8461	19.8540	19.8555	19.8625	19.8625	19.8638	19.8598	19.8555	19.8525	19.8494	(88)
util rest of house	0.9981	0.9949	0.9851	0.9497	0.8486	0.6500	0.4449	0.5069	0.8050	0.9711	0.9956	0.9986	(89)
MIT 2	18.5004	18.6827	18.9739	19.3492	19.6569	19.8227	19.8572	19.8543	19.7510	19.3453	18.8525	18.4719	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.7078	18.8899	19.1813	19.5572	19.8703	20.0443	20.0851	20.0803	19.9656	19.5518	19.0584	18.6782	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7078	18.8899	19.1813	19.5572	19.8703	20.0443	20.0851	20.0803	19.9656	19.5518	19.0584	18.6782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9933	0.9819	0.9449	0.8493	0.6671	0.4734	0.5354	0.8128	0.9674	0.9943	0.9981	(94)
Useful gains	534.7541	648.0899	750.7718	828.8279	807.7041	626.2781	424.3181	442.2631	606.2824	611.0614	532.9908	500.0090	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1821.4389	1765.6075	1597.7825	1332.2276	1019.8343	674.8914	432.0216	455.6249	729.0490	1117.3850	1497.1450	1818.2768	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	957.2935	750.9718	630.1759	362.4478	157.8248	0.0000	0.0000	0.0000	0.0000	376.7048	694.1910	980.7912	(98)
Space heating												4910.4009	(98)
Space heating per m2											(98) / (4) =	50.4044	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1165.2410	917.3174	940.8984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8348	0.9014	0.8709	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	972.7300	826.8358	819.4064	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1200.8310	1149.1054	1068.7526	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	164.2327	239.7686	185.5135	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												589.5148 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	41.0582	59.9422	46.3784	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												147.3787 (107)
Space cooling per m2												1.5128 (108)
Energy for space heating												50.4044 (99)
Energy for space cooling												1.5128 (108)
Total												51.9173 (109)
Target Fabric Energy Efficiency (TFEE)												59.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1986	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.4206	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3423	0.3178	0.3260	0.3097	0.3097	0.3015	0.2934	0.2852	0.2771	0.3015	0.2852	0.3015	(22b)
Effective ac	0.5586	0.5505	0.5531	0.5479	0.5479	0.5455	0.5430	0.5407	0.5384	0.5455	0.5407	0.5455	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4091	45.7388	45.9567	45.5264	45.5264	45.3195	45.1181	44.9222	44.7319	45.3195	44.9222	45.3195	(38)
Heat transfer coeff	136.3708	135.7005	135.9184	135.4881	135.4881	135.2812	135.0798	134.8839	134.6936	135.2812	134.8839	135.2812	(39)
Average = Sum(39)m / 12 =												135.3625	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3998	1.3929	1.3952	1.3908	1.3908	1.3886	1.3866	1.3846	1.3826	1.3886	1.3846	1.3886	(40)
HLP (average)												1.3895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
RHI water heating demand												1691	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581	(83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6094	49.8545	49.7745	49.9326	49.9326	50.0090	50.0836	50.1563	50.2272	50.0090	50.1563	50.0090	
alpha	4.3073	4.3236	4.3183	4.3288	4.3288	4.3339	4.3389	4.3438	4.3485	4.3339	4.3438	4.3339	
util living area													
	0.9892	0.9810	0.9544	0.8816	0.7460	0.5339	0.3935	0.4170	0.6828	0.9087	0.9770	0.9914	(86)
MIT	19.7594	19.9189	20.2390	20.6068	20.8601	20.9744	20.9946	20.9933	20.9280	20.6169	20.1433	19.7348	(87)
Th 2	19.7635	19.7687	19.7670	19.7704	19.7704	19.7721	19.7736	19.7752	19.7767	19.7721	19.7752	19.7721	(88)
util rest of house													
	0.9855	0.9747	0.9391	0.8433	0.6711	0.4278	0.2721	0.2891	0.5768	0.8686	0.9677	0.9885	(89)
MIT 2	18.1700	18.4029	18.8557	19.3535	19.6550	19.7594	19.7724	19.7736	19.7324	19.3830	18.7334	18.1405	(90)
Living area fraction										fLA = Living area / (4) =		0.2032	(91)
MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9672	0.9291	0.8374	0.6798	0.4488	0.2969	0.3153	0.5954	0.8631	0.9598	0.9838	(94)
Useful gains	842.3263	945.9218	1049.6512	1075.6616	911.3263	624.8666	393.0876	392.2294	672.1528	839.6731	825.6147	788.8906	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1853.6897	1819.8754	1649.6171	1369.5393	1002.6023	636.6801	394.5385	394.0597	710.5598	1113.8804	1499.9031	1821.4952	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	752.4543	587.2968	446.3747	211.5920	67.9093	0.0000	0.0000	0.0000	0.0000	204.0102	485.4877	768.2578	(98)
Space heating												3523.3828	(98)
RHI space heating demand												3523	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1986	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.4206	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4156	0.4074	0.3993	0.3586	0.3504	0.3097	0.3097	0.3015	0.3260	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5864	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5455	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.7181	48.4395	48.1664	46.8836	46.6436	45.5264	45.5264	45.3195	45.9567	46.6436	47.1291	47.6367	(38)
Heat transfer coeff	138.6798	138.4012	138.1281	136.8453	136.6053	135.4881	135.4881	135.2812	135.9184	136.6053	137.0908	137.5984	(39)
Average = Sum(39)m / 12 =												136.8442	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4235	1.4207	1.4179	1.4047	1.4022	1.3908	1.3908	1.3886	1.3952	1.4022	1.4072	1.4124	(40)
HLP (average)												1.4047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	812.5826	957.3999	1093.0625	1226.8648	1312.2575	1290.0990	1233.6318	1147.9861	1052.5460	916.5641	804.2065	765.7350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7834	48.8816	48.9783	49.4374	49.5243	49.9326	49.9326	50.0090	49.7745	49.5243	49.3489	49.1668	
alpha	4.2522	4.2588	4.2652	4.2958	4.3016	4.3288	4.3288	4.3339	4.3183	4.3016	4.2899	4.2778	
util living area													
	0.9924	0.9842	0.9642	0.9102	0.7980	0.6273	0.4723	0.5239	0.7624	0.9403	0.9856	0.9941	(86)
MIT	19.6138	19.8185	20.1278	20.5033	20.7942	20.9465	20.9875	20.9807	20.8751	20.4849	19.9751	19.5735	(87)
Th 2	19.7453	19.7475	19.7497	19.7597	19.7616	19.7704	19.7704	19.7721	19.7670	19.7616	19.7578	19.7538	(88)
util rest of house													
	0.9899	0.9790	0.9521	0.8799	0.7343	0.5246	0.3458	0.3930	0.6689	0.9133	0.9799	0.9921	(89)
MIT 2	17.9463	18.2436	18.6869	19.2112	19.5758	19.7384	19.7665	19.7652	19.6775	19.2021	18.4802	17.8935	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2852	18.5637	18.9797	19.4738	19.8234	19.9839	20.0146	20.0122	19.9209	19.4629	18.7840	18.2349	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2852	18.5637	18.9797	19.4738	19.8234	19.9839	20.0146	20.0122	19.9209	19.4629	18.7840	18.2349	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9720	0.9423	0.8715	0.7379	0.5436	0.3716	0.4196	0.6820	0.9049	0.9734	0.9884	(94)
Useful gains	800.7785	930.6139	1030.0350	1069.2137	968.2885	701.2449	458.4785	481.6665	717.8254	829.3758	782.8098	756.8333	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1939.4688	1891.0693	1723.8024	1446.9719	1109.7054	729.4591	462.6436	488.6683	791.1691	1210.7133	1601.7680	1931.1844	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	847.1856	645.4261	516.1630	271.9859	105.2142	0.0000	0.0000	0.0000	0.0000	283.7151	589.6499	873.7172	(98)
Space heating												4133.0568	(98)
Space heating per m2											(98) / (4) =	42.4251	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4448.9309	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	847.1856	645.4261	516.1630	271.9859	105.2142	0.0000	0.0000	0.0000	0.0000	283.7151	589.6499	873.7172	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	911.9328	694.7536	555.6114	292.7728	113.2553	0.0000	0.0000	0.0000	0.0000	305.3984	634.7146	940.4921	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3414	89.2738	89.1325	88.7966	88.0832	86.7000	86.7000	86.7000	86.7000	88.8002	89.2147	89.3689	(217)
Fuel for water heating, kWh/month													
	193.3893	169.6391	176.2131	155.4523	151.2997	134.0367	125.5844	142.1462	143.2609	161.3479	173.6973	187.6388	(219)
Water heating fuel used												1913.7056	(219)
Annual totals kWh/year													
Space heating fuel - main system												4448.9309	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												6281.7681	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4448.9309	3.4800	154.8228	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1913.7056	3.4800	66.5970	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			330.7532	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9754	(257)
SAP value		86.3932	
SAP rating (Section 12)		86	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4448.9309	0.2160	960.9691	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1913.7056	0.2160	413.3604	(264)
Space and water heating			1374.3295	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-552.7634	0.5190	-286.8842	(269)
Total kg/year			1332.3588	(272)
CO2 emissions per m2			13.6800	(273)
EI value			87.4641	
EI rating			87	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300 (1b)	x	2.5400 (2b)	=	125.2982	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4206	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3423	0.3178	0.3260	0.3097	0.3097	0.3015	0.2934	0.2852	0.2771	0.3015	0.2852	0.3015	(22b)
Effective ac	0.5586	0.5505	0.5531	0.5479	0.5479	0.5455	0.5430	0.5407	0.5384	0.5455	0.5407	0.5455	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4091	45.7388	45.9567	45.5264	45.5264	45.3195	45.1181	44.9222	44.7319	45.3195	44.9222	45.3195	(38)
Heat transfer coeff	136.3708	135.7005	135.9184	135.4881	135.4881	135.2812	135.0798	134.8839	134.6936	135.2812	134.8839	135.2812	(39)
Average = Sum(39)m / 12 =												135.3625	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3998	1.3929	1.3952	1.3908	1.3908	1.3886	1.3866	1.3846	1.3826	1.3886	1.3846	1.3886	(40)
HLP (average)												1.3895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
								Total per year (kWh/year) = Sum(64)m =				1691.0602	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581	(83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6094	49.8545	49.7745	49.9326	49.9326	50.0090	50.0836	50.1563	50.2272	50.0090	50.1563	50.0090	
alpha	4.3073	4.3236	4.3183	4.3288	4.3288	4.3339	4.3389	4.3438	4.3485	4.3339	4.3438	4.3339	
util living area													
	0.9892	0.9810	0.9544	0.8816	0.7460	0.5339	0.3935	0.4170	0.6828	0.9087	0.9770	0.9914	(86)
MIT	19.7594	19.9189	20.2390	20.6068	20.8601	20.9744	20.9946	20.9933	20.9280	20.6169	20.1433	19.7348	(87)
Th 2	19.7635	19.7687	19.7670	19.7704	19.7704	19.7721	19.7736	19.7752	19.7767	19.7721	19.7752	19.7721	(88)
util rest of house													
	0.9855	0.9747	0.9391	0.8433	0.6711	0.4278	0.2721	0.2891	0.5768	0.8686	0.9677	0.9885	(89)
MIT 2	18.1700	18.4029	18.8557	19.3535	19.6550	19.7594	19.7724	19.7736	19.7324	19.3830	18.7334	18.1405	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9672	0.9291	0.8374	0.6798	0.4488	0.2969	0.3153	0.5954	0.8631	0.9598	0.9838	(94)
Useful gains	842.3263	945.9218	1049.6512	1075.6616	911.3263	624.8666	393.0876	392.2294	672.1528	839.6731	825.6147	788.8906	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1853.6897	1819.8754	1649.6171	1369.5393	1002.6023	636.6801	394.5385	394.0597	710.5598	1113.8804	1499.9031	1821.4952	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	752.4543	587.2968	446.3747	211.5920	67.9093	0.0000	0.0000	0.0000	0.0000	204.0102	485.4877	768.2578	(98)
Space heating												3523.3828	(98)
Space heating per m2											(98) / (4) =	36.1669	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3792.6618	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	752.4543	587.2968	446.3747	211.5920	67.9093	0.0000	0.0000	0.0000	0.0000	204.0102	485.4877	768.2578	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	809.9616	632.1817	480.4894	227.7632	73.0994	0.0000	0.0000	0.0000	0.0000	219.6020	522.5917	826.9728	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2846	89.2249	89.0446	88.6088	87.7544	86.7000	86.7000	86.7000	86.7000	88.5516	89.1043	89.3094	(217)
Fuel for water heating, kWh/month													
	193.5123	169.7321	176.3871	155.7819	151.8666	134.0367	125.5844	142.1462	143.2609	161.8009	173.9127	187.7637	(219)
Water heating fuel used												1915.7854	(219)
Annual totals kWh/year													
Space heating fuel - main system												3792.6618	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												5553.8623	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3792.6618	7.3800	279.8984	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1915.7854	7.3800	141.3850	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			483.9794	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3792.6618	0.2160	819.2149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.7854	0.2160	413.8096	(264)
Space and water heating			1233.0246	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			1152.7950	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3792.6618	1.2200	4627.0474	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.7854	1.2200	2337.2582	(264)
Space and water heating			6964.3056	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			6489.7299	(272)
Primary energy kWh/m2/year			66.6160	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 87

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-193 kg (16.7%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£60	1.98 kg/m²	B 88	B 89
	Total Savings	£60	1.98 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£135	£150	-£14
Mains gas	£528	£454	£75
Space heating	£408	£408	£0
Water heating	£141	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£180	-£180	£0
Total cost of fuels	£483	£424	£61
Total cost of uses	£483	£423	£60
Delivered energy	57 kWh/m²	47 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	67 kWh/m²	56 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1986	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.4206	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4156	0.4074	0.3993	0.3586	0.3504	0.3097	0.3097	0.3015	0.3260	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5864	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5455	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.7181	48.4395	48.1664	46.8836	46.6436	45.5264	45.5264	45.3195	45.9567	46.6436	47.1291	47.6367	(38)
Heat transfer coeff	138.6798	138.4012	138.1281	136.8453	136.6053	135.4881	135.4881	135.2812	135.9184	136.6053	137.0908	137.5984	(39)
Average = Sum(39)m / 12 =												136.8442	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4235	1.4207	1.4179	1.4047	1.4022	1.3908	1.3908	1.3886	1.3952	1.4022	1.4072	1.4124	(40)
HLP (average)												1.4047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197	(61)
Total heat required for water heating calculated for each month													
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1683	(H8)
Utilisation factor												0.5751	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.6652	(H14)
Volume ratio Veff/V												0.7601	(H15)
Solar storage volume factor												0.9452	(H16)
Solar input												-866.8465	(H17)
Solar input	-25.1368	-41.9461	-71.4391	-95.7424	-118.2817	-116.2897	-114.7529	-100.2602	-78.5238	-53.6225	-29.8159	-21.0352	(63)
								Solar input (sum of months) = Sum(63)m =				-866.8465	(63)
Output from w/h													
	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
								Total per year (kWh/year) = Sum(64)m =				830.1649	(64)
Heat gains from water heating, kWh/month													
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	10.6334	0.7200	0.7000	0.7700	26.6661	(74)
East	6.6700	19.6403	0.7200	0.7000	0.7700	45.7548	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	5.2300	46.7521	0.7200	0.7000	0.7700	85.4016	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	192.9565	342.4332	501.9917	673.0424	796.8170	808.9758	772.5528	678.1151	561.2365	387.7808	233.6974	163.4207	(83)
Total gains	812.5826	957.3999	1093.0625	1226.8648	1312.2575	1290.0990	1233.6318	1147.9861	1052.5460	916.5641	804.2065	765.7350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.7834	48.8816	48.9783	49.4374	49.5243	49.9326	49.9326	50.0090	49.7745	49.5243	49.3489	49.1668	
alpha	4.2522	4.2588	4.2652	4.2958	4.3016	4.3288	4.3288	4.3339	4.3183	4.3016	4.2899	4.2778	
util living area													
	0.9924	0.9842	0.9642	0.9102	0.7980	0.6273	0.4723	0.5239	0.7624	0.9403	0.9856	0.9941	(86)
MIT	19.6138	19.8185	20.1278	20.5033	20.7942	20.9465	20.9875	20.9807	20.8751	20.4849	19.9751	19.5735	(87)
Th 2	19.7453	19.7475	19.7497	19.7597	19.7616	19.7704	19.7704	19.7721	19.7670	19.7616	19.7578	19.7538	(88)
util rest of house													
	0.9899	0.9790	0.9521	0.8799	0.7343	0.5246	0.3458	0.3930	0.6689	0.9133	0.9799	0.9921	(89)
MIT 2	17.9463	18.2436	18.6869	19.2112	19.5758	19.7384	19.7665	19.7652	19.6775	19.2021	18.4802	17.8935	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.2852	18.5637	18.9797	19.4738	19.8234	19.9839	20.0146	20.0122	19.9209	19.4629	18.7840	18.2349	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2852	18.5637	18.9797	19.4738	19.8234	19.9839	20.0146	20.0122	19.9209	19.4629	18.7840	18.2349	(93)

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8. Space heating requirement

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9720	0.9423	0.8715	0.7379	0.5436	0.3716	0.4196	0.6820	0.9049	0.9734	0.9884	(94)
Useful gains	800.7785	930.6139	1030.0350	1069.2137	968.2885	701.2449	458.4785	481.6665	717.8254	829.3758	782.8098	756.8333	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1939.4688	1891.0693	1723.8024	1446.9719	1109.7054	729.4591	462.6436	488.6683	791.1691	1210.7133	1601.7680	1931.1844	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	847.1856	645.4261	516.1630	271.9859	105.2142	0.0000	0.0000	0.0000	0.0000	283.7151	589.6499	873.7172	(98)
Space heating												4133.0568	(98)
Space heating per m2											(98) / (4) =	42.4251	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4448.9309	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	847.1856	645.4261	516.1630	271.9859	105.2142	0.0000	0.0000	0.0000	0.0000	283.7151	589.6499	873.7172	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	911.9328	694.7536	555.6114	292.7728	113.2553	0.0000	0.0000	0.0000	0.0000	305.3984	634.7146	940.4921	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.6399	109.4971	85.6241	42.2941	14.9880	0.0000	0.0000	22.9806	45.6834	89.6547	125.1477	146.6554	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4102	89.4213	89.4304	89.4557	89.4882	86.7000	86.7000	86.7000	86.7000	89.1102	89.3228	89.4256	(217)
Fuel for water heating, kWh/month	165.1264	122.4508	95.7439	47.2793	16.7485	0.0000	0.0000	26.5058	52.6913	100.6110	140.1072	163.9971	(219)
Water heating fuel used												931.2615	(219)
Annual totals kWh/year													
Space heating fuel - main system												4448.9309	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 853 * 1.00) =										-552.7634		-552.7634	(233)
Total delivered energy for all uses												5349.3241	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4448.9309	3.4800	154.8228	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	931.2615	3.4800	32.4079	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	396.8950	13.1900	52.3504	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-552.7634	13.1900	-72.9095	(252)
Total energy cost			303.1592	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.8940	(257)
SAP value	87.5284	
SAP rating (Section 12)	88	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4448.9309	0.2160	960.9691	(261)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	931.2615	0.2160	201.1525 (264)
Space and water heating			1162.1216 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.8950	0.5190	205.9885 (268)
Energy saving/generation technologies			
PV Unit	-552.7634	0.5190	-286.8842 (269)
Total kg/year			1146.1009 (272)
CO2 emissions per m2			11.7600 (273)
EI value			89.2166
EI rating			89 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.3300	(1b)	x 2.5400	(2b) =	125.2982	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.4200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		251.7749	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1986	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4206	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3260	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3423	0.3178	0.3260	0.3097	0.3097	0.3015	0.2934	0.2852	0.2771	0.3015	0.2852	0.3015	(22b)
Effective ac	0.5586	0.5505	0.5531	0.5479	0.5479	0.5455	0.5430	0.5407	0.5384	0.5455	0.5407	0.5455	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.4200	1.2357	27.7053			(27)
Opening Type 15			4.2400	1.5000	6.3600			(26a)
Ground floor			49.3300	0.1900	9.3727			(28a)
External Wall	147.2700	26.6600	120.6100	0.2700	32.5647			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			245.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8955			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.0662	(36)
Total fabric heat loss (33) + (36) =	89.9617	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.4091	45.7388	45.9567	45.5264	45.5264	45.3195	45.1181	44.9222	44.7319	45.3195	44.9222	45.3195	(38)
Heat transfer coeff	136.3708	135.7005	135.9184	135.4881	135.4881	135.2812	135.0798	134.8839	134.6936	135.2812	134.8839	135.2812	(39)
Average = Sum(39)m / 12 =												135.3625	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3998	1.3929	1.3952	1.3908	1.3908	1.3886	1.3866	1.3846	1.3826	1.3886	1.3846	1.3886	(40)
HLP (average)												1.3895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7143 (42)
Average daily hot water use (litres/day)	98.6652 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.5317	104.5851	100.6385	96.6919	92.7453	88.7987	88.7987	92.7453	96.6919	100.6385	104.5851	108.5317	(44)
Energy conte	160.9494	140.7674	145.2593	126.6406	121.5147	104.8579	97.1663	111.4997	112.8314	131.4941	143.5361	155.8709	(45)
Energy content (annual)										Total = Sum(45)m =		1552.3877	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1424	21.1151	21.7889	18.9961	18.2272	15.7287	14.5749	16.7250	16.9247	19.7241	21.5304	23.3806	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8274	10.6759	11.8038	11.3959	11.7550	11.3519	11.7154	11.7411	11.3758	11.7832	11.4275	11.8197 (61)
Total heat required for water heating calculated for each month												
	172.7768	151.4432	157.0631	138.0365	133.2697	116.2098	108.8816	123.2408	124.2072	143.2773	154.9636	167.6906 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3075 (H8)
Utilisation factor												0.5346 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.6652 (H14)
Volume ratio Veff/V												0.7601 (H15)
Solar storage volume factor												0.9452 (H16)
Solar input												-901.7521 (H17)
Solar input	-29.4173	-41.8296	-71.8950	-97.0030	-113.9358	-121.7015	-119.1421	-106.6358	-83.4884	-57.7210	-34.7930	-24.1896 (63)
								Solar input (sum of months) = Sum(63)m =				-901.7521 (63)
Output from w/h												
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010 (64)
								Total per year (kWh/year) = Sum(64)m =				805.0602 (64)
Heat gains from water heating, kWh/month												
	56.4725	49.4741	51.2497	44.9570	43.3424	37.7032	35.2366	40.0089	40.3604	46.6676	50.5826	54.7820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	162.8594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.1846	49.9027	40.5836	30.7244	22.9668	19.3896	20.9511	27.2330	36.5521	46.4113	54.1689	57.7461	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	376.2509	380.1552	370.3164	349.3710	322.9311	298.0813	281.4801	277.5758	287.4145	308.3600	334.7999	359.6497	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	54.0003	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	-108.5730	(71)
Water heating gains (Table 5)													
	75.9039	73.6222	68.8840	62.4402	58.2559	52.3656	47.3611	53.7754	56.0561	62.7252	70.2536	73.6317	(72)
Total internal gains													
	619.6261	614.9668	591.0707	553.8223	515.4405	481.1232	461.0790	469.8710	491.3095	528.7833	570.5092	602.3143	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.1800	13.4839	0.7200	0.7000	0.7700	33.8145	(74)
East	6.6700	25.1925	0.7200	0.7000	0.7700	58.6897	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	5.2300	56.7559	0.7200	0.7000	0.7700	103.6755	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	239.8083	362.9867	538.7287	730.6747	825.2083	911.2957	862.9656	774.0395	637.5251	444.1279	289.6535	199.5581 (83)
Total gains	859.4345	977.9535	1129.7995	1284.4970	1340.6488	1392.4188	1324.0445	1243.9105	1128.8345	972.9112	860.1626	801.8724 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.6094	49.8545	49.7745	49.9326	49.9326	50.0090	50.0836	50.1563	50.2272	50.0090	50.1563	50.0090	
alpha	4.3073	4.3236	4.3183	4.3288	4.3288	4.3339	4.3389	4.3438	4.3485	4.3339	4.3438	4.3339	
util living area													
	0.9892	0.9810	0.9544	0.8816	0.7460	0.5339	0.3935	0.4170	0.6828	0.9087	0.9770	0.9914	(86)
MIT	19.7594	19.9189	20.2390	20.6068	20.8601	20.9744	20.9946	20.9933	20.9280	20.6169	20.1433	19.7348	(87)
Th 2	19.7635	19.7687	19.7670	19.7704	19.7704	19.7721	19.7736	19.7752	19.7767	19.7721	19.7752	19.7721	(88)
util rest of house													
	0.9855	0.9747	0.9391	0.8433	0.6711	0.4278	0.2721	0.2891	0.5768	0.8686	0.9677	0.9885	(89)
MIT 2	18.1700	18.4029	18.8557	19.3535	19.6550	19.7594	19.7724	19.7736	19.7324	19.3830	18.7334	18.1405	(90)
Living area fraction									fLA = Living area / (4) =			0.2032	(91)
MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4930	18.7110	19.1368	19.6082	19.8999	20.0063	20.0208	20.0215	19.9754	19.6338	19.0200	18.4645	(93)

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8. Space heating requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9801	0.9672	0.9291	0.8374	0.6798	0.4488	0.2969	0.3153	0.5954	0.8631	0.9598	0.9838	(94)
Useful gains	842.3263	945.9218	1049.6512	1075.6616	911.3263	624.8666	393.0876	392.2294	672.1528	839.6731	825.6147	788.8906	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1853.6897	1819.8754	1649.6171	1369.5393	1002.6023	636.6801	394.5385	394.0597	710.5598	1113.8804	1499.9031	1821.4952	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	752.4543	587.2968	446.3747	211.5920	67.9093	0.0000	0.0000	0.0000	0.0000	204.0102	485.4877	768.2578	(98)
Space heating												3523.3828	(98)
Space heating per m2											(98) / (4) =	36.1669	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3792.6618	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	752.4543	587.2968	446.3747	211.5920	67.9093	0.0000	0.0000	0.0000	0.0000	204.0102	485.4877	768.2578	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	809.9616	632.1817	480.4894	227.7632	73.0994	0.0000	0.0000	0.0000	0.0000	219.6020	522.5917	826.9728	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	143.3594	109.6137	85.1682	41.0335	19.3338	0.0000	0.0000	16.6050	40.7188	85.5562	120.1706	143.5010	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3721	89.3811	89.3715	89.3643	89.1706	86.7000	86.7000	86.7000	86.7000	88.9302	89.2464	89.3808	(217)
Fuel for water heating, kWh/month													
	160.4073	122.6363	95.2968	45.9171	21.6818	0.0000	0.0000	19.1523	46.9652	96.2060	134.6504	160.5502	(219)
Water heating fuel used												903.4633	(219)
Annual totals kWh/year													
Space heating fuel - main system												3792.6618	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												396.8950	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 967 * 1.00) =										-626.4799		-626.4799	(233)
Total delivered energy for all uses												4591.5402	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3792.6618	7.3800	279.8984	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	903.4633	7.3800	66.6756	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	396.8950	28.6600	113.7501	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-626.4799	28.6600	-179.5491	(252)
Total energy cost			423.6000	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3792.6618	0.2160	819.2149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.4633	0.2160	195.1481	(264)
Space and water heating			1014.3630	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	396.8950	0.5190	205.9885	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	0.5190	-325.1430	(269)
Total kg/year			960.0835	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3792.6618	1.2200	4627.0474	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	903.4633	1.2200	1102.2253	(264)
Space and water heating			5729.2727	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	396.8950	3.0700	1218.4675	(268)
Energy saving/generation technologies				
PV Unit	-626.4799	3.0700	-1923.2932	(269)
Primary energy kWh/year			5408.1970	(272)
Primary energy kWh/m2/year			55.5142	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		664.69 (P1)
Transmission heat loss coefficient		89.96 (37)
Summer heat loss coefficient		754.65 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
South West	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.1800	87.1704	0.7200	0.7000	0.8865	251.6781
East	6.6700	125.2818	0.7200	0.7000	0.8865	336.0203
South East	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
South	5.2300	118.5567	0.7200	0.7000	0.8865	249.3328
South West	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
West	1.3000	125.2818	0.7200	0.7000	0.8865	65.4912
total:						1006.9586

	Jun	Jul	Aug	
Solar gains	1081	1007	900	(P3)
Internal gains	478	458	467	
Total summer gains	1559	1465	1367	(P5)
Summer gain/loss ratio	2.07	1.94	1.81	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.72	19.49	19.36	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 399 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Blackcap Walk, Boorley Green, SOUTHAMPTON, SO32 2DZ		

SAP Rating	86 B	**DER**	15.38	**TER**	18.75
Environmental	87 B	**% DER<TER**	17.98		
CO_2 Emissions (t/year)	1.11	**DFEE**	54.59	**TFEE**	59.70
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.56		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.75	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.38	$kgCO_2/m^2$	Pass
	-3.37 (-18.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.70	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.59	$kWh/m^2/yr$	
	-5.1 (-8.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.18 m², No overhang
Windows facing East	6.67 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	5.23 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	1.30 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.025	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 400 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	21 Wren Walk , Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.35	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.99		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.03	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 117 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.08 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.79 m², No overhang
Windows facing South: 7.03 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.8917	57.5813	57.2770	55.8478	55.5804	54.3356	54.3356	54.1051	54.8151	55.5804	56.1214	56.6869	(38)
Heat transfer coeff	147.3482	147.0377	146.7334	145.3042	145.0368	143.7920	143.7920	143.5615	144.2715	145.0368	145.5778	146.1433	(39)
Average = Sum(39)m / 12 =												145.3029	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2547	1.2520	1.2494	1.2373	1.2350	1.2244	1.2244	1.2224	1.2285	1.2350	1.2396	1.2444	(40)
HLP (average)												1.2373	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	456.1245	453.6518	436.8767	409.7601	381.8770	355.4447	338.5930	345.3364	359.5722	386.9219	418.2604	442.0964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	603.5642	704.0425	782.3709	850.7092	893.3141	872.4449	833.0682	784.7848	737.2004	663.9652	594.6032	568.5042	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3489	55.4657	55.5808	56.1275	56.2309	56.7177	56.7177	56.8088	56.5292	56.2309	56.0220	55.8052	
alpha	4.6899	4.6977	4.7054	4.7418	4.7487	4.7812	4.7812	4.7873	4.7686	4.7487	4.7348	4.7203	
util living area													
	0.9990	0.9976	0.9943	0.9832	0.9473	0.8483	0.6979	0.7491	0.9247	0.9885	0.9979	0.9992	(86)
MIT	19.5421	19.6929	19.9398	20.2744	20.6042	20.8579	20.9595	20.9428	20.7526	20.3290	19.8746	19.5164	(87)
Th 2	19.8765	19.8786	19.8807	19.8903	19.8921	19.9005	19.9005	19.9021	19.8973	19.8921	19.8885	19.8846	(88)
util rest of house													
	0.9986	0.9968	0.9920	0.9758	0.9205	0.7669	0.5524	0.6111	0.8744	0.9821	0.9969	0.9990	(89)
MIT 2	17.9313	18.1530	18.5148	19.0062	19.4702	19.7929	19.8839	19.8753	19.6758	19.0898	18.4261	17.8992	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.1919	18.4021	18.7453	19.2114	19.6536	19.9652	20.0579	20.0480	19.8501	19.2903	18.6604	18.1608	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1919	18.4021	18.7453	19.2114	19.6536	19.9652	20.0579	20.0480	19.8501	19.2903	18.6604	18.1608	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9886	0.9693	0.9130	0.7726	0.5754	0.6319	0.8716	0.9769	0.9953	0.9983	(94)
Useful gains	602.1776	700.5469	773.4609	824.5846	815.5904	674.0268	479.3150	495.9046	642.5393	648.6063	591.8064	567.5188	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2046.9451	1985.3246	1796.8022	1498.2836	1153.5696	771.4741	497.2189	523.7102	829.5686	1260.4090	1682.9396	2040.2787	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1074.9070	863.3707	761.3659	485.0633	251.4565	0.0000	0.0000	0.0000	0.0000	455.1812	785.6159	1095.7334	(98)
Space heating												5772.6938	(98)
Space heating per m2											(98) / (4) =	49.1544	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6213.8792	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1074.9070	863.3707	761.3659	485.0633	251.4565	0.0000	0.0000	0.0000	0.0000	455.1812	785.6159	1095.7334	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1157.0581	929.3549	819.5542	522.1349	270.6743	0.0000	0.0000	0.0000	0.0000	489.9690	845.6576	1179.4762	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4307	89.3947	89.3219	89.1537	88.7430	86.7000	86.7000	86.7000	86.7000	89.0945	89.3428	89.4501	(217)
Fuel for water heating, kWh/month													
	199.2066	174.6686	181.2706	159.5804	154.7538	138.0806	129.3317	146.4468	147.6134	165.7439	178.8138	193.2880	(219)
Water heating fuel used												1968.7983	(219)
Annual totals kWh/year													
Space heating fuel - main system												6213.8792	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												7797.8611	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6213.8792	0.2160	1342.1979	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.7983	0.2160	425.2604	(264)
Space and water heating			1767.4583	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total CO2, kg/year			1567.7386	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3500	ZC1
Total Floor Area	TFA	117.4400	
Assumed number of occupants	N	2.8529	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2212	ZC2
CO2 emissions from cooking, equation (L16)		1.5963	ZC3
Total CO2 emissions		29.1675	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.1675	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3823	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2738	48.8380	45.2514	46.7598	48.8380	49.2738	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
								Total per year (kWh/year) = Sum(64)m =				2191.5671	(64)
Heat gains from water heating, kWh/month													
	68.0400	59.8728	62.6490	55.8306	53.9604	47.3407	45.0751	50.5194	51.0859	57.9195	61.6460	66.2950	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	91.4516	89.0964	84.2057	77.5425	72.5275	65.7510	60.5848	67.9025	70.9527	77.8488	85.6194	89.1062	(72)
Total internal gains													
	469.2708	466.8008	450.0312	422.9078	394.3338	367.2120	350.3657	357.7982	372.7274	400.0836	431.4133	455.2454	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	598.2806	685.8927	752.3387	808.7383	841.8413	819.5873	783.0315	742.3156	703.1520	642.4964	585.7133	565.8522	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9991	0.9979	0.9950	0.9849	0.9507	0.8501	0.6941	0.7436	0.9249	0.9892	0.9980	0.9993	(86)
MIT	19.6598	19.7980	20.0262	20.3380	20.6438	20.8784	20.9682	20.9546	20.7853	20.3938	19.9720	19.6378	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9987	0.9972	0.9930	0.9783	0.9260	0.7727	0.5571	0.6131	0.8765	0.9832	0.9972	0.9991	(89)
MIT 2	18.1554	18.3590	18.6937	19.1531	19.5843	19.8842	19.9642	19.9577	19.7800	19.2380	18.6215	18.1294	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9957	0.9901	0.9727	0.9194	0.7787	0.5788	0.6330	0.8746	0.9786	0.9958	0.9985	(94)
Useful gains	597.0587	682.9412	744.9099	786.6699	773.9910	638.2325	453.2416	469.9028	614.9759	628.7219	583.2258	564.9797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1922.2555	1862.2151	1683.7369	1401.1974	1078.3872	721.6497	467.3891	491.9640	777.3351	1181.3694	1578.3831	1914.1382	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating												5277.2932	(98)
Space heating per m2											(98) / (4) =	44.9361	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5650.2069	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1055.6171	848.4712	747.8451	473.7256	242.4741	0.0000	0.0000	0.0000	0.0000	440.2245	767.1448	1074.7044	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3924	88.2401	87.9281	87.2257	85.7099	80.3000	80.3000	80.3000	80.3000	86.9818	88.0068	88.4596	(217)
Fuel for water heating, kWh/month													
	245.8079	217.0089	228.6666	206.5187	203.4827	191.2901	183.2705	204.3037	206.5600	214.8010	224.5707	239.6884	(219)
Water heating fuel used												2565.9692	(219)
Annual totals kWh/year													
Space heating fuel - main system												5650.2069	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Total delivered energy for all uses												8771.2617	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5650.2069	0.2160	1220.4447	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.9692	0.2160	554.2493	(264)
Space and water heating			1774.6940	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Total CO2, kg/m2/year			2062.7834	(272)
Emissions per m2 for space and water heating			15.1115	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1216	(272b)
Emissions per m2 for pumps and fans			0.3314	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1115 * 1.00) + 2.1216 + 0.3314, rounded to 2 d.p.			17.5600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3363	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2858	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3644	0.3573	0.3501	0.3144	0.3073	0.2715	0.2715	0.2644	0.2858	0.3073	0.3216	0.3359	(22b)
Effective ac	0.5664	0.5638	0.5613	0.5494	0.5472	0.5369	0.5369	0.5350	0.5408	0.5472	0.5517	0.5564	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.5243	56.2670	56.0147	54.8300	54.6083	53.5764	53.5764	53.3853	53.9739	54.6083	55.0567	55.5255	(38)
Heat transfer coeff	145.9807	145.7234	145.4712	144.2864	144.0647	143.0328	143.0328	142.8418	143.4303	144.0647	144.5132	144.9820	(39)
Average = Sum(39)m / 12 =												144.2853	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2430	1.2408	1.2387	1.2286	1.2267	1.2179	1.2179	1.2163	1.2213	1.2267	1.2305	1.2345	(40)
HLP (average)												1.2286	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	569.7620	671.0930	751.1920	821.9374	866.1077	847.4409	809.9340	759.2525	710.8143	635.0876	562.9124	535.5510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8673	55.9660	56.0630	56.5234	56.6104	57.0188	57.0188	57.0950	56.8608	56.6104	56.4347	56.2522	
alpha	4.7245	4.7311	4.7375	4.7682	4.7740	4.8013	4.8013	4.8063	4.7907	4.7740	4.7623	4.7501	
util living area													
	0.9992	0.9981	0.9952	0.9852	0.9521	0.8579	0.7099	0.7630	0.9323	0.9904	0.9983	0.9994	(86)
MIT	19.5306	19.6813	19.9283	20.2620	20.5937	20.8512	20.9570	20.9386	20.7419	20.3144	19.8598	19.5033	(87)
Th 2	19.8857	19.8875	19.8892	19.8972	19.8987	19.9057	19.9057	19.9070	19.9030	19.8987	19.8957	19.8925	(88)
util rest of house													
	0.9989	0.9974	0.9932	0.9786	0.9272	0.7790	0.5646	0.6264	0.8856	0.9849	0.9976	0.9992	(89)
MIT 2	18.5441	18.6959	18.9435	19.2803	19.6005	19.8277	19.8934	19.8869	19.7429	19.3355	18.8809	18.5221	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.7037	18.8553	19.1028	19.4392	19.7612	19.9933	20.0655	20.0571	19.9045	19.4939	19.0392	18.6808	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7037	18.8553	19.1028	19.4392	19.7612	19.9933	20.0655	20.0571	19.9045	19.4939	19.0392	18.6808	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9913	0.9748	0.9232	0.7866	0.5881	0.6479	0.8857	0.9820	0.9967	0.9989	(94)
Useful gains	568.8920	668.7179	744.6812	801.2479	799.6014	666.5679	476.3562	491.8935	629.5346	623.6594	561.0800	534.9446	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2102.6669	2033.6165	1833.3501	1520.6560	1161.3334	771.4178	495.6799	522.3843	832.5388	1281.2909	1725.3763	2099.4615	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1141.1285	917.2118	809.9697	517.9738	269.1286	0.0000	0.0000	0.0000	0.0000	489.2779	838.2934	1164.0006	(98)
Space heating												6146.9842	(98)
Space heating per m2											(98) / (4) =	52.3415	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1344.5088	1058.4431	1085.5974	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7379	0.8277	0.7930	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	992.0762	876.1021	860.8254	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0102	1058.7086	1001.8556	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	81.3125	135.8593	104.9264	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												322.0982	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   20.3281   33.9648   26.2316    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              80.5246 (107)
Space cooling per m2                                                                                                        0.6857 (108)
Energy for space heating                                                                                                   52.3415 (99)
Energy for space cooling                                                                                                    0.6857 (108)
Total                                                                                                                      53.0272 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                      53.0 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3823 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	551.3321	639.7941	708.0052	766.8188	802.1780	782.8159	748.1246	704.3214	663.6108	600.4572	540.8695	519.7501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9994	0.9985	0.9962	0.9879	0.9587	0.8677	0.7178	0.7697	0.9382	0.9919	0.9986	0.9995	(86)
MIT	19.6225	19.7616	19.9917	20.3068	20.6187	20.8644	20.9629	20.9467	20.7630	20.3618	19.9365	19.6010	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9991	0.9979	0.9946	0.9825	0.9371	0.7946	0.5801	0.6405	0.8958	0.9873	0.9980	0.9994	(89)
MIT 2	18.6879	18.8286	19.0599	19.3809	19.6839	19.9048	19.9666	19.9614	19.8240	19.4386	19.0121	18.6735	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9931	0.9794	0.9335	0.8016	0.6024	0.6609	0.8959	0.9849	0.9974	0.9991	(94)
Useful gains	550.6590	638.0132	703.1465	751.0311	748.8526	627.4996	450.6595	465.4570	594.5591	591.4016	539.4500	519.2829	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1982.2899	1914.9463	1724.6217	1426.1308	1089.0156	723.6310	467.5504	492.2031	781.7717	1203.1824	1621.6299	1974.9303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1065.1334	858.0990	759.9775	486.0717	253.0813	0.0000	0.0000	0.0000	0.0000	455.1649	779.1695	1083.0017	(98)
Space heating												5739.6992	(98)
Space heating per m2											(98) / (4) =	48.8735	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8038	980.7392	1005.3689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7475	0.8386	0.8058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.2544	822.4029	810.1758	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1029.4744	986.4639	937.6505	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.7185	122.0614	94.8411	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												287.6210	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   17.6796   30.5153   23.7103    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              71.9052 (107)
Space cooling per m2                                                                                                        0.6123 (108)
Energy for space heating                                                                                                   48.8735 (99)
Energy for space cooling                                                                                                    0.6123 (108)
Total                                                                                                                      49.4857 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        56.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3296	0.3061	0.3139	0.2982	0.2982	0.2904	0.2825	0.2747	0.2668	0.2904	0.2747	0.2904	(22b)
Effective ac	0.5543	0.5468	0.5493	0.5445	0.5445	0.5422	0.5399	0.5377	0.5356	0.5422	0.5377	0.5422	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3191	54.5723	54.8151	54.3356	54.3356	54.1051	53.8807	53.6625	53.4504	54.1051	53.6625	54.1051	(38)
Heat transfer coeff	144.7756	144.0287	144.2715	143.7920	143.7920	143.5615	143.3371	143.1189	142.9068	143.5615	143.1189	143.5615	(39)
Average = Sum(39)m / 12 =												143.6522	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2328	1.2264	1.2285	1.2244	1.2244	1.2224	1.2205	1.2187	1.2168	1.2224	1.2187	1.2224	(40)
HLP (average)												1.2232	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
RHI water heating demand												1743	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3324	56.6245	56.5292	56.7177	56.7177	56.8088	56.8977	56.9845	57.0690	56.8088	56.9845	56.8088	
alpha	4.7555	4.7750	4.7686	4.7812	4.7812	4.7873	4.7932	4.7990	4.8046	4.7873	4.7990	4.7873	
util living area	0.9944	0.9912	0.9809	0.9502	0.8701	0.6841	0.5176	0.5365	0.7988	0.9519	0.9880	0.9955	(86)
MIT	19.8395	19.9498	20.1928	20.5067	20.7854	20.9521	20.9899	20.9883	20.8963	20.5835	20.1769	19.8276	(87)
Th 2	19.8939	19.8989	19.8973	19.9005	19.9005	19.9021	19.9036	19.9051	19.9065	19.9021	19.9051	19.9021	(88)
util rest of house	0.9925	0.9882	0.9739	0.9304	0.8161	0.5752	0.3785	0.3936	0.7072	0.9280	0.9830	0.9939	(89)
MIT 2	18.3771	18.5407	18.8906	19.3360	19.7008	19.8747	19.9008	19.9018	19.8335	19.4496	18.8760	18.3656	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9218	0.8147	0.5909	0.4012	0.4170	0.7167	0.9203	0.9777	0.9910	(94)
Useful gains	853.3650	922.7293	981.8782	997.7155	889.7391	654.4338	423.3814	422.2437	690.0225	822.2716	824.0546	807.9531	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1985.4058	1939.8797	1745.8660	1441.5789	1060.6450	681.7779	426.7137	426.1455	758.1810	1181.9507	1600.9986	1952.7442	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	842.2384	683.5251	568.4069	319.5817	127.1539	0.0000	0.0000	0.0000	0.0000	267.6012	559.3997	851.7246	(98)
Space heating												4219.6315	(98)
RHI space heating demand												4220	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653 (8)
Pressure test		Yes
Measured/design AP50		4.0800
Infiltration rate		0.3693 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss	(33) + (36) = 89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.8917	57.5813	57.2770	55.8478	55.5804	54.3356	54.3356	54.1051	54.8151	55.5804	56.1214	56.6869	(38)
Heat transfer coeff	147.3482	147.0377	146.7334	145.3042	145.0368	143.7920	143.7920	143.5615	144.2715	145.0368	145.5778	146.1433	(39)
Average = Sum(39)m / 12 =												145.3029	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2547	1.2520	1.2494	1.2373	1.2350	1.2244	1.2244	1.2224	1.2285	1.2350	1.2396	1.2444	(40)
HLP (average)												1.2373	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3489	55.4657	55.5808	56.1275	56.2309	56.7177	56.7177	56.8088	56.5292	56.2309	56.0220	55.8052	
alpha	4.6899	4.6977	4.7054	4.7418	4.7487	4.7812	4.7812	4.7873	4.7686	4.7487	4.7348	4.7203	
util living area													
	0.9960	0.9925	0.9849	0.9634	0.9051	0.7717	0.6055	0.6511	0.8592	0.9693	0.9924	0.9968	(86)
MIT	19.7172	19.8636	20.0983	20.4108	20.7042	20.9088	20.9778	20.9686	20.8356	20.4668	20.0353	19.6883	(87)
Th 2	19.8765	19.8786	19.8807	19.8903	19.8921	19.9005	19.9005	19.9021	19.8973	19.8921	19.8885	19.8846	(88)
util rest of house													
	0.9946	0.9900	0.9795	0.9488	0.8645	0.6784	0.4681	0.5155	0.7871	0.9541	0.9893	0.9957	(89)
MIT 2	18.1867	18.4011	18.7427	19.1957	19.5940	19.8372	19.8922	19.8889	19.7640	19.2814	18.6592	18.1502	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4343	18.6377	18.9620	19.3923	19.7736	20.0106	20.0678	20.0636	19.9374	19.4732	18.8818	18.3991	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4343	18.6377	18.9620	19.3923	19.7736	20.0106	20.0678	20.0636	19.9374	19.4732	18.8818	18.3991	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9732	0.9402	0.8593	0.6889	0.4903	0.5369	0.7902	0.9462	0.9851	0.9935	(94)
Useful gains	822.7065	913.6945	968.0120	985.4305	924.0225	718.3300	489.4497	511.8165	723.8116	811.5350	791.7256	784.2168	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2082.6594	2019.9564	1828.5978	1524.5700	1170.9713	778.0013	498.6467	525.9529	842.1648	1286.9431	1715.1690	2075.1011	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	937.4050	743.4080	640.2758	388.1804	183.7299	0.0000	0.0000	0.0000	0.0000	353.7036	664.8792	960.4179	(98)
Space heating												4871.9999	(98)
Space heating per m2											(98) / (4) =	41.4850	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5244.3486	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	937.4050	743.4080	640.2758	388.1804	183.7299	0.0000	0.0000	0.0000	0.0000	353.7036	664.8792	960.4179	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	1009.0474	800.2239	689.2097	417.8476	197.7717	0.0000	0.0000	0.0000	0.0000	380.7358	715.6935	1033.8190	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3732	89.3277	89.2352	89.0188	88.5028	86.7000	86.7000	86.7000	86.7000	88.9332	89.2617	89.3966	(217)
Fuel for water heating, kWh/month	199.3348	174.7995	181.4466	159.8224	155.1739	138.0806	129.3317	146.4468	147.6134	166.0445	178.9761	193.4035	(219)
Water heating fuel used												1970.4738	(219)
Annual totals kWh/year													
Space heating fuel - main system												5244.3486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												6830.0060	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5244.3486	3.4800	182.5033	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.4738	3.4800	68.5725	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			320.3185	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8282	(257)
SAP value		88.4465	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5244.3486	0.2160	1132.7793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.4738	0.2160	425.6223	(264)
Space and water heating			1558.4016	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total kg/year			1358.6819	(272)
CO2 emissions per m2			11.5700	(273)
EI value			88.7920	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653 (8)
Pressure test		Yes
Measured/design AP50		4.0800
Infiltration rate		0.3693 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3296	0.3061	0.3139	0.2982	0.2982	0.2904	0.2825	0.2747	0.2668	0.2904	0.2747	0.2904	(22b)
Effective ac	0.5543	0.5468	0.5493	0.5445	0.5445	0.5422	0.5399	0.5377	0.5356	0.5422	0.5377	0.5422	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3191	54.5723	54.8151	54.3356	54.3356	54.1051	53.8807	53.6625	53.4504	54.1051	53.6625	54.1051	(38)
Heat transfer coeff	144.7756	144.0287	144.2715	143.7920	143.7920	143.5615	143.3371	143.1189	142.9068	143.5615	143.1189	143.5615	(39)
Average = Sum(39)m / 12 =												143.6522	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2328	1.2264	1.2285	1.2244	1.2244	1.2224	1.2205	1.2187	1.2168	1.2224	1.2187	1.2224	(40)
HLP (average)												1.2232	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3324	56.6245	56.5292	56.7177	56.7177	56.8088	56.8977	56.9845	57.0690	56.8088	56.9845	56.8088	
alpha	4.7555	4.7750	4.7686	4.7812	4.7812	4.7873	4.7932	4.7990	4.8046	4.7873	4.7990	4.7873	
util living area													
	0.9944	0.9912	0.9809	0.9502	0.8701	0.6841	0.5176	0.5365	0.7988	0.9519	0.9880	0.9955	(86)
MIT	19.8395	19.9498	20.1928	20.5067	20.7854	20.9521	20.9899	20.9883	20.8963	20.5835	20.1769	19.8276	(87)
Th 2	19.8939	19.8989	19.8973	19.9005	19.9005	19.9021	19.9036	19.9051	19.9065	19.9021	19.9051	19.9021	(88)
util rest of house													
	0.9925	0.9882	0.9739	0.9304	0.8161	0.5752	0.3785	0.3936	0.7072	0.9280	0.9830	0.9939	(89)
MIT 2	18.3771	18.5407	18.8906	19.3360	19.7008	19.8747	19.9008	19.9018	19.8335	19.4496	18.8760	18.3656	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9218	0.8147	0.5909	0.4012	0.4170	0.7167	0.9203	0.9777	0.9910	(94)
Useful gains	853.3650	922.7293	981.8782	997.7155	889.7391	654.4338	423.3814	422.2437	690.0225	822.2716	824.0546	807.9531	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1985.4058	1939.8797	1745.8660	1441.5789	1060.6450	681.7779	426.7137	426.1455	758.1810	1181.9507	1600.9986	1952.7442	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	842.2384	683.5251	568.4069	319.5817	127.1539	0.0000	0.0000	0.0000	0.0000	267.6012	559.3997	851.7246	(98)
Space heating												4219.6315	(98)
Space heating per m2											(98) / (4) =	35.9301	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4542.1222	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	842.2384	683.5251	568.4069	319.5817	127.1539	0.0000	0.0000	0.0000	0.0000	267.6012	559.3997	851.7246	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	906.6075	735.7644	611.8481	344.0061	136.8718	0.0000	0.0000	0.0000	0.0000	288.0530	602.1525	916.8187	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3244	89.2872	89.1703	88.8894	88.2095	86.7000	86.7000	86.7000	86.7000	88.7354	89.1689	89.3436	(217)
Fuel for water heating, kWh/month													
	199.4437	174.8788	181.5787	160.0551	155.6898	138.0806	129.3317	146.4468	147.6134	166.4147	179.1625	193.5183	(219)
Water heating fuel used												1972.2142	(219)
Annual totals kWh/year													
Space heating fuel - main system												4542.1222	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												6025.2685	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4542.1222	7.3800	335.2086	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1972.2142	7.3800	145.5494	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			447.5912	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4542.1222	0.2160	981.0984	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.2142	0.2160	425.9983	(264)
Space and water heating			1407.0967	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			1153.2704	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4542.1222	1.2200	5541.3891	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.2142	1.2200	2406.1014	(264)
Space and water heating			7947.4904	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			6446.0518	(272)
Primary energy kWh/m2/year			54.8880	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (17.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.67 kg/m²	B 89	B 90
Total Savings	£62	1.67 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£173	-£14
Mains gas	£588	£512	£76
Space heating	£464	£464	£0
Water heating	£146	£84	£62
Lighting	£138	£138	£0
Generated (PV)	-£299	-£299	£0
Total cost of fuels	£448	£386	£62
Total cost of uses	£449	£387	£62
Delivered energy	51 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	45 kWh/m²	9 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200	(1b)	x 2.5300	(2b) =	148.5616	(1b) - (3b)
First floor	58.7200	(1c)	x 2.6200	(2c) =	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653 (8)
Pressure test		Yes
Measured/design AP50		4.0800
Infiltration rate		0.3693 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.8917	57.5813	57.2770	55.8478	55.5804	54.3356	54.3356	54.1051	54.8151	55.5804	56.1214	56.6869	(38)
Heat transfer coeff	147.3482	147.0377	146.7334	145.3042	145.0368	143.7920	143.7920	143.5615	144.2715	145.0368	145.5778	146.1433	(39)
Average = Sum(39)m / 12 =												145.3029	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2547	1.2520	1.2494	1.2373	1.2350	1.2244	1.2244	1.2224	1.2285	1.2350	1.2396	1.2444	(40)
HLP (average)												1.2373	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1306	(H8)
Utilisation factor												0.5871	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-878.7246	(H17)
Solar input	-25.4813	-42.5209	-72.4180	-97.0543	-119.9025	-117.8832	-116.3253	-101.6340	-79.5998	-54.3573	-30.2244	-21.3235	(63)
								Solar input (sum of months) = Sum(63)m =				-878.7246	(63)
Output from w/h													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
								Total per year (kWh/year) = Sum(64)m =				868.4047	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3489	55.4657	55.5808	56.1275	56.2309	56.7177	56.7177	56.8088	56.5292	56.2309	56.0220	55.8052	
alpha	4.6899	4.6977	4.7054	4.7418	4.7487	4.7812	4.7812	4.7873	4.7686	4.7487	4.7348	4.7203	
util living area													
	0.9960	0.9925	0.9849	0.9634	0.9051	0.7717	0.6055	0.6511	0.8592	0.9693	0.9924	0.9968	(86)
MIT	19.7172	19.8636	20.0983	20.4108	20.7042	20.9088	20.9778	20.9686	20.8356	20.4668	20.0353	19.6883	(87)
Th 2	19.8765	19.8786	19.8807	19.8903	19.8921	19.9005	19.9005	19.9021	19.8973	19.8921	19.8885	19.8846	(88)
util rest of house													
	0.9946	0.9900	0.9795	0.9488	0.8645	0.6784	0.4681	0.5155	0.7871	0.9541	0.9893	0.9957	(89)
MIT 2	18.1867	18.4011	18.7427	19.1957	19.5940	19.8372	19.8922	19.8889	19.7640	19.2814	18.6592	18.1502	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4343	18.6377	18.9620	19.3923	19.7736	20.0106	20.0678	20.0636	19.9374	19.4732	18.8818	18.3991	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4343	18.6377	18.9620	19.3923	19.7736	20.0106	20.0678	20.0636	19.9374	19.4732	18.8818	18.3991	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9732	0.9402	0.8593	0.6889	0.4903	0.5369	0.7902	0.9462	0.9851	0.9935	(94)
Useful gains	822.7065	913.6945	968.0120	985.4305	924.0225	718.3300	489.4497	511.8165	723.8116	811.5350	791.7256	784.2168	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	2082.6594	2019.9564	1828.5978	1524.5700	1170.9713	778.0013	498.6467	525.9529	842.1648	1286.9431	1715.1690	2075.1011 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	937.4050	743.4080	640.2758	388.1804	183.7299	0.0000	0.0000	0.0000	0.0000	353.7036	664.8792	960.4179 (98)
Space heating												4871.9999 (98)
Space heating per m2											(98) / (4) =	41.4850 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5244.3486	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	937.4050	743.4080	640.2758	388.1804	183.7299	0.0000	0.0000	0.0000	0.0000	353.7036	664.8792	960.4179	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1009.0474	800.2239	689.2097	417.8476	197.7717	0.0000	0.0000	0.0000	0.0000	380.7358	715.6935	1033.8190	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4377	89.4622	89.4949	89.5551	89.6134	86.7000	86.7000	86.7000	86.7000	89.2127	89.3622	89.4500	(217)
Fuel for water heating, kWh/month													
	170.7006	127.0072	100.0016	50.4913	19.4510	2.1138	0.0000	29.2219	55.8028	104.5943	144.9525	169.4497	(219)
Water heating fuel used												973.7868	(219)
Annual totals kWh/year													
Space heating fuel - main system												5244.3486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												5883.3189	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5244.3486	3.4800	182.5033	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.7868	3.4800	33.8878	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			292.2288	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7556 (257)
SAP value		89.4597
SAP rating (Section 12)		89 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5244.3486	0.2160	1132.7793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.7868	0.2160	210.3379	(264)
Space and water heating			1343.1172	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-939.9020	0.5190	-487.8092 (269)
Total kg/year			1169.3475 (272)
CO2 emissions per m2			9.9600 (273)
EI value			90.3538
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3296	0.3061	0.3139	0.2982	0.2982	0.2904	0.2825	0.2747	0.2668	0.2904	0.2747	0.2904	(22b)
Effective ac	0.5543	0.5468	0.5493	0.5445	0.5445	0.5422	0.5399	0.5377	0.5356	0.5422	0.5377	0.5422	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.3191	54.5723	54.8151	54.3356	54.3356	54.1051	53.8807	53.6625	53.4504	54.1051	53.6625	54.1051	(38)
Heat transfer coeff	144.7756	144.0287	144.2715	143.7920	143.7920	143.5615	143.3371	143.1189	142.9068	143.5615	143.1189	143.5615	(39)
Average = Sum(39)m / 12 =												143.6522	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2328	1.2264	1.2285	1.2244	1.2244	1.2224	1.2205	1.2187	1.2168	1.2224	1.2187	1.2224	(40)
HLP (average)												1.2232	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2653	(H8)
Utilisation factor												0.5463	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-915.1250	(H17)
Solar input	-29.8536	-42.4499	-72.9612	-98.4415	-115.6255	-123.5063	-120.9089	-108.2172	-84.7266	-58.5770	-35.3089	-24.5483	(63)
								Solar input (sum of months) = Sum(63)m =				-915.1250	(63)
Output from w/h													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
								Total per year (kWh/year) = Sum(64)m =				840.3783	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3324	56.6245	56.5292	56.7177	56.7177	56.8088	56.8977	56.9845	57.0690	56.8088	56.9845	56.8088	
alpha	4.7555	4.7750	4.7686	4.7812	4.7812	4.7873	4.7932	4.7990	4.8046	4.7873	4.7990	4.7873	
util living area													
	0.9944	0.9912	0.9809	0.9502	0.8701	0.6841	0.5176	0.5365	0.7988	0.9519	0.9880	0.9955	(86)
MIT	19.8395	19.9498	20.1928	20.5067	20.7854	20.9521	20.9899	20.9883	20.8963	20.5835	20.1769	19.8276	(87)
Th 2	19.8939	19.8989	19.8973	19.9005	19.9005	19.9021	19.9036	19.9051	19.9065	19.9021	19.9051	19.9021	(88)
util rest of house													
	0.9925	0.9882	0.9739	0.9304	0.8161	0.5752	0.3785	0.3936	0.7072	0.9280	0.9830	0.9939	(89)
MIT 2	18.3771	18.5407	18.8906	19.3360	19.7008	19.8747	19.9008	19.9018	19.8335	19.4496	18.8760	18.3656	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6137	18.7687	19.1013	19.5254	19.8762	20.0490	20.0770	20.0776	20.0054	19.6331	19.0865	18.6021	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9218	0.8147	0.5909	0.4012	0.4170	0.7167	0.9203	0.9777	0.9910	(94)
Useful gains	853.3650	922.7293	981.8782	997.7155	889.7391	654.4338	423.3814	422.2437	690.0225	822.2716	824.0546	807.9531	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1985.4058	1939.8797	1745.8660	1441.5789	1060.6450	681.7779	426.7137	426.1455	758.1810	1181.9507	1600.9986	1952.7442 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	842.2384	683.5251	568.4069	319.5817	127.1539	0.0000	0.0000	0.0000	0.0000	267.6012	559.3997	851.7246 (98)

Space heating 4219.6315 (98)
Space heating per m2 (98) / (4) = 35.9301 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4542.1222 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	842.2384	683.5251	568.4069	319.5817	127.1539	0.0000	0.0000	0.0000	0.0000	267.6012	559.3997	851.7246	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	906.6075	735.7644	611.8481	344.0061	136.8718	0.0000	0.0000	0.0000	0.0000	288.0530	602.1525	916.8187	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4060	89.4293	89.4532	89.5016	89.4187	86.7000	86.7000	86.7000	86.7000	89.0788	89.3002	89.4105	(217)
Fuel for water heating, kWh/month													
	165.8707	127.1334	99.4409	48.9716	24.2765	0.0000	0.0000	21.6289	49.8896	100.0144	139.3595	165.9177	(219)
Water heating fuel used												942.5033	(219)
Annual totals kWh/year													
Space heating fuel - main system												4542.1222	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	480.0856 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) = -1044.1535 -1044.1535 (233)
Total delivered energy for all uses 5045.5575 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4542.1222	7.3800	335.2086	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.5033	7.3800	69.5567	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			385.9285	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4542.1222	0.2160	981.0984	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.5033	0.2160	203.5807	(264)
Space and water heating			1184.6791	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			956.8028	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	4542.1222	1.2200	5541.3891	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.5033	1.2200	1149.8540	(264)
Space and water heating			6691.2431	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			5343.3045	(272)
Primary energy kWh/m2/year			45.4982	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	798.36	(P1)
Transmission heat loss coefficient	89.46	(37)
Summer heat loss coefficient	887.81	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.7900	87.1704	0.7200	0.7000	0.7650	265.8842
South	7.0300	118.5567	0.7200	0.7000	0.7650	289.2117
total:						555.0959

	Jun	Jul	Aug	
Solar gains	595	555	501	(P3)
Internal gains	523	501	511	
Total summer gains	1118	1056	1011	(P5)
Summer gain/loss ratio	1.26	1.19	1.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	16.91	18.74	18.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 400 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	21 Wren Walk , Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.35	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.99		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.03	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.82		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.56	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.35	$kgCO_2/m^2$	Pass
	-4.21 (-24.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.03	$kWh/m^2/yr$	
	-3.9 (-6.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.08 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass
Based on:			
Overshading	Average		
Windows facing North	8.79 m², No overhang		
Windows facing South	7.03 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.08 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.020	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 401 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	23 Wren Walk , Boorley Green, Southhampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.37	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.88		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.12	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.66		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 117 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.37 kgCO□/m²OK
-------------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.1 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.34 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.19 (measured in this dwelling)
Maximum                                 10.0                                    OK
-------------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
-------------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
-------------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing North:                   8.79 m², No overhang
Windows facing South:                   7.03 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.020 W/m²K
Photovoltaic array                      1.10 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4062	0.3983	0.3903	0.3505	0.3425	0.3027	0.3027	0.2947	0.3186	0.3425	0.3584	0.3744	(22b)
Effective ac	0.5825	0.5793	0.5762	0.5614	0.5587	0.5458	0.5458	0.5434	0.5508	0.5587	0.5642	0.5701	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.1316	57.8119	57.4984	56.0263	55.7509	54.4688	54.4688	54.2313	54.9626	55.7509	56.3081	56.8906	(38)
Heat transfer coeff	147.5880	147.2683	146.9549	145.4828	145.2073	143.9252	143.9252	143.6877	144.4190	145.2073	145.7645	146.3470	(39)
Average = Sum(39)m / 12 =												145.4814	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2567	1.2540	1.2513	1.2388	1.2364	1.2255	1.2255	1.2235	1.2297	1.2364	1.2412	1.2461	(40)
HLP (average)												1.2388	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	456.1245	453.6518	436.8767	409.7601	381.8770	355.4447	338.5930	345.3364	359.5722	386.9219	418.2604	442.0964	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	603.5642	704.0425	782.3709	850.7092	893.3141	872.4449	833.0682	784.7848	737.2004	663.9652	594.6032	568.5042	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2589	55.3789	55.4970	56.0586	56.1649	56.6652	56.6652	56.7589	56.4715	56.1649	55.9502	55.7275	
alpha	4.6839	4.6919	4.6998	4.7372	4.7443	4.7777	4.7777	4.7839	4.7648	4.7443	4.7300	4.7152	
util living area													
	0.9990	0.9976	0.9943	0.9833	0.9475	0.8486	0.6983	0.7494	0.9249	0.9885	0.9979	0.9992	(86)
MIT	19.5395	19.6904	19.9377	20.2729	20.6032	20.8574	20.9593	20.9425	20.7520	20.3278	19.8729	19.5141	(87)
Th 2	19.8749	19.8771	19.8792	19.8891	19.8910	19.8996	19.8996	19.9012	19.8963	19.8910	19.8872	19.8833	(88)
util rest of house													
	0.9986	0.9968	0.9920	0.9758	0.9207	0.7671	0.5527	0.6114	0.8746	0.9821	0.9969	0.9990	(89)
MIT 2	17.9264	18.1484	18.5106	19.0032	19.4678	19.7916	19.8829	19.8743	19.6742	19.0872	18.4227	17.8950	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.1873	18.3978	18.7415	19.2086	19.6515	19.9641	20.0570	20.0471	19.8486	19.2879	18.6573	18.1569	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1873	18.3978	18.7415	19.2086	19.6515	19.9641	20.0570	20.0471	19.8486	19.2879	18.6573	18.1569	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9886	0.9693	0.9131	0.7728	0.5757	0.6322	0.8717	0.9769	0.9953	0.9983	(94)
Useful gains	602.1751	700.5440	773.4615	824.6058	815.6907	674.2351	479.5620	496.1223	642.6479	648.6144	591.8043	567.5170	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2049.6057	1987.8044	1798.9469	1499.7243	1154.6175	772.0232	497.5561	524.0484	830.2049	1261.5500	1684.6443	2042.5541	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1076.8883	865.0390	762.9611	486.0853	252.1616	0.0000	0.0000	0.0000	0.0000	456.0241	786.8448	1097.4276	(98)
Space heating												5783.4318	(98)
Space heating per m2											(98) / (4) =	49.2458	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6225.4379	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1076.8883	865.0390	762.9611	486.0853	252.1616	0.0000	0.0000	0.0000	0.0000	456.0241	786.8448	1097.4276	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1159.1909	931.1507	821.2714	523.2350	271.4333	0.0000	0.0000	0.0000	0.0000	490.8763	846.9804	1181.2999	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4315	89.3955	89.3228	89.1549	88.7451	86.7000	86.7000	86.7000	86.7000	89.0956	89.3435	89.4506	(217)
Fuel for water heating, kWh/month													
	199.2050	174.6669	181.2686	159.5783	154.7502	138.0806	129.3317	146.4468	147.6134	165.7418	178.8124	193.2867	(219)
Water heating fuel used												1968.7825	(219)
Annual totals kWh/year													
Space heating fuel - main system												6225.4379	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												7809.4040	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6225.4379	0.2160	1344.6946	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.7825	0.2160	425.2570	(264)
Space and water heating			1769.9516	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total CO2, kg/year			1570.2319	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3700	ZC1
Total Floor Area	TFA	117.4400	
Assumed number of occupants	N	2.8529	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2212	ZC2
CO2 emissions from cooking, equation (L16)		1.5963	ZC3
Total CO2 emissions		29.1875	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.1875	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3823	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2738	48.8380	45.2514	46.7598	48.8380	49.2738	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
								Total per year (kWh/year) = Sum(64)m =				2191.5671	(64)
Heat gains from water heating, kWh/month													
	68.0400	59.8728	62.6490	55.8306	53.9604	47.3407	45.0751	50.5194	51.0859	57.9195	61.6460	66.2950	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	91.4516	89.0964	84.2057	77.5425	72.5275	65.7510	60.5848	67.9025	70.9527	77.8488	85.6194	89.1062	(72)
Total internal gains													
	469.2708	466.8008	450.0312	422.9078	394.3338	367.2120	350.3657	357.7982	372.7274	400.0836	431.4133	455.2454	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	598.2806	685.8927	752.3387	808.7383	841.8413	819.5873	783.0315	742.3156	703.1520	642.4964	585.7133	565.8522	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9991	0.9979	0.9950	0.9849	0.9507	0.8501	0.6941	0.7436	0.9249	0.9892	0.9980	0.9993	(86)
MIT	19.6598	19.7980	20.0262	20.3380	20.6438	20.8784	20.9682	20.9546	20.7853	20.3938	19.9720	19.6378	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9987	0.9972	0.9930	0.9783	0.9260	0.7727	0.5571	0.6131	0.8765	0.9832	0.9972	0.9991	(89)
MIT 2	18.1554	18.3590	18.6937	19.1531	19.5843	19.8842	19.9642	19.9577	19.7800	19.2380	18.6215	18.1294	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3988	18.5918	18.9093	19.3448	19.7557	20.0451	20.1266	20.1190	19.9426	19.4250	18.8400	18.3734	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9957	0.9901	0.9727	0.9194	0.7787	0.5788	0.6330	0.8746	0.9786	0.9958	0.9985	(94)
Useful gains	597.0587	682.9412	744.9099	786.6699	773.9910	638.2325	453.2416	469.9028	614.9759	628.7219	583.2258	564.9797	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1922.2555	1862.2151	1683.7369	1401.1974	1078.3872	721.6497	467.3891	491.9640	777.3351	1181.3694	1578.3831	1914.1382	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating												5277.2932	(98)
Space heating per m2											(98) / (4) =	44.9361	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5650.2069	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	985.9464	792.4721	698.4873	442.4597	226.4708	0.0000	0.0000	0.0000	0.0000	411.1697	716.5133	1003.7739	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1055.6171	848.4712	747.8451	473.7256	242.4741	0.0000	0.0000	0.0000	0.0000	440.2245	767.1448	1074.7044	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.2754	191.4889	201.0621	180.1374	174.4047	153.6060	147.1662	164.0558	165.8677	186.8379	197.6376	212.0275	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.3924	88.2401	87.9281	87.2257	85.7099	80.3000	80.3000	80.3000	80.3000	86.9818	88.0068	88.4596	(217)
Fuel for water heating, kWh/month													
	245.8079	217.0089	228.6666	206.5187	203.4827	191.2901	183.2705	204.3037	206.5600	214.8010	224.5707	239.6884	(219)
Water heating fuel used												2565.9692	(219)
Annual totals kWh/year													
Space heating fuel - main system												5650.2069	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Total delivered energy for all uses												8771.2617	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5650.2069	0.2160	1220.4447	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.9692	0.2160	554.2493	(264)
Space and water heating			1774.6940	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Total CO2, kg/m2/year			2062.7834	(272)
Emissions per m2 for space and water heating			15.1115	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1216	(272b)
Emissions per m2 for pumps and fans			0.3314	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1115 * 1.00) + 2.1216 + 0.3314, rounded to 2 d.p.			17.5600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3418	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2905	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3704	0.3631	0.3559	0.3196	0.3123	0.2760	0.2760	0.2687	0.2905	0.3123	0.3268	0.3413	(22b)
Effective ac	0.5686	0.5659	0.5633	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5534	0.5583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.7429	56.4770	56.2165	54.9927	54.7637	53.6978	53.6978	53.5004	54.1083	54.7637	55.2269	55.7112	(38)
Heat transfer coeff	146.1993	145.9335	145.6729	144.4491	144.2201	143.1542	143.1542	142.9568	143.5648	144.2201	144.6833	145.1676	(39)
Average = Sum(39)m / 12 =												144.4480	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2426	1.2404	1.2300	1.2280	1.2190	1.2190	1.2173	1.2225	1.2280	1.2320	1.2361	(40)
HLP (average)												1.2300	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	569.7620	671.0930	751.1920	821.9374	866.1077	847.4409	809.9340	759.2525	710.8143	635.0876	562.9124	535.5510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7838	55.8854	55.9854	56.4597	56.5494	56.9704	56.9704	57.0491	56.8075	56.5494	56.3683	56.1803	
alpha	4.7189	4.7257	4.7324	4.7640	4.7700	4.7980	4.7980	4.8033	4.7872	4.7700	4.7579	4.7454	
util living area													
	0.9992	0.9981	0.9952	0.9853	0.9522	0.8581	0.7103	0.7634	0.9324	0.9904	0.9983	0.9994	(86)
MIT	19.5282	19.6790	19.9263	20.2606	20.5927	20.8508	20.9569	20.9384	20.7413	20.3133	19.8582	19.5012	(87)
Th 2	19.8843	19.8861	19.8878	19.8961	19.8976	19.9049	19.9049	19.9062	19.9021	19.8976	19.8945	19.8912	(88)
util rest of house													
	0.9989	0.9974	0.9932	0.9786	0.9273	0.7792	0.5649	0.6266	0.8857	0.9849	0.9976	0.9992	(89)
MIT 2	18.5406	18.6926	18.9405	19.2781	19.5987	19.8266	19.8925	19.8861	19.7415	19.3335	18.8784	18.5191	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.7004	18.8521	19.1000	19.4371	19.7595	19.9923	20.0647	20.0563	19.9033	19.4921	19.0369	18.6780	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7004	18.8521	19.1000	19.4371	19.7595	19.9923	20.0647	20.0563	19.9033	19.4921	19.0369	18.6780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9965	0.9913	0.9748	0.9233	0.7868	0.5884	0.6481	0.8858	0.9820	0.9967	0.9989	(94)
Useful gains	568.8905	668.7160	744.6817	801.2646	799.6861	666.7518	476.5789	492.0873	629.6257	623.6651	561.0786	534.9435	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2105.3251	2036.0853	1835.4751	1522.0702	1162.3463	771.9339	495.9907	522.6971	833.1472	1282.4133	1727.0713	2101.7345	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1143.1074	918.8722	811.5503	518.9801	269.8191	0.0000	0.0000	0.0000	0.0000	490.1086	839.5147	1165.6925	(98)
Space heating												6157.6450	(98)
Space heating per m2											(98) / (4) =	52.4323	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1345.6493	1059.3410	1086.4716	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7374	0.8273	0.7925	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	992.2508	876.3721	861.0297	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1105.0102	1058.7086	1001.8556	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	81.1868	135.6584	104.7745	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												321.6197	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   20.2967   33.9146   26.1936    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              80.4049 (107)
Space cooling per m2                                                                                                        0.6846 (108)
Energy for space heating                                                                                                   52.4323 (99)
Energy for space cooling                                                                                                    0.6846 (108)
Total                                                                                                                      53.1169 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                      53.1 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1323 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3823 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3249 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4143	0.4062	0.3980	0.3574	0.3493	0.3087	0.3087	0.3006	0.3249	0.3493	0.3655	0.3818	(22b)
Effective ac	0.5858	0.5825	0.5792	0.5639	0.5610	0.5476	0.5476	0.5452	0.5528	0.5610	0.5668	0.5729	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			15.8200	1.3258	20.9735			(27)
Ground floor			58.7200	0.1300	7.6336			(28a)
External Wall	158.6200	20.0600	138.5600	0.1800	24.9408			(29a)
Main Roof	58.7200		58.7200	0.1300	7.6336			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.2695			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.6110	(36)
Total fabric heat loss (33) + (36) =	77.8805	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.4614	58.1288	57.8029	56.2718	55.9853	54.6518	54.6518	54.4049	55.1655	55.9853	56.5648	57.1707	(38)
Heat transfer coeff	136.3419	136.0093	135.6833	134.1523	133.8658	132.5323	132.5323	132.2854	133.0460	133.8658	134.4453	135.0512	(39)
Average = Sum(39)m / 12 =												134.1509	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1581	1.1553	1.1423	1.1399	1.1285	1.1285	1.1264	1.1329	1.1399	1.1448	1.1500	(40)
HLP (average)												1.1423	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.3423	30.9106	31.8969	27.8085	26.6829	23.0253	21.3364	24.4838	24.7762	28.8743	31.5185	34.2271	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	142.6428	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1844	24.1450	19.6360	14.8657	11.1123	9.3815	10.1370	13.1765	17.6854	22.4557	26.2091	27.9400	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.8420	284.7666	277.3966	261.7068	241.9012	223.2867	210.8511	207.9264	215.2964	230.9863	250.7919	269.4064	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	37.2643	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	47.5030	45.9979	42.8722	38.6229	35.8642	31.9796	28.6779	32.9083	34.4114	38.8095	43.7757	46.0041	(72)
Total internal gains													
	422.3223	420.7023	405.6977	380.9883	354.6705	330.4406	315.4588	319.8041	333.1861	358.0444	386.5696	409.1433	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.6300	0.7000	0.7700	28.5649	(74)
South	7.0300	46.7521	0.6300	0.7000	0.7700	100.4449	(78)

Solar gains	129.0098	219.0918	302.3075	385.8305	447.5075	452.3752	432.6658	384.5174	330.4247	242.4128	154.2999	110.6068	(83)
Total gains	551.3321	639.7941	708.0052	766.8188	802.1780	782.8159	748.1246	704.3214	663.6108	600.4572	540.8695	519.7501	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8170	59.9632	60.1073	60.7933	60.9234	61.5364	61.5364	61.6512	61.2988	60.9234	60.6608	60.3886	
alpha	4.9878	4.9975	5.0072	5.0529	5.0616	5.1024	5.1024	5.1101	5.0866	5.0616	5.0441	5.0259	
util living area													
	0.9994	0.9985	0.9962	0.9879	0.9587	0.8677	0.7178	0.7697	0.9382	0.9919	0.9986	0.9995	(86)
MIT	19.6225	19.7616	19.9917	20.3068	20.6187	20.8644	20.9629	20.9467	20.7630	20.3618	19.9365	19.6010	(87)
Th 2	19.9514	19.9537	19.9559	19.9664	19.9684	19.9776	19.9776	19.9793	19.9741	19.9684	19.9644	19.9602	(88)
util rest of house													
	0.9991	0.9979	0.9946	0.9825	0.9371	0.7946	0.5801	0.6405	0.8958	0.9873	0.9980	0.9994	(89)
MIT 2	18.6879	18.8286	19.0599	19.3809	19.6839	19.9048	19.9666	19.9614	19.8240	19.4386	19.0121	18.6735	(90)
Living area fraction										fLA = Living area / (4) =		0.1618	(91)
MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8391	18.9795	19.2106	19.5307	19.8351	20.0600	20.1278	20.1208	19.9760	19.5880	19.1616	18.8236	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9931	0.9794	0.9335	0.8016	0.6024	0.6609	0.8959	0.9849	0.9974	0.9991	(94)
Useful gains	550.6590	638.0132	703.1465	751.0311	748.8526	627.4996	450.6595	465.4570	594.5591	591.4016	539.4500	519.2829	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1982.2899	1914.9463	1724.6217	1426.1308	1089.0156	723.6310	467.5504	492.2031	781.7717	1203.1824	1621.6299	1974.9303	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1065.1334	858.0990	759.9775	486.0717	253.0813	0.0000	0.0000	0.0000	0.0000	455.1649	779.1695	1083.0017	(98)
Space heating												5739.6992	(98)
Space heating per m2											(98) / (4) =	48.8735	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1245.8038	980.7392	1005.3689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7475	0.8386	0.8058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	931.2544	822.4029	810.1758	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1029.4744	986.4639	937.6505	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.7185	122.0614	94.8411	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												287.6210	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   17.6796   30.5153   23.7103    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              71.9052 (107)
Space cooling per m2                                                                                                        0.6123 (108)
Energy for space heating                                                                                                   48.8735 (99)
Energy for space cooling                                                                                                    0.6123 (108)
Total                                                                                                                      49.4857 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        56.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3345	0.3106	0.3186	0.3027	0.3027	0.2947	0.2868	0.2788	0.2708	0.2947	0.2788	0.2947	(22b)
Effective ac	0.5560	0.5483	0.5508	0.5458	0.5458	0.5434	0.5411	0.5389	0.5367	0.5434	0.5389	0.5434	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5838	(36)
Total fabric heat loss	(33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.4818	54.7125	54.9626	54.4688	54.4688	54.2313	54.0002	53.7754	53.5570	54.2313	53.7754	54.2313	(38)
Heat transfer coeff	144.9382	144.1689	144.4190	143.9252	143.9252	143.6877	143.4566	143.2319	143.0134	143.6877	143.2319	143.6877	(39)
Average = Sum(39)m / 12 =												143.7811	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2341	1.2276	1.2297	1.2255	1.2255	1.2235	1.2215	1.2196	1.2178	1.2235	1.2196	1.2235	(40)
HLP (average)												1.2243	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529	(42)
Average daily hot water use (litres/day)	101.9553	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
RHI water heating demand												1743	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2692	56.5694	56.4715	56.6652	56.6652	56.7589	56.8503	56.9395	57.0265	56.7589	56.9395	56.7589	
alpha	4.7513	4.7713	4.7648	4.7777	4.7777	4.7839	4.7900	4.7960	4.8018	4.7839	4.7960	4.7839	
util living area													
	0.9944	0.9912	0.9809	0.9502	0.8703	0.6845	0.5180	0.5369	0.7991	0.9520	0.9880	0.9955	(86)
MIT	19.8378	19.9483	20.1914	20.5057	20.7847	20.9518	20.9898	20.9882	20.8960	20.5827	20.1759	19.8262	(87)
Th 2	19.8928	19.8980	19.8963	19.8996	19.8996	19.9012	19.9028	19.9043	19.9058	19.9012	19.9043	19.9012	(88)
util rest of house													
	0.9925	0.9882	0.9739	0.9305	0.8164	0.5755	0.3787	0.3938	0.7075	0.9280	0.9830	0.9939	(89)
MIT 2	18.3737	18.5379	18.8878	19.3339	19.6992	19.8737	19.9000	19.9010	19.8325	19.4478	18.8740	18.3630	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9219	0.8150	0.5913	0.4015	0.4172	0.7169	0.9203	0.9777	0.9910	(94)
Useful gains	853.3657	922.7345	981.9041	997.8043	889.9703	654.7751	423.6165	422.4630	690.2431	822.3403	824.0624	807.9528	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1987.1882	1941.3886	1747.2832	1442.6341	1061.4250	682.2533	426.9687	426.3862	758.6239	1182.7572	1601.9963	1954.1178	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	843.5639	684.5355	569.4420	320.2774	127.5623	0.0000	0.0000	0.0000	0.0000	268.1501	560.1124	852.7468	(98)
Space heating												4226.3905	(98)
RHI space heating demand												4226	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4062	0.3983	0.3903	0.3505	0.3425	0.3027	0.3027	0.2947	0.3186	0.3425	0.3584	0.3744	(22b)
Effective ac	0.5825	0.5793	0.5762	0.5614	0.5587	0.5458	0.5458	0.5434	0.5508	0.5587	0.5642	0.5701	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss	(33) + (36) = 89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.1316	57.8119	57.4984	56.0263	55.7509	54.4688	54.4688	54.2313	54.9626	55.7509	56.3081	56.8906	(38)
Heat transfer coeff	147.5880	147.2683	146.9549	145.4828	145.2073	143.9252	143.9252	143.6877	144.4190	145.2073	145.7645	146.3470	(39)
Average = Sum(39)m / 12 =												145.4814	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2567	1.2540	1.2513	1.2388	1.2364	1.2255	1.2255	1.2235	1.2297	1.2364	1.2412	1.2461	(40)
HLP (average)												1.2388	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2589	55.3789	55.4970	56.0586	56.1649	56.6652	56.6652	56.7589	56.4715	56.1649	55.9502	55.7275	
alpha	4.6839	4.6919	4.6998	4.7372	4.7443	4.7777	4.7777	4.7839	4.7648	4.7443	4.7300	4.7152	
util living area													
	0.9960	0.9925	0.9849	0.9634	0.9053	0.7720	0.6059	0.6515	0.8594	0.9693	0.9924	0.9968	(86)
MIT	19.7145	19.8611	20.0961	20.4094	20.7032	20.9084	20.9776	20.9685	20.8350	20.4656	20.0336	19.6861	(87)
Th 2	19.8749	19.8771	19.8792	19.8891	19.8910	19.8996	19.8996	19.9012	19.8963	19.8910	19.8872	19.8833	(88)
util rest of house													
	0.9946	0.9900	0.9795	0.9489	0.8648	0.6787	0.4684	0.5158	0.7873	0.9541	0.9893	0.9957	(89)
MIT 2	18.1816	18.3963	18.7385	19.1927	19.5918	19.8361	19.8913	19.8880	19.7625	19.2789	18.6557	18.1460	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4296	18.6333	18.9581	19.3895	19.7716	20.0096	20.0670	20.0628	19.9360	19.4709	18.8786	18.3951	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4296	18.6333	18.9581	19.3895	19.7716	20.0096	20.0670	20.0628	19.9360	19.4709	18.8786	18.3951	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9732	0.9402	0.8595	0.6892	0.4905	0.5372	0.7904	0.9463	0.9851	0.9935	(94)
Useful gains	822.7045	913.6987	968.0361	985.5083	924.2400	718.6437	489.7400	512.0908	724.0401	811.5851	791.7292	784.2146	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2085.3654	2022.4797	1830.7838	1526.0458	1172.0562	778.5715	498.9910	526.3007	842.8316	1288.1158	1716.9069	2077.4143	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	939.4197	745.1008	641.8843	389.1870	184.3752	0.0000	0.0000	0.0000	0.0000	354.5388	666.1279	962.1406	(98)
Space heating												4882.7744	(98)
Space heating per m2											(98) / (4) =	41.5768	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5255.9466	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	939.4197	745.1008	641.8843	389.1870	184.3752	0.0000	0.0000	0.0000	0.0000	354.5388	666.1279	962.1406	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1011.2160	802.0461	690.9412	418.9311	198.4663	0.0000	0.0000	0.0000	0.0000	381.6349	717.0376	1035.6734	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3742	89.3288	89.2365	89.0204	88.5055	86.7000	86.7000	86.7000	86.7000	88.9348	89.2627	89.3974	(217)
Fuel for water heating, kWh/month													
	199.3327	174.7974	181.4439	159.8194	155.1691	138.0806	129.3317	146.4468	147.6134	166.0415	178.9742	193.4018	(219)
Water heating fuel used												1970.4526	(219)
Annual totals kWh/year													
Space heating fuel - main system												5255.9466	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												6841.5827	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5255.9466	3.4800	182.9069	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.4526	3.4800	68.5718	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			320.7214	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8292	(257)
SAP value		88.4320	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5255.9466	0.2160	1135.2845	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.4526	0.2160	425.6178	(264)
Space and water heating			1560.9022	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-939.9020	0.5190	-487.8092	(269)
Total kg/year			1361.1825	(272)
CO2 emissions per m2			11.5900	(273)
EI value			88.7713	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3345	0.3106	0.3186	0.3027	0.3027	0.2947	0.2868	0.2788	0.2708	0.2947	0.2788	0.2947	(22b)
Effective ac	0.5560	0.5483	0.5508	0.5458	0.5458	0.5434	0.5411	0.5389	0.5367	0.5434	0.5389	0.5434	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5838	(36)
Total fabric heat loss					(33) + (36) =		89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.4818	54.7125	54.9626	54.4688	54.4688	54.2313	54.0002	53.7754	53.5570	54.2313	53.7754	54.2313	(38)
Heat transfer coeff	144.9382	144.1689	144.4190	143.9252	143.9252	143.6877	143.4566	143.2319	143.0134	143.6877	143.2319	143.6877	(39)
Average = Sum(39)m / 12 =												143.7811	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2341	1.2276	1.2297	1.2255	1.2255	1.2235	1.2215	1.2196	1.2178	1.2235	1.2196	1.2235	(40)
HLP (average)												1.2243	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8529	(42)
Average daily hot water use (litres/day)												101.9553	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
								Total per year (kWh/year) = Sum(64)m =				1742.9345	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2692	56.5694	56.4715	56.6652	56.6652	56.7589	56.8503	56.9395	57.0265	56.7589	56.9395	56.7589	
alpha	4.7513	4.7713	4.7648	4.7777	4.7777	4.7839	4.7900	4.7960	4.8018	4.7839	4.7960	4.7839	
util living area													
	0.9944	0.9912	0.9809	0.9502	0.8703	0.6845	0.5180	0.5369	0.7991	0.9520	0.9880	0.9955	(86)
MIT	19.8378	19.9483	20.1914	20.5057	20.7847	20.9518	20.9898	20.9882	20.8960	20.5827	20.1759	19.8262	(87)
Th 2	19.8928	19.8980	19.8963	19.8996	19.8996	19.9012	19.9028	19.9043	19.9058	19.9012	19.9043	19.9012	(88)
util rest of house													
	0.9925	0.9882	0.9739	0.9305	0.8164	0.5755	0.3787	0.3938	0.7075	0.9280	0.9830	0.9939	(89)
MIT 2	18.3737	18.5379	18.8878	19.3339	19.6992	19.8737	19.9000	19.9010	19.8325	19.4478	18.8740	18.3630	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9219	0.8150	0.5913	0.4015	0.4172	0.7169	0.9203	0.9777	0.9910	(94)
Useful gains	853.3657	922.7345	981.9041	997.8043	889.9703	654.7751	423.6165	422.4630	690.2431	822.3403	824.0624	807.9528	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1987.1882	1941.3886	1747.2832	1442.6341	1061.4250	682.2533	426.9687	426.3862	758.6239	1182.7572	1601.9963	1954.1178	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	843.5639	684.5355	569.4420	320.2774	127.5623	0.0000	0.0000	0.0000	0.0000	268.1501	560.1124	852.7468	(98)
Space heating												4226.3905	(98)
Space heating per m2											(98) / (4) =	35.9877	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4549.3978	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	843.5639	684.5355	569.4420	320.2774	127.5623	0.0000	0.0000	0.0000	0.0000	268.1501	560.1124	852.7468	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	908.0344	736.8520	612.9624	344.7550	137.3114	0.0000	0.0000	0.0000	0.0000	288.6438	602.9197	917.9190	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3251	89.2879	89.1714	88.8909	88.2120	86.7000	86.7000	86.7000	86.7000	88.7369	89.1696	89.3441	(217)
Fuel for water heating, kWh/month													
	199.4421	174.8774	181.5766	160.0524	155.6853	138.0806	129.3317	146.4468	147.6134	166.4119	179.1610	193.5172	(219)
Water heating fuel used												1972.1963	(219)
Annual totals kWh/year													
Space heating fuel - main system												4549.3978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												6032.5262	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4549.3978	7.3800	335.7456	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1972.1963	7.3800	145.5481	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			448.1268	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4549.3978	0.2160	982.6699	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.1963	0.2160	425.9944	(264)
Space and water heating			1408.6643	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			1154.8381	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4549.3978	1.2200	5550.2653	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1972.1963	1.2200	2406.0795	(264)
Space and water heating			7956.3448	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			6454.9062	(272)
Primary energy kWh/m2/year			54.9634	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-196 kg (17.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.67 kg/m²	B 89	B 90
Total Savings	£62	1.67 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£173	-£14
Mains gas	£588	£512	£76
Space heating	£464	£464	£0
Water heating	£146	£84	£62
Lighting	£138	£138	£0
Generated (PV)	-£299	-£299	£0
Total cost of fuels	£448	£386	£62
Total cost of uses	£449	£387	£62
Delivered energy	51 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200	(1b)	x 2.5300	(2b) =	148.5616	(1b) - (3b)
First floor	58.7200	(1c)	x 2.6200	(2c) =	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4062	0.3983	0.3903	0.3505	0.3425	0.3027	0.3027	0.2947	0.3186	0.3425	0.3584	0.3744	(22b)
Effective ac	0.5825	0.5793	0.5762	0.5614	0.5587	0.5458	0.5458	0.5434	0.5508	0.5587	0.5642	0.5701	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.1316	57.8119	57.4984	56.0263	55.7509	54.4688	54.4688	54.2313	54.9626	55.7509	56.3081	56.8906	(38)
Heat transfer coeff	147.5880	147.2683	146.9549	145.4828	145.2073	143.9252	143.9252	143.6877	144.4190	145.2073	145.7645	146.3470	(39)
Average = Sum(39)m / 12 =												145.4814	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2567	1.2540	1.2513	1.2388	1.2364	1.2255	1.2255	1.2235	1.2297	1.2364	1.2412	1.2461	(40)
HLP (average)												1.2388	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1306	(H8)
Utilisation factor												0.5871	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-878.7246	(H17)
Solar input	-25.4813	-42.5209	-72.4180	-97.0543	-119.9025	-117.8832	-116.3253	-101.6340	-79.5998	-54.3573	-30.2244	-21.3235	(63)
								Solar input (sum of months) = Sum(63)m =				-878.7246	(63)
Output from w/h													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
								Total per year (kWh/year) = Sum(64)m =				868.4047	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	10.6334	0.7200	0.7000	0.7700	32.6456	(74)
South	7.0300	46.7521	0.7200	0.7000	0.7700	114.7942	(78)

Solar gains	147.4398	250.3907	345.4943	440.9491	511.4372	517.0003	494.4752	439.4484	377.6282	277.0432	176.3428	126.4077	(83)
Total gains	829.3929	926.7524	994.6874	1048.1425	1075.3622	1042.7284	998.3600	953.1953	916.0044	857.6524	803.6755	789.3411	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2589	55.3789	55.4970	56.0586	56.1649	56.6652	56.6652	56.7589	56.4715	56.1649	55.9502	55.7275	
alpha	4.6839	4.6919	4.6998	4.7372	4.7443	4.7777	4.7777	4.7839	4.7648	4.7443	4.7300	4.7152	
util living area													
	0.9960	0.9925	0.9849	0.9634	0.9053	0.7720	0.6059	0.6515	0.8594	0.9693	0.9924	0.9968	(86)
MIT	19.7145	19.8611	20.0961	20.4094	20.7032	20.9084	20.9776	20.9685	20.8350	20.4656	20.0336	19.6861	(87)
Th 2	19.8749	19.8771	19.8792	19.8891	19.8910	19.8996	19.8996	19.9012	19.8963	19.8910	19.8872	19.8833	(88)
util rest of house													
	0.9946	0.9900	0.9795	0.9489	0.8648	0.6787	0.4684	0.5158	0.7873	0.9541	0.9893	0.9957	(89)
MIT 2	18.1816	18.3963	18.7385	19.1927	19.5918	19.8361	19.8913	19.8880	19.7625	19.2789	18.6557	18.1460	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.4296	18.6333	18.9581	19.3895	19.7716	20.0096	20.0670	20.0628	19.9360	19.4709	18.8786	18.3951	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4296	18.6333	18.9581	19.3895	19.7716	20.0096	20.0670	20.0628	19.9360	19.4709	18.8786	18.3951	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9859	0.9732	0.9402	0.8595	0.6892	0.4905	0.5372	0.7904	0.9463	0.9851	0.9935	(94)
Useful gains	822.7045	913.6987	968.0361	985.5083	924.2400	718.6437	489.7400	512.0908	724.0401	811.5851	791.7292	784.2146	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W													
	2085.3654	2022.4797	1830.7838	1526.0458	1172.0562	778.5715	498.9910	526.3007	842.8316	1288.1158	1716.9069	2077.4143	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	939.4197	745.1008	641.8843	389.1870	184.3752	0.0000	0.0000	0.0000	0.0000	354.5388	666.1279	962.1406	(98)
Space heating												4882.7744	(98)
Space heating per m2											(98) / (4) =	41.5768	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5255.9466	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	939.4197	745.1008	641.8843	389.1870	184.3752	0.0000	0.0000	0.0000	0.0000	354.5388	666.1279	962.1406	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1011.2160	802.0461	690.9412	418.9311	198.4663	0.0000	0.0000	0.0000	0.0000	381.6349	717.0376	1035.6734	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.6706	113.6235	89.4963	45.2176	17.4307	1.8327	0.0000	25.3354	48.3810	93.3114	129.5327	151.5727	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4385	89.4631	89.4958	89.5559	89.6143	86.7000	86.7000	86.7000	86.7000	89.2139	89.3630	89.4507	(217)
Fuel for water heating, kWh/month													
	170.6990	127.0060	100.0006	50.4909	19.4508	2.1138	0.0000	29.2219	55.8028	104.5929	144.9511	169.4484	(219)
Water heating fuel used												973.7781	(219)
Annual totals kWh/year													
Space heating fuel - main system												5255.9466	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1068 * 1.00) =										-939.9020		-939.9020	(233)
Total delivered energy for all uses												5894.9082	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5255.9466	3.4800	182.9069	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.7781	3.4800	33.8875	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	480.0856	13.1900	63.3233	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-939.9020	13.1900	-123.9731	(252)
Total energy cost			292.6321	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7566	(257)
SAP value		89.4451	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5255.9466	0.2160	1135.2845	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.7781	0.2160	210.3361	(264)
Space and water heating			1345.6205	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-939.9020	0.5190	-487.8092 (269)
Total kg/year			1171.8508 (272)
CO2 emissions per m2			9.9800 (273)
EI value			90.3332
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	58.7200 (1b)	x	2.5300 (2b)	=	148.5616	(1b) - (3b)
First floor	58.7200 (1c)	x	2.6200 (2c)	=	153.8464	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	302.4080	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1653	(8)
Pressure test		Yes	
Measured/design AP50		4.1900	
Infiltration rate		0.3748	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3186	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3345	0.3106	0.3186	0.3027	0.3027	0.2947	0.2868	0.2788	0.2708	0.2947	0.2788	0.2947	(22b)
Effective ac	0.5560	0.5483	0.5508	0.5458	0.5458	0.5434	0.5411	0.5389	0.5367	0.5434	0.5389	0.5434	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.8200	1.2357	19.5494			(27)
Opening Type 10			4.2400	1.5000	6.3600			(26a)
Ground floor			58.7200	0.1900	11.1568			(28a)
External Wall	158.6200	20.0600	138.5600	0.2700	37.4112			(29a)
Main Roof	58.7200		58.7200	0.1600	9.3952			(30)
Total net area of external elements Aum(A, m2)			276.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		83.8726			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5838	(36)
Total fabric heat loss (33) + (36) =	89.4564	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.4818	54.7125	54.9626	54.4688	54.4688	54.2313	54.0002	53.7754	53.5570	54.2313	53.7754	54.2313	(38)
Heat transfer coeff	144.9382	144.1689	144.4190	143.9252	143.9252	143.6877	143.4566	143.2319	143.0134	143.6877	143.2319	143.6877	(39)
Average = Sum(39)m / 12 =												143.7811	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2341	1.2276	1.2297	1.2255	1.2255	1.2235	1.2215	1.2196	1.2178	1.2235	1.2196	1.2235	(40)
HLP (average)												1.2243	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8529 (42)
Average daily hot water use (litres/day)	101.9553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1509	108.0726	103.9944	99.9162	95.8380	91.7598	91.7598	95.8380	99.9162	103.9944	108.0726	112.1509	(44)
Energy conte	166.3165	145.4615	150.1032	130.8636	125.5667	108.3546	100.4064	115.2178	116.5939	135.8790	148.3225	161.0686	(45)
Energy content (annual)										Total = Sum(45)m =		1604.1543	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9475	21.8192	22.5155	19.6295	18.8350	16.2532	15.0610	17.2827	17.4891	20.3818	22.2484	24.1603	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8354	10.6829	11.8111	11.4083	11.7665	11.3613	11.7241	11.7516	11.3869	11.7898	11.4347	11.8275	(61)
Total heat required for water heating calculated for each month													
	178.1519	156.1444	161.9143	142.2719	137.3332	119.7159	112.1306	126.9694	127.9809	147.6687	159.7572	172.8962	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2653	(H8)
Utilisation factor												0.5463	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.9553	(H14)
Volume ratio Veff/V												0.7356	(H15)
Solar storage volume factor												0.9386	(H16)
Solar input												-915.1250	(H17)
Solar input	-29.8536	-42.4499	-72.9612	-98.4415	-115.6255	-123.5063	-120.9089	-108.2172	-84.7266	-58.5770	-35.3089	-24.5483	(63)
								Solar input (sum of months) = Sum(63)m =				-915.1250	(63)
Output from w/h													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
								Total per year (kWh/year) = Sum(64)m =				840.3783	(64)
Heat gains from water heating, kWh/month													
	58.2591	51.0367	52.8621	46.3642	44.6926	38.8682	36.3162	41.2478	41.6142	48.1272	52.1759	56.5122	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	171.1714	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.9611	60.3624	49.0900	37.1643	27.7808	23.4537	25.3425	32.9412	44.2136	56.1393	65.5229	69.8499	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.6597	425.0248	414.0248	390.6071	361.0465	333.2637	314.7031	310.3380	321.3380	344.7556	374.3162	402.0990	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	54.9700	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	-114.1142	(71)
Water heating gains (Table 5)													
	78.3052	75.9474	71.0512	64.3948	60.0706	53.9836	48.8121	55.4406	57.7975	64.6871	72.4665	75.9573	(72)
Total internal gains													
	681.9531	676.3618	649.1931	607.1933	563.9250	525.7282	503.8848	513.7469	538.3762	580.6091	627.3327	662.9334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7900	13.4839	0.7200	0.7000	0.7700	41.3969	(74)
South	7.0300	56.7559	0.7200	0.7000	0.7700	139.3573	(78)

Solar gains	180.7542	261.6813	366.2049	475.1973	528.1274	581.7100	551.3040	498.9330	424.4088	312.9161	215.5426	152.3196	(83)
Total gains	862.7073	938.0430	1015.3980	1082.3906	1092.0524	1107.4381	1055.1888	1012.6799	962.7850	893.5252	842.8754	815.2529	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2692	56.5694	56.4715	56.6652	56.6652	56.7589	56.8503	56.9395	57.0265	56.7589	56.9395	56.7589	
alpha	4.7513	4.7713	4.7648	4.7777	4.7777	4.7839	4.7900	4.7960	4.8018	4.7839	4.7960	4.7839	
util living area													
	0.9944	0.9912	0.9809	0.9502	0.8703	0.6845	0.5180	0.5369	0.7991	0.9520	0.9880	0.9955	(86)
MIT	19.8378	19.9483	20.1914	20.5057	20.7847	20.9518	20.9898	20.9882	20.8960	20.5827	20.1759	19.8262	(87)
Th 2	19.8928	19.8980	19.8963	19.8996	19.8996	19.9012	19.9028	19.9043	19.9058	19.9012	19.9043	19.9012	(88)
util rest of house													
	0.9925	0.9882	0.9739	0.9305	0.8164	0.5755	0.3787	0.3938	0.7075	0.9280	0.9830	0.9939	(89)
MIT 2	18.3737	18.5379	18.8878	19.3339	19.6992	19.8737	19.9000	19.9010	19.8325	19.4478	18.8740	18.3630	(90)
Living area fraction									fLA = Living area / (4) =			0.1618	(91)
MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6106	18.7661	19.0987	19.5235	19.8748	20.0482	20.0763	20.0769	20.0046	19.6314	19.0846	18.5998	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9837	0.9670	0.9219	0.8150	0.5913	0.4015	0.4172	0.7169	0.9203	0.9777	0.9910	(94)
Useful gains	853.3657	922.7345	981.9041	997.8043	889.9703	654.7751	423.6165	422.4630	690.2431	822.3403	824.0624	807.9528	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1987.1882	1941.3886	1747.2832	1442.6341	1061.4250	682.2533	426.9687	426.3862	758.6239	1182.7572	1601.9963	1954.1178 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	843.5639	684.5355	569.4420	320.2774	127.5623	0.0000	0.0000	0.0000	0.0000	268.1501	560.1124	852.7468 (98)

Space heating 4226.3905 (98)
Space heating per m2 (98) / (4) = 35.9877 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4549.3978 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	843.5639	684.5355	569.4420	320.2774	127.5623	0.0000	0.0000	0.0000	0.0000	268.1501	560.1124	852.7468	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	908.0344	736.8520	612.9624	344.7550	137.3114	0.0000	0.0000	0.0000	0.0000	288.6438	602.9197	917.9190	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.2983	113.6945	88.9531	43.8304	21.7077	0.0000	0.0000	18.7523	43.2543	89.0917	124.4483	148.3478	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4066	89.4299	89.4539	89.5023	89.4200	86.7000	86.7000	86.7000	86.7000	89.0801	89.3008	89.4110	(217)
Fuel for water heating, kWh/month													
	165.8695	127.1326	99.4401	48.9712	24.2761	0.0000	0.0000	21.6289	49.8896	100.0130	139.3585	165.9168	(219)
Water heating fuel used												942.4964	(219)
Annual totals kWh/year													
Space heating fuel - main system												4549.3978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												480.0856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1187 * 1.00) =										-1044.1535		-1044.1535	(233)
Total delivered energy for all uses												5052.8262	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4549.3978	7.3800	335.7456	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.4964	7.3800	69.5562	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	480.0856	28.6600	137.5925	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1044.1535	28.6600	-299.2544	(252)
Total energy cost			386.4649	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4549.3978	0.2160	982.6699	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4964	0.2160	203.5792	(264)
Space and water heating			1186.2491	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	480.0856	0.5190	249.1644	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	0.5190	-541.9157	(269)
Total kg/year			958.3729	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	4549.3978	1.2200	5550.2653	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.4964	1.2200	1149.8456	(264)
Space and water heating			6700.1109	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	480.0856	3.0700	1473.8626	(268)
Energy saving/generation technologies				
PV Unit	-1044.1535	3.0700	-3205.5513	(269)
Primary energy kWh/year			5352.1722	(272)
Primary energy kWh/m2/year			45.5737	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	798.36	(P1)
Transmission heat loss coefficient	89.46	(37)
Summer heat loss coefficient	887.81	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.7900	87.1704	0.7200	0.7000	0.7650	265.8842
South	7.0300	118.5567	0.7200	0.7000	0.7650	289.2117
total:						555.0959

	Jun	Jul	Aug	
Solar gains	595	555	501	(P3)
Internal gains	523	501	511	
Total summer gains	1118	1056	1011	(P5)
Summer gain/loss ratio	1.26	1.19	1.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	16.91	18.74	18.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 401 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	23 Wren Walk , Boorley Green, Southhampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.37	**TER**	17.56
Environmental	89 B	**% DER<TER**	23.88		
CO_2 Emissions (t/year)	1.11	**DFEE**	53.12	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.66		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.56	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.37	$kgCO_2/m^2$	Pass
	-4.19 (-23.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.12	$kWh/m^2/yr$	
	-3.8 (-6.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.19 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.79 m², No overhang
Windows facing South	7.03 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.19 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.020	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 402 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	25 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.85	**TER**	18.73
Environmental	88 B	**% DER<TER**	20.70		
CO_2 Emissions (t/year)	1.03	**DFEE**	54.90	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.66		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.85 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.64 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.05 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 5.05 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.6400	
Infiltration rate		0.3940	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4270	0.4186	0.4102	0.3684	0.3600	0.3181	0.3181	0.3098	0.3349	0.3600	0.3767	0.3935	(22b)
Effective ac	0.5912	0.5876	0.5841	0.5678	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.1764	47.8879	47.6052	46.2772	46.0287	44.8720	44.8720	44.6578	45.3175	46.0287	46.5313	47.0568	(38)
Heat transfer coeff	128.2123	127.9239	127.6411	126.3131	126.0646	124.9080	124.9080	124.6938	125.3535	126.0646	126.5673	127.0928	(39)
Average = Sum(39)m / 12 =												126.3119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3395	1.3364	1.3335	1.3196	1.3170	1.3049	1.3049	1.3027	1.3096	1.3170	1.3223	1.3278	(40)
HLP (average)												1.3196	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	414.3696	412.0990	397.0299	372.6834	347.8122	324.0158	308.6796	315.0648	327.6871	352.2580	380.4587	401.7538	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	540.1842	630.4392	709.5908	788.2035	842.6844	829.2476	789.9041	734.3087	675.1233	596.9958	531.8143	509.0393	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8454	51.9623	52.0774	52.6250	52.7287	53.2170	53.2170	53.3084	53.0278	52.7287	52.5193	52.3021	
alpha	4.4564	4.4642	4.4718	4.5083	4.5152	4.5478	4.5478	4.5539	4.5352	4.5152	4.5013	4.4868	
util living area													
	0.9984	0.9965	0.9915	0.9749	0.9245	0.8044	0.6488	0.7068	0.9044	0.9842	0.9968	0.9988	(86)
MIT	19.4808	19.6417	19.9108	20.2767	20.6254	20.8737	20.9646	20.9479	20.7575	20.3111	19.8307	19.4540	(87)
Th 2	19.8101	19.8124	19.8147	19.8255	19.8275	19.8370	19.8370	19.8387	19.8333	19.8275	19.8234	19.8192	(88)
util rest of house													
	0.9978	0.9952	0.9882	0.9640	0.8887	0.7114	0.4997	0.5619	0.8440	0.9754	0.9954	0.9983	(89)
MIT 2	17.7964	18.0331	18.4265	18.9610	19.4430	19.7473	19.8235	19.8161	19.6254	19.0173	18.3173	17.7634	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.0525	18.2776	18.6521	19.1610	19.6227	19.9185	19.9970	19.9881	19.7975	19.2140	18.5473	18.0203	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0525	18.2776	18.6521	19.1610	19.6227	19.9185	19.9970	19.9881	19.7975	19.2140	18.5473	18.0203	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9927	0.9833	0.9555	0.8807	0.7190	0.5220	0.5827	0.8416	0.9686	0.9930	0.9973	(94)
Useful gains	538.2574	625.8058	697.7686	753.1299	742.1713	596.2282	412.2941	427.8547	568.1826	578.2648	528.1021	507.6423	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1763.2354	1711.3146	1551.1088	1296.0955	998.7752	664.3222	424.3096	447.4132	714.1990	1085.9207	1448.8546	1756.4663	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.3836	729.4619	634.8852	390.9352	190.9133	0.0000	0.0000	0.0000	0.0000	377.6960	662.9418	929.1250	(98)
Space heating												4827.3420	(98)
Space heating per m2											(98) / (4) =	50.4319	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5196.2777	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.3836	729.4619	634.8852	390.9352	190.9133	0.0000	0.0000	0.0000	0.0000	377.6960	662.9418	929.1250	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	981.0372	785.2120	683.4071	420.8129	205.5041	0.0000	0.0000	0.0000	0.0000	406.5619	713.6079	1000.1346	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3761	89.3350	89.2488	89.0449	88.5594	86.7000	86.7000	86.7000	86.7000	88.9992	89.2777	89.3973	(217)
Fuel for water heating, kWh/month													
	192.5281	168.8349	175.2729	154.3972	149.8863	133.5081	125.0945	141.5841	142.6920	160.3421	172.8729	186.8180	(219)
Water heating fuel used												1903.8311	(219)
Annual totals kWh/year													
Space heating fuel - main system												5196.2777	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6883.8706	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5196.2777	0.2160	1122.3960	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1903.8311	0.2160	411.2275	(264)
Space and water heating			1533.6235	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1421.3959	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.8500	ZC1
Total Floor Area	TFA	95.7200	
Assumed number of occupants	N	2.6962	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4284	ZC2
CO2 emissions from cooking, equation (L16)		1.9192	ZC3
Total CO2 emissions		32.1977	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.1977	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8674	(36)
Total fabric heat loss (33) + (36) =	69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962 (42)
Average daily hot water use (litres/day)	98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4758	47.0560	43.6002	45.0536	47.0560	47.4758	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
								Total per year (kWh/year) = Sum(64)m =				2122.5163	(64)
Heat gains from water heating, kWh/month													
	66.0221	58.1080	60.8279	53.7934	51.9915	45.6133	43.4304	48.6760	49.2219	56.2709	59.8465	64.3409	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	88.7394	86.4702	81.7580	74.7131	69.8810	63.3519	58.3741	65.4248	68.3637	75.6330	83.1201	86.4797	(72)
Total internal gains													
	427.5190	425.2510	410.1872	385.2117	359.6745	335.2136	319.8823	326.9318	340.2223	365.4222	393.6144	414.9057	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.0500	46.7521	0.6300	0.7000	0.7700	72.1546	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	110.0877	191.0477	273.4908	363.5801	433.0132	442.0778	421.0715	366.8384	304.0067	214.1456	132.4361	93.8748	(83)
Total gains	537.6067	616.2986	683.6780	748.7918	792.6878	777.2914	740.9538	693.7703	644.2290	579.5677	526.0506	508.7806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9985	0.9968	0.9922	0.9767	0.9272	0.8037	0.6419	0.6980	0.9024	0.9845	0.9969	0.9989	(86)
MIT	19.6248	19.7713	20.0176	20.3527	20.6722	20.8961	20.9736	20.9605	20.7958	20.3893	19.9473	19.5993	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9980	0.9957	0.9893	0.9668	0.8936	0.7153	0.5030	0.5622	0.8439	0.9762	0.9957	0.9985	(89)
MIT 2	18.0685	18.2840	18.6443	19.1343	19.5762	19.8501	19.9145	19.9089	19.7451	19.1928	18.5487	18.0370	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3050	18.5101	18.8531	19.3195	19.7428	20.0091	20.0755	20.0688	19.9048	19.3747	18.7613	18.2745	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3050	18.5101	18.8531	19.3195	19.7428	20.0091	20.0755	20.0688	19.9048	19.3747	18.7613	18.2745	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9851	0.9594	0.8869	0.7233	0.5238	0.5819	0.8428	0.9701	0.9935	0.9975	(94)
Useful gains	535.8642	612.2678	673.5137	718.3924	702.9996	562.1857	388.1428	403.7336	542.9298	562.2368	522.6440	507.5096	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1641.6088	1591.8197	1441.7000	1203.7348	927.3813	618.1381	397.1745	418.5627	665.6570	1011.7745	1349.8307	1635.7393	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	822.6740	658.2589	571.5306	349.4465	166.9399	0.0000	0.0000	0.0000	0.0000	334.4561	595.5744	839.4029	(98)
Space heating												4338.2834	(98)
Space heating per m2											(98) / (4) =	45.3226	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4644.8430	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	822.6740	658.2589	571.5306	349.4465	166.9399	0.0000	0.0000	0.0000	0.0000	334.4561	595.5744	839.4029	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	880.8073	704.7740	611.9172	374.1398	178.7365	0.0000	0.0000	0.0000	0.0000	358.0900	637.6600	898.7183	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1354	87.9607	87.5911	86.7779	85.0347	80.3000	80.3000	80.3000	80.3000	86.5647	87.7082	88.2124	(217)
Fuel for water heating, kWh/month													
	239.6390	211.6640	223.2933	200.0100	197.6146	184.3102	176.5832	196.8489	199.0229	210.1085	219.1648	233.6978	(219)
Water heating fuel used												2491.9571	(219)
Annual totals kWh/year													
Space heating fuel - main system												4644.8430	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Total delivered energy for all uses												7620.0939	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4644.8430	0.2160	1003.2861	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2491.9571	0.2160	538.2627	(264)
Space and water heating			1541.5488	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Total CO2, kg/m2/year			1792.3783	(272)
Emissions per m2 for space and water heating			16.1048	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2138	(272b)
Emissions per m2 for pumps and fans			0.4067	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1048 * 1.00) + 2.2138 + 0.4067, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		4.6400	
Infiltration rate		0.3535	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3005	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3831	0.3756	0.3681	0.3305	0.3230	0.2854	0.2854	0.2779	0.3005	0.3230	0.3380	0.3530	(22b)
Effective ac	0.5734	0.5705	0.5677	0.5546	0.5522	0.5407	0.5407	0.5386	0.5451	0.5522	0.5571	0.5623	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.7279	46.4956	46.2680	45.1990	44.9990	44.0678	44.0678	43.8954	44.4265	44.9990	45.4036	45.8266	(38)
Heat transfer coeff	126.7638	126.5316	126.3040	125.2349	125.0349	124.1038	124.1038	123.9314	124.4624	125.0349	125.4395	125.8626	(39)
Average = Sum(39)m / 12 =												125.2340	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3243	1.3219	1.3195	1.3083	1.3063	1.2965	1.2965	1.2947	1.3003	1.3063	1.3105	1.3149	(40)
HLP (average)												1.3083	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	507.3638	598.4404	679.2980	760.2324	816.2213	804.9063	767.3642	709.4585	649.4506	568.9204	501.0283	477.0371	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4379	52.5341	52.6288	53.0780	53.1629	53.5618	53.5618	53.6363	53.4075	53.1629	52.9914	52.8133	
alpha	4.4959	4.5023	4.5086	4.5385	4.5442	4.5708	4.5708	4.5758	4.5605	4.5442	4.5328	4.5209	
util living area													
	0.9988	0.9972	0.9928	0.9777	0.9306	0.8150	0.6606	0.7212	0.9135	0.9867	0.9975	0.9991	(86)
MIT	19.4687	19.6296	19.8988	20.2638	20.6153	20.8679	20.9626	20.9441	20.7465	20.2950	19.8143	19.4398	(87)
Th 2	19.8218	19.8237	19.8256	19.8343	19.8359	19.8436	19.8436	19.8450	19.8406	19.8359	19.8326	19.8292	(88)
util rest of house													
	0.9983	0.9961	0.9900	0.9680	0.8969	0.7241	0.5111	0.5769	0.8570	0.9793	0.9964	0.9987	(89)
MIT 2	18.4324	18.5944	18.8637	19.2302	19.5639	19.7786	19.8337	19.8281	19.6898	19.2657	18.7860	18.4092	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.5899	18.7517	19.0211	19.3873	19.7237	19.9442	20.0053	19.9977	19.8504	19.4222	18.9423	18.5659	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5899	18.7517	19.0211	19.3873	19.7237	19.9442	20.0053	19.9977	19.8504	19.4222	18.9423	18.5659	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9948	0.9872	0.9630	0.8929	0.7333	0.5339	0.5983	0.8576	0.9755	0.9952	0.9982	(94)
Useful gains	506.1668	595.3096	670.6324	732.0939	728.7746	590.2162	409.7199	424.4864	556.9530	554.9695	498.6142	476.1866	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1811.4450	1752.6816	1581.4598	1313.3773	1003.2416	663.2338	422.6106	445.8692	715.7096	1103.0815	1485.4899	1808.1277	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	971.1270	777.7540	677.6555	418.5240	204.2034	0.0000	0.0000	0.0000	0.0000	407.7953	710.5505	990.9642	(98)
Space heating												5158.5740	(98)
Space heating per m2											(98) / (4) =	53.8923	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1166.5756	918.3680	941.8783	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7721	0.8527	0.8163	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	900.6908	783.1261	768.8376	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1043.7742	997.7268	931.9604	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	103.0200	159.6629	121.3634	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												384.0463 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	25.7550	39.9157	30.3408	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												96.0116 (107)
Space cooling per m2												1.0030 (108)
Energy for space heating												53.8923 (99)
Energy for space cooling												1.0030 (108)
Total												54.8954 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8674	(36)
Total fabric heat loss					(33) + (36) =		69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.0500	46.7521	0.6300	0.7000	0.7700	72.1546	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	110.0877	191.0477	273.4908	363.5801	433.0132	442.0778	421.0715	366.8384	304.0067	214.1456	132.4361	93.8748	(83)
Total gains	491.6370	571.1479	640.2279	708.2924	754.3622	741.7523	707.2112	657.0530	606.0211	538.3282	482.1089	463.6264	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9990	0.9977	0.9941	0.9812	0.9381	0.8240	0.6660	0.7256	0.9191	0.9885	0.9979	0.9992	(86)
MIT	19.5806	19.7282	19.9770	20.3174	20.6457	20.8830	20.9690	20.9532	20.7722	20.3520	19.9052	19.5557	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9986	0.9969	0.9918	0.9730	0.9082	0.7388	0.5249	0.5894	0.8670	0.9821	0.9970	0.9990	(89)
MIT 2	18.6055	18.7546	19.0041	19.3481	19.6615	19.8660	19.9164	19.9118	19.7833	19.3863	18.9396	18.5873	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.7538	18.9026	19.1520	19.4954	19.8111	20.0206	20.0764	20.0701	19.9336	19.5331	19.0863	18.7345	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7538	18.9026	19.1520	19.4954	19.8111	20.0206	20.0764	20.0701	19.9336	19.5331	19.0863	18.7345	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9896	0.9688	0.9045	0.7476	0.5465	0.6097	0.8677	0.9789	0.9960	0.9986	(94)
Useful gains	490.6943	568.7459	633.5915	686.2062	682.3309	554.5264	386.4623	400.6223	525.8526	526.9793	480.1943	462.9588	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1694.2045	1637.7282	1476.5813	1224.0554	935.2572	619.4533	397.2775	418.7160	668.9624	1030.0426	1387.4549	1689.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	895.4116	718.3561	627.1844	387.2514	188.1772	0.0000	0.0000	0.0000	0.0000	374.2791	653.2276	912.3251	(98)
Space heating												4756.2125	(98)
Space heating per m2											(98) / (4) =	49.6888	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1074.2106	845.6551	867.0633	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7849	0.8658	0.8318	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	843.1645	732.1378	721.2162	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.9578	927.4180	870.7072	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	91.2912	145.2885	111.2214	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  347.8010 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   22.8228   36.3221   27.8053    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                   86.9502 (107)
Space cooling per m2                                                                                             0.9084 (108)
Energy for space heating                                                                                        49.6888 (99)
Energy for space cooling                                                                                         0.9084 (108)
Total                                                                                                           50.5972 (109)
Target Fabric Energy Efficiency (TFEE)                                                                             58.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.6400	
Infiltration rate		0.3940	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3516	0.3265	0.3349	0.3181	0.3181	0.3098	0.3014	0.2930	0.2846	0.3098	0.2930	0.3098	(22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7859	45.0919	45.3175	44.8720	44.8720	44.6578	44.4493	44.2466	44.0495	44.6578	44.2466	44.6578	(38)
Heat transfer coeff	125.8219	125.1279	125.3535	124.9080	124.9080	124.6938	124.4853	124.2825	124.0854	124.6938	124.2825	124.6938	(39)
Average = Sum(39)m / 12 =												124.7780	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3145	1.3072	1.3096	1.3049	1.3049	1.3027	1.3005	1.2984	1.2963	1.3027	1.2984	1.3027	(40)
HLP (average)												1.3036	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
RHI water heating demand												1684	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8304	53.1234	53.0278	53.2170	53.2170	53.3084	53.3977	53.4848	53.5697	53.3084	53.4848	53.3084	
alpha	4.5220	4.5416	4.5352	4.5478	4.5478	4.5539	4.5598	4.5657	4.5713	4.5539	4.5657	4.5539	
util living area													
	0.9921	0.9877	0.9737	0.9321	0.8336	0.6357	0.4773	0.5002	0.7676	0.9397	0.9838	0.9935	(86)
MIT	19.7993	19.9188	20.1823	20.5200	20.8028	20.9580	20.9909	20.9891	20.9002	20.5790	20.1530	19.7870	(87)
Th 2	19.8295	19.8352	19.8333	19.8370	19.8370	19.8387	19.8404	19.8421	19.8437	19.8387	19.8421	19.8387	(88)
util rest of house													
	0.9894	0.9836	0.9642	0.9065	0.7707	0.5241	0.3404	0.3580	0.6689	0.9105	0.9772	0.9912	(89)
MIT 2	18.2734	18.4503	18.8277	19.3012	19.6611	19.8160	19.8381	19.8392	19.7764	19.3918	18.7959	18.2622	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9555	0.8969	0.7706	0.5396	0.3614	0.3798	0.6789	0.9018	0.9703	0.9873	(94)
Useful gains	759.7079	822.4199	880.4778	898.1407	790.4460	565.9432	360.3636	359.3581	598.9808	725.6084	731.3278	719.8698	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1711.8538	1673.3940	1508.4520	1247.3851	916.1539	584.7666	362.6634	362.1578	651.1012	1019.0286	1379.8111	1682.6152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	708.3966	571.8546	467.2128	251.4559	93.5267	0.0000	0.0000	0.0000	0.0000	218.3047	466.9080	716.2826	(98)
Space heating												3493.9419	(98)
RHI space heating demand												3494	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620 (8)
Pressure test		Yes
Measured/design AP50		4.6400
Infiltration rate		0.3940 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4270	0.4186	0.4102	0.3684	0.3600	0.3181	0.3181	0.3098	0.3349	0.3600	0.3767	0.3935	(22b)
Effective ac	0.5912	0.5876	0.5841	0.5678	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.1764	47.8879	47.6052	46.2772	46.0287	44.8720	44.8720	44.6578	45.3175	46.0287	46.5313	47.0568	(38)
Heat transfer coeff	128.2123	127.9239	127.6411	126.3131	126.0646	124.9080	124.9080	124.6938	125.3535	126.0646	126.5673	127.0928	(39)
Average = Sum(39)m / 12 =												126.3119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3395	1.3364	1.3335	1.3196	1.3170	1.3049	1.3049	1.3027	1.3096	1.3170	1.3223	1.3278	(40)
HLP (average)												1.3196	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	741.9664	829.6178	899.8076	965.5015	1006.5684	982.8166	939.0210	886.0292	835.8057	770.5968	718.8293	706.3694	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8454	51.9623	52.0774	52.6250	52.7287	53.2170	53.2170	53.3084	53.0278	52.7287	52.5193	52.3021	
alpha	4.4564	4.4642	4.4718	4.5083	4.5152	4.5478	4.5478	4.5539	4.5352	4.5152	4.5013	4.4868	
util living area													
	0.9942	0.9896	0.9792	0.9495	0.8751	0.7264	0.5629	0.6128	0.8331	0.9605	0.9894	0.9953	(86)
MIT	19.6689	19.8247	20.0793	20.4179	20.7224	20.9184	20.9799	20.9707	20.8392	20.4564	20.0030	19.6390	(87)
Th 2	19.8101	19.8124	19.8147	19.8255	19.8275	19.8370	19.8370	19.8387	19.8333	19.8275	19.8234	19.8192	(88)
util rest of house													
	0.9922	0.9861	0.9717	0.9302	0.8259	0.6265	0.4252	0.4746	0.7526	0.9414	0.9852	0.9937	(89)
MIT 2	18.0704	18.2981	18.6673	19.1538	19.5580	19.7834	19.8299	19.8272	19.7081	19.2169	18.5664	18.0331	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3133	18.5301	18.8819	19.3459	19.7350	19.9559	20.0047	20.0010	19.8801	19.4053	18.7847	18.2772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3133	18.5301	18.8819	19.3459	19.7350	19.9559	20.0047	20.0010	19.8801	19.4053	18.7847	18.2772	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9806	0.9636	0.9201	0.8213	0.6378	0.4461	0.4952	0.7564	0.9321	0.9796	0.9906	(94)
Useful gains	733.4371	813.5513	867.0937	888.3329	826.6455	626.8600	418.8573	438.7612	632.2132	718.2589	704.1904	699.7215	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1796.6827	1743.6207	1580.4442	1319.4557	1012.9236	668.9945	425.2796	449.0217	724.5506	1110.0380	1478.9045	1789.1057	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	791.0547	625.0066	530.7328	310.4084	138.5908	0.0000	0.0000	0.0000	0.0000	291.4836	557.7942	810.5018	(98)
Space heating												4055.5730	(98)
Space heating per m2											(98) / (4) =	42.3691	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4365.5253	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	791.0547	625.0066	530.7328	310.4084	138.5908	0.0000	0.0000	0.0000	0.0000	291.4836	557.7942	810.5018	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	851.5121	672.7736	571.2947	334.1318	149.1828	0.0000	0.0000	0.0000	0.0000	313.7606	600.4243	872.4455	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3111	89.2595	89.1509	88.8929	88.3055	86.7000	86.7000	86.7000	86.7000	88.8225	89.1866	89.3366	(217)
Fuel for water heating, kWh/month													
	192.6683	168.9777	175.4653	154.6612	150.3173	133.5081	125.0945	141.5841	142.6920	160.6611	173.0495	186.9448	(219)
Water heating fuel used												1905.6241	(219)
Annual totals kWh/year													
Space heating fuel - main system												4365.5253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6054.9112	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4365.5253	3.4800	151.9203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1905.6241	3.4800	66.3157	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			309.7142	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9244	(257)
SAP value		87.1048	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4365.5253	0.2160	942.9535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1905.6241	0.2160	411.6148	(264)
Space and water heating			1354.5683	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			1242.3407	(272)
CO2 emissions per m2			12.9800	(273)
EI value			88.1699	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8826 = 3.943, stars = 4
Water heating environmental impact	0.216 / 0.8826 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.6400	
Infiltration rate		0.3940	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3516	0.3265	0.3349	0.3181	0.3181	0.3098	0.3014	0.2930	0.2846	0.3098	0.2930	0.3098	(22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7859	45.0919	45.3175	44.8720	44.8720	44.6578	44.4493	44.2466	44.0495	44.6578	44.2466	44.6578	(38)
Heat transfer coeff	125.8219	125.1279	125.3535	124.9080	124.9080	124.6938	124.4853	124.2825	124.0854	124.6938	124.2825	124.6938	(39)
Average = Sum(39)m / 12 =												124.7780	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3145	1.3072	1.3096	1.3049	1.3049	1.3027	1.3005	1.2984	1.2963	1.3027	1.2984	1.3027	(40)
HLP (average)												1.3036	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8304	53.1234	53.0278	53.2170	53.2170	53.3084	53.3977	53.4848	53.5697	53.3084	53.4848	53.3084	
alpha	4.5220	4.5416	4.5352	4.5478	4.5478	4.5539	4.5598	4.5657	4.5713	4.5539	4.5657	4.5539	
util living area													
	0.9921	0.9877	0.9737	0.9321	0.8336	0.6357	0.4773	0.5002	0.7676	0.9397	0.9838	0.9935	(86)
MIT	19.7993	19.9188	20.1823	20.5200	20.8028	20.9580	20.9909	20.9891	20.9002	20.5790	20.1530	19.7870	(87)
Th 2	19.8295	19.8352	19.8333	19.8370	19.8370	19.8387	19.8404	19.8421	19.8437	19.8387	19.8421	19.8387	(88)
util rest of house													
	0.9894	0.9836	0.9642	0.9065	0.7707	0.5241	0.3404	0.3580	0.6689	0.9105	0.9772	0.9912	(89)
MIT 2	18.2734	18.4503	18.8277	19.3012	19.6611	19.8160	19.8381	19.8392	19.7764	19.3918	18.7959	18.2622	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9555	0.8969	0.7706	0.5396	0.3614	0.3798	0.6789	0.9018	0.9703	0.9873	(94)
Useful gains	759.7079	822.4199	880.4778	898.1407	790.4460	565.9432	360.3636	359.3581	598.9808	725.6084	731.3278	719.8698	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1711.8538	1673.3940	1508.4520	1247.3851	916.1539	584.7666	362.6634	362.1578	651.1012	1019.0286	1379.8111	1682.6152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	708.3966	571.8546	467.2128	251.4559	93.5267	0.0000	0.0000	0.0000	0.0000	218.3047	466.9080	716.2826	(98)
Space heating												3493.9419	(98)
Space heating per m2											(98) / (4) =	36.5017	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3760.9709	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	708.3966	571.8546	467.2128	251.4559	93.5267	0.0000	0.0000	0.0000	0.0000	218.3047	466.9080	716.2826	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	762.5367	615.5593	502.9202	270.6738	100.6746	0.0000	0.0000	0.0000	0.0000	234.9889	502.5920	771.0254	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2562	89.2128	89.0753	88.7422	87.9947	86.7000	86.7000	86.7000	86.7000	88.6072	89.0832	89.2770	(217)
Fuel for water heating, kWh/month													
	192.7868	169.0663	175.6143	154.9238	150.8483	133.5081	125.0945	141.5841	142.6920	161.0514	173.2504	187.0697	(219)
Water heating fuel used												1907.4898	(219)
Annual totals kWh/year													
Space heating fuel - main system												3760.9709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												5368.8726	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3760.9709	7.3800	277.5596	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1907.4898	7.3800	140.7727	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			439.4705	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3760.9709	0.2160	812.3697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.4898	0.2160	412.0178	(264)
Space and water heating			1224.3875	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			1068.9013	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3760.9709	1.2200	4588.3844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.4898	1.2200	2327.1375	(264)
Space and water heating			6915.5220	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			5995.7866	(272)
Primary energy kWh/m2/year			62.6388	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-192 kg (18.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.01 kg/m²	B 88	B 90
Total Savings	£60	2.01 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£153	-£14
Mains gas	£525	£451	£74
Space heating	£406	£406	£0
Water heating	£141	£81	£60
Lighting	£117	£117	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£440	£380	£60
Total cost of uses	£440	£380	£60
Delivered energy	56 kWh/m²	46 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	63 kWh/m²	51 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620 (8)
Pressure test		Yes
Measured/design AP50		4.6400
Infiltration rate		0.3940 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4270	0.4186	0.4102	0.3684	0.3600	0.3181	0.3181	0.3098	0.3349	0.3600	0.3767	0.3935	(22b)
Effective ac	0.5912	0.5876	0.5841	0.5678	0.5648	0.5506	0.5506	0.5480	0.5561	0.5648	0.5710	0.5774	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.1764	47.8879	47.6052	46.2772	46.0287	44.8720	44.8720	44.6578	45.3175	46.0287	46.5313	47.0568	(38)
Heat transfer coeff	128.2123	127.9239	127.6411	126.3131	126.0646	124.9080	124.9080	124.6938	125.3535	126.0646	126.5673	127.0928	(39)
Average = Sum(39)m / 12 =												126.3119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3395	1.3364	1.3335	1.3196	1.3170	1.3049	1.3049	1.3027	1.3096	1.3170	1.3223	1.3278	(40)
HLP (average)												1.3196	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1734	(H8)
Utilisation factor												0.5735	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-865.2518	(H17)
Solar input	-25.0906	-41.8690	-71.3076	-95.5663	-118.0641	-116.0758	-114.5418	-100.0758	-78.3794	-53.5239	-29.7610	-20.9965	(63)
								Solar input (sum of months) = Sum(63)m =				-865.2518	(63)
Output from w/h													
	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
									Total per year (kWh/year) = Sum(64)m =			825.4368	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	741.9664	829.6178	899.8076	965.5015	1006.5684	982.8166	939.0210	886.0292	835.8057	770.5968	718.8293	706.3694	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.8454	51.9623	52.0774	52.6250	52.7287	53.2170	53.2170	53.3084	53.0278	52.7287	52.5193	52.3021	
alpha	4.4564	4.4642	4.4718	4.5083	4.5152	4.5478	4.5478	4.5539	4.5352	4.5152	4.5013	4.4868	
util living area													
	0.9942	0.9896	0.9792	0.9495	0.8751	0.7264	0.5629	0.6128	0.8331	0.9605	0.9894	0.9953	(86)
MIT	19.6689	19.8247	20.0793	20.4179	20.7224	20.9184	20.9799	20.9707	20.8392	20.4564	20.0030	19.6390	(87)
Th 2	19.8101	19.8124	19.8147	19.8255	19.8275	19.8370	19.8370	19.8387	19.8333	19.8275	19.8234	19.8192	(88)
util rest of house													
	0.9922	0.9861	0.9717	0.9302	0.8259	0.6265	0.4252	0.4746	0.7526	0.9414	0.9852	0.9937	(89)
MIT 2	18.0704	18.2981	18.6673	19.1538	19.5580	19.7834	19.8299	19.8272	19.7081	19.2169	18.5664	18.0331	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.3133	18.5301	18.8819	19.3459	19.7350	19.9559	20.0047	20.0010	19.8801	19.4053	18.7847	18.2772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3133	18.5301	18.8819	19.3459	19.7350	19.9559	20.0047	20.0010	19.8801	19.4053	18.7847	18.2772	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9806	0.9636	0.9201	0.8213	0.6378	0.4461	0.4952	0.7564	0.9321	0.9796	0.9906	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	733.4371	813.5513	867.0937	888.3329	826.6455	626.8600	418.8573	438.7612	632.2132	718.2589	704.1904	699.7215	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1796.6827	1743.6207	1580.4442	1319.4557	1012.9236	668.9945	425.2796	449.0217	724.5506	1110.0380	1478.9045	1789.1057	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	791.0547	625.0066	530.7328	310.4084	138.5908	0.0000	0.0000	0.0000	0.0000	291.4836	557.7942	810.5018	(98)
Space heating												4055.5730	(98)
Space heating per m2											(98) / (4) =	42.3691	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4365.5253	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	791.0547	625.0066	530.7328	310.4084	138.5908	0.0000	0.0000	0.0000	0.0000	291.4836	557.7942	810.5018	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	851.5121	672.7736	571.2947	334.1318	149.1828	0.0000	0.0000	0.0000	0.0000	313.7606	600.4243	872.4455	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3831	89.4101	89.4437	89.5070	89.5834	86.7000	86.7000	86.7000	86.7000	89.1293	89.2983	89.3963	(217)
Fuel for water heating, kWh/month	164.4423	121.8652	95.1675	46.8305	16.3807	0.0000	0.0000	26.1564	52.2890	100.0561	139.5054	163.3330	(219)
Water heating fuel used												926.0261	(219)
Annual totals kWh/year													
Space heating fuel - main system												4365.5253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5125.3133	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4365.5253	3.4800	151.9203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	926.0261	3.4800	32.2257	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			282.2192	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8423	(257)
SAP value		88.2496	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4365.5253	0.2160	942.9535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	926.0261	0.2160	200.0216	(264)
Space and water heating			1142.9751	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	408.2938	0.5190	211.9045 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			1056.6975 (272)
CO2 emissions per m2			11.0400 (273)
EI value			89.9376
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.6400	
Infiltration rate		0.3940	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3349	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3516	0.3265	0.3349	0.3181	0.3181	0.3098	0.3014	0.2930	0.2846	0.3098	0.2930	0.3098	(22b)
Effective ac	0.5618	0.5533	0.5561	0.5506	0.5506	0.5480	0.5454	0.5429	0.5405	0.5480	0.5429	0.5480	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.7859	45.0919	45.3175	44.8720	44.8720	44.6578	44.4493	44.2466	44.0495	44.6578	44.2466	44.6578	(38)
Heat transfer coeff	125.8219	125.1279	125.3535	124.9080	124.9080	124.6938	124.4853	124.2825	124.0854	124.6938	124.2825	124.6938	(39)
Average = Sum(39)m / 12 =												124.7780	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3145	1.3072	1.3096	1.3049	1.3049	1.3027	1.3005	1.2984	1.2963	1.3027	1.2984	1.3027	(40)
HLP (average)												1.3036	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy			2.6962	(42)
Average daily hot water use (litres/day)			98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3132	(H8)
Utilisation factor												0.5330	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-899.9616	(H17)
Solar input	-29.3589	-41.7465	-71.7522	-96.8104	-113.7096	-121.4598	-118.9055	-106.4240	-83.3227	-57.6064	-34.7239	-24.1416	(63)
								Solar input (sum of months) = Sum(63)m =				-899.9616	(63)
Output from w/h													
	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
								Total per year (kWh/year) = Sum(64)m =				800.4747	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8304	53.1234	53.0278	53.2170	53.2170	53.3084	53.3977	53.4848	53.5697	53.3084	53.4848	53.3084	
alpha	4.5220	4.5416	4.5352	4.5478	4.5478	4.5539	4.5598	4.5657	4.5713	4.5539	4.5657	4.5539	
util living area													
	0.9921	0.9877	0.9737	0.9321	0.8336	0.6357	0.4773	0.5002	0.7676	0.9397	0.9838	0.9935	(86)
MIT	19.7993	19.9188	20.1823	20.5200	20.8028	20.9580	20.9909	20.9891	20.9002	20.5790	20.1530	19.7870	(87)
Th 2	19.8295	19.8352	19.8333	19.8370	19.8370	19.8387	19.8404	19.8421	19.8437	19.8387	19.8421	19.8387	(88)
util rest of house													
	0.9894	0.9836	0.9642	0.9065	0.7707	0.5241	0.3404	0.3580	0.6689	0.9105	0.9772	0.9912	(89)
MIT 2	18.2734	18.4503	18.8277	19.3012	19.6611	19.8160	19.8381	19.8392	19.7764	19.3918	18.7959	18.2622	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5054	18.6735	19.0336	19.4864	19.8346	19.9896	20.0133	20.0140	19.9472	19.5723	19.0022	18.4940	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9555	0.8969	0.7706	0.5396	0.3614	0.3798	0.6789	0.9018	0.9703	0.9873	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	759.7079	822.4199	880.4778	898.1407	790.4460	565.9432	360.3636	359.3581	598.9808	725.6084	731.3278	719.8698	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1711.8538	1673.3940	1508.4520	1247.3851	916.1539	584.7666	362.6634	362.1578	651.1012	1019.0286	1379.8111	1682.6152	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	708.3966	571.8546	467.2128	251.4559	93.5267	0.0000	0.0000	0.0000	0.0000	218.3047	466.9080	716.2826	(98)
Space heating												3493.9419	(98)
Space heating per m2											(98) / (4) =	36.5017	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3760.9709	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	708.3966	571.8546	467.2128	251.4559	93.5267	0.0000	0.0000	0.0000	0.0000	218.3047	466.9080	716.2826	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	762.5367	615.5593	502.9202	270.6738	100.6746	0.0000	0.0000	0.0000	0.0000	234.9889	502.5920	771.0254	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3470	89.3716	89.3938	89.4404	89.3425	86.7000	86.7000	86.7000	86.7000	88.9789	89.2284	89.3516	(217)
Fuel for water heating, kWh/month	159.7313	122.0547	94.7234	45.4744	21.2988	0.0000	0.0000	18.8343	46.5874	95.6371	134.0528	159.8949	(219)
Water heating fuel used												898.2890	(219)
Annual totals kWh/year													
Space heating fuel - main system												3760.9709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4409.6718	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3760.9709	7.3800	277.5596	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	898.2890	7.3800	66.2937	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			379.3214	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3760.9709	0.2160	812.3697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.2890	0.2160	194.0304	(264)
Space and water heating			1006.4001	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			876.8639	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3760.9709	1.2200	4588.3844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.2890	1.2200	1095.9126	(264)
Space and water heating			5684.2971	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4918.0617	(272)
Primary energy kWh/m2/year			51.3797	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	651.97	(P1)
Transmission heat loss coefficient	80.04	(37)
Summer heat loss coefficient	732.00	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.0500	87.1704	0.7200	0.7000	0.7650	273.7489
East	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
South	5.0500	118.5567	0.7200	0.7000	0.7650	207.7552
West	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
total:						543.2361

	Jun	Jul	Aug	
Solar gains	585	543	481	(P3)
Internal gains	475	455	464	
Total summer gains	1059	998	945	(P5)
Summer gain/loss ratio	1.45	1.36	1.29	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.91	18.84	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 402 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	25 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.85	**TER**	18.73
Environmental	88 B	**% DER<TER**	20.70		
CO_2 Emissions (t/year)	1.03	**DFEE**	54.90	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.66		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.85	$kgCO_2/m^2$	Pass
	-3.88 (-20.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.19	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.90	$kWh/m^2/yr$	
	-3.3 (-5.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.64 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	9.05 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	5.05 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.64 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 403 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	27 Wren Walk, Boorley Green , Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.33	**TER**	17.17
Environmental	88 B	**% DER<TER**	22.35		
CO_2 Emissions (t/year)	1.21	**DFEE**	53.93	**TFEE**	57.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.17 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.33 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.9 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.89 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   8.08 m², No overhang
Windows facing North East:              1.02 m², No overhang
Windows facing East:                    0.82 m², No overhang
Windows facing South:                   8.11 m², No overhang
Windows facing West:                    1.42 m², No overhang
Windows facing North West:              1.02 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.021 W/m²K
Photovoltaic array                      1.10 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.8900	
Infiltration rate		0.3953	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3360	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4284	0.4200	0.4116	0.3696	0.3612	0.3192	0.3192	0.3108	0.3360	0.3612	0.3780	0.3948	(22b)
Effective ac	0.5918	0.5882	0.5847	0.5683	0.5652	0.5510	0.5510	0.5483	0.5565	0.5652	0.5715	0.5779	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.7371	64.3472	63.9651	62.1701	61.8343	60.2709	60.2709	59.9814	60.8731	61.8343	62.5137	63.2239	(38)
Heat transfer coeff	165.9693	165.5794	165.1973	163.4023	163.0665	161.5031	161.5031	161.2136	162.1053	163.0665	163.7458	164.4561	(39)
Average = Sum(39)m / 12 =												163.4007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2940	1.2910	1.2880	1.2740	1.2714	1.2592	1.2592	1.2569	1.2639	1.2714	1.2767	1.2822	(40)
HLP (average)												1.2740	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	471.4291	469.0425	451.8108	423.8129	394.8802	367.4647	349.9693	356.6640	371.3337	399.5668	431.9855	456.7820	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.8436	320.6571	452.7084	589.3935	689.8055	698.8286	667.8426	590.1432	499.2649	357.8630	223.2689	158.6496	(83)
Total gains	657.2726	789.6996	904.5192	1013.2064	1084.6857	1066.2933	1017.8118	946.8072	870.5986	757.4298	655.2544	615.4316	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6662	53.7926	53.9170	54.5093	54.6216	55.1503	55.1503	55.2493	54.9454	54.6216	54.3949	54.1600	
alpha	4.5777	4.5862	4.5945	4.6340	4.6414	4.6767	4.6767	4.6833	4.6630	4.6414	4.6263	4.6107	
util living area													
	0.9989	0.9973	0.9929	0.9775	0.9292	0.8108	0.6530	0.7112	0.9091	0.9867	0.9978	0.9992	(86)
MIT	19.4908	19.6591	19.9305	20.2934	20.6356	20.8786	20.9670	20.9510	20.7654	20.3205	19.8389	19.4642	(87)
Th 2	19.8455	19.8479	19.8503	19.8613	19.8633	19.8729	19.8729	19.8747	19.8692	19.8633	19.8592	19.8548	(88)
util rest of house													
	0.9986	0.9964	0.9901	0.9677	0.8955	0.7207	0.5074	0.5699	0.8516	0.9793	0.9968	0.9990	(89)
MIT 2	17.8351	18.0827	18.4799	19.0111	19.4858	19.7856	19.8602	19.8530	19.6656	19.0567	18.3537	17.8025	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.0622	18.2989	18.6789	19.1870	19.6435	19.9355	20.0120	20.0036	19.8164	19.2300	18.5574	18.0304	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0622	18.2989	18.6789	19.1870	19.6435	19.9355	20.0120	20.0036	19.8164	19.2300	18.5574	18.0304	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9943	0.9859	0.9596	0.8872	0.7265	0.5269	0.5879	0.8481	0.9731	0.9950	0.9982	(94)
Useful gains	655.7082	785.2294	891.7273	972.2993	962.3266	774.6819	536.2537	556.6460	738.3484	737.0849	651.9624	614.3479	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2284.1014	2218.5794	2011.9155	1680.9145	1295.3130	861.6927	551.0416	580.9509	926.6565	1407.2661	1876.1012	2274.4901	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1211.5246	963.2112	833.4201	510.2030	247.7419	0.0000	0.0000	0.0000	0.0000	498.6148	881.3799	1235.1458	(98)
Space heating												6381.2412	(98)
Space heating per m2											(98) / (4) =	49.7524	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6868.9356	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1211.5246	963.2112	833.4201	510.2030	247.7419	0.0000	0.0000	0.0000	0.0000	498.6148	881.3799	1235.1458	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1304.1169	1036.8258	897.1152	549.1959	266.6759	0.0000	0.0000	0.0000	0.0000	536.7220	948.7405	1329.5434	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4736	89.4363	89.3598	89.1778	88.7261	86.7000	86.7000	86.7000	86.7000	89.1436	89.3903	89.4915	(217)
Fuel for water heating, kWh/month													
	200.7363	176.0093	182.6623	160.8206	156.0224	139.1747	130.3455	147.6104	148.7894	166.9854	180.1695	194.7720	(219)
Water heating fuel used												1984.0979	(219)
Annual totals kWh/year													
Space heating fuel - main system												6868.9356	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												8463.8554	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6868.9356	0.2160	1483.6901	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1984.0979	0.2160	428.5651	(264)
Space and water heating			1912.2552	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total CO2, kg/year			1710.2718	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3300	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		28.4563	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4563	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650 (1b) - (3b)	
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.5747	482.1908	464.9647	436.9743	407.4792	379.3683	361.8784	369.2681	384.5026	412.7279	445.1377	469.9303	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	162.6131	280.5749	396.1199	515.7193	603.5799	611.4750	584.3622	516.3753	436.8568	313.1301	195.3603	138.8184 (83)
Total gains	647.1878	762.7657	861.0845	952.6936	1011.0591	990.8433	946.2406	885.6434	821.3594	725.8580	640.4980	608.7487 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area													
	0.9991	0.9977	0.9939	0.9803	0.9350	0.8168	0.6547	0.7113	0.9119	0.9879	0.9980	0.9993	(86)
MIT	19.6132	19.7664	20.0160	20.3511	20.6690	20.8941	20.9733	20.9600	20.7931	20.3818	19.9359	19.5879	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house													
	0.9988	0.9969	0.9916	0.9718	0.9043	0.7317	0.5173	0.5777	0.8576	0.9812	0.9972	0.9991	(89)
MIT 2	18.0691	18.2946	18.6601	19.1513	19.5936	19.8725	19.9395	19.9336	19.7646	19.2011	18.5499	18.0379	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.2809	18.4965	18.8461	19.3158	19.7411	20.0126	20.0813	20.0743	19.9057	19.3630	18.7400	18.2504	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2809	18.4965	18.8461	19.3158	19.7411	20.0126	20.0813	20.0743	19.9057	19.3630	18.7400	18.2504	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9953	0.9881	0.9649	0.8970	0.7376	0.5357	0.5949	0.8549	0.9758	0.9956	0.9985	(94)
Useful gains	645.8673	759.1449	850.8111	919.2148	906.8725	730.8242	506.9417	526.8927	702.1545	708.3216	637.6908	607.8281	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2139.3317	2075.8550	1880.7998	1570.3106	1209.9212	806.9751	519.0314	546.8815	868.6529	1318.5408	1758.3867	2131.2874	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1111.1375	884.8292	766.3116	468.7890	225.4682	0.0000	0.0000	0.0000	0.0000	454.0031	806.9010	1133.4538	(98)
Space heating												5850.8933	(98)
Space heating per m2											(98) / (4) =	45.6174	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6264.3397	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1111.1375	884.8292	766.3116	468.7890	225.4682	0.0000	0.0000	0.0000	0.0000	454.0031	806.9010	1133.4538	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1189.6547	947.3546	820.4621	501.9154	241.4007	0.0000	0.0000	0.0000	0.0000	486.0847	863.9197	1213.5479	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5678	88.4108	88.0854	87.3362	85.6769	80.3000	80.3000	80.3000	80.3000	87.1884	88.2058	88.6334	(217)
Fuel for water heating, kWh/month													
	246.9604	218.0262	229.7459	207.6128	205.3382	192.9601	184.8705	206.0873	207.8790	215.6527	225.5323	240.8050	(219)
Water heating fuel used												2581.4705	(219)
Annual totals kWh/year													
Space heating fuel - main system												6264.3397	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Total delivered energy for all uses												9406.6138	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6264.3397	0.2160	1353.0974	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.4705	0.2160	557.5976	(264)
Space and water heating			1910.6950	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Total CO2, kg/m2/year			2201.7521	(272)
Emissions per m2 for space and water heating			14.8970	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9658	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8970 * 1.00) + 1.9658 + 0.3035, rounded to 2 d.p.			17.1700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		4.8900	
Infiltration rate		0.3652	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3104	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3957	0.3880	0.3802	0.3414	0.3337	0.2949	0.2949	0.2871	0.3104	0.3337	0.3492	0.3647	(22b)
Effective ac	0.5783	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5412	0.5482	0.5557	0.5610	0.5665	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.2633	62.9307	62.6046	61.0731	60.7866	59.4527	59.4527	59.2057	59.9665	60.7866	61.3662	61.9722	(38)
Heat transfer coeff	164.4955	164.1628	163.8368	162.3053	162.0188	160.6849	160.6849	160.4379	161.1987	162.0188	162.5984	163.2044	(39)
Average = Sum(39)m / 12 =												162.3039	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2825	1.2799	1.2774	1.2654	1.2632	1.2528	1.2528	1.2509	1.2568	1.2632	1.2677	1.2724	(40)
HLP (average)												1.2654	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058	(72)
Total internal gains	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.8436	320.6571	452.7084	589.3935	689.8055	698.8286	667.8426	590.1432	499.2649	357.8630	223.2689	158.6496	(83)
Total gains	623.2355	756.5225	873.1282	984.2435	1057.3014	1041.1307	994.5355	921.1117	844.0423	728.3603	623.3471	582.2510	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1470	54.2568	54.3647	54.8777	54.9748	55.4311	55.4311	55.5165	55.2544	54.9748	54.7788	54.5754	
alpha	4.6098	4.6171	4.6243	4.6585	4.6650	4.6954	4.6954	4.7011	4.6836	4.6650	4.6519	4.6384	
util living area	0.9992	0.9978	0.9938	0.9796	0.9340	0.8193	0.6626	0.7229	0.9164	0.9886	0.9982	0.9994	(86)
MIT	19.4811	19.6494	19.9209	20.2831	20.6275	20.8739	20.9655	20.9481	20.7566	20.3077	19.8259	19.4529	(87)
Th 2	19.8546	19.8566	19.8586	19.8680	19.8698	19.8780	19.8780	19.8795	19.8748	19.8698	19.8662	19.8625	(88)
util rest of house	0.9989	0.9970	0.9914	0.9707	0.9020	0.7309	0.5167	0.5820	0.8619	0.9821	0.9974	0.9992	(89)
MIT 2	18.4703	18.6398	18.9118	19.2765	19.6043	19.8154	19.8687	19.8636	19.7287	19.3055	18.8239	18.4483	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.6089	18.7783	19.0502	19.4146	19.7447	19.9605	20.0191	20.0123	19.8697	19.4429	18.9613	18.5861	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6089	18.7783	19.0502	19.4146	19.7447	19.9605	20.0191	20.0123	19.8697	19.4429	18.9613	18.5861	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9959	0.9890	0.9659	0.8976	0.7385	0.5366	0.6007	0.8615	0.9786	0.9965	0.9988	(94)
Useful gains	622.2333	753.4049	863.4816	950.6731	948.9850	768.8552	533.7129	553.3465	727.1691	712.7702	621.1388	581.5707	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2353.7513	2278.2948	2056.1820	1706.5691	1303.3854	861.3573	549.4045	579.5523	930.0621	1432.7176	1928.6249	2347.8713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1288.2494	1024.7261	887.3692	544.2451	263.6739	0.0000	0.0000	0.0000	0.0000	535.6409	941.3900	1314.1276	(98)
Space heating												6799.4220	(98)
Space heating per m2											(98) / (4) =	53.0128	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1510.4380	1189.0682	1219.3279	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7701	0.8529	0.8161	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1163.2426	1014.1069	995.1291	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1335.3884	1278.2843	1194.8451	0.0000	0.0000	0.0000	0.0000	(103)

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Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	123.9449	196.5480	148.5887	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												469.0816 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	30.9862	49.1370	37.1472	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												117.2704 (107)
Space cooling per m2												0.9143 (108)
Energy for space heating												53.0128 (99)
Energy for space cooling												0.9143 (108)
Total												53.9271 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058	(72)
Total internal gains													
	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	162.6131	280.5749	396.1199	515.7193	603.5799	611.4750	584.3622	516.3753	436.8568	313.1301	195.3603	138.8184	(83)
Total gains	600.0051	716.4404	816.5397	910.5693	971.0757	953.7771	911.0552	847.3438	781.6341	683.6274	595.4385	562.4198	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area													
	0.9994	0.9983	0.9952	0.9835	0.9433	0.8330	0.6744	0.7337	0.9247	0.9906	0.9986	0.9995	(86)
MIT	19.5790	19.7331	19.9845	20.3232	20.6476	20.8834	20.9696	20.9540	20.7740	20.3527	19.9034	19.5542	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house													
	0.9991	0.9977	0.9933	0.9763	0.9156	0.7508	0.5355	0.6002	0.8756	0.9853	0.9979	0.9994	(89)
MIT 2	18.6240	18.7795	19.0318	19.3746	19.6856	19.8906	19.9417	19.9371	19.8079	19.4078	18.9578	18.6058	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.7549	18.9103	19.1625	19.5047	19.8175	20.0267	20.0827	20.0766	19.9404	19.5374	19.0875	18.7359	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7549	18.9103	19.1625	19.5047	19.8175	20.0267	20.0827	20.0766	19.9404	19.5374	19.0875	18.7359	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9968	0.9914	0.9723	0.9115	0.7578	0.5545	0.6180	0.8752	0.9824	0.9972	0.9991	(94)
Useful gains	599.2542	714.1698	809.5084	885.3640	885.0871	722.7516	505.1943	523.6225	684.1248	671.5793	593.7772	561.9113	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2211.8770	2139.0370	1928.9995	1598.7794	1221.4199	809.0839	519.2396	547.2130	873.8456	1344.7779	1810.8814	2204.9208	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1199.7914	957.5108	832.9014	513.6591	250.2316	0.0000	0.0000	0.0000	0.0000	500.8598	876.3150	1222.3991	(98)
Space heating												6353.6681	(98)
Space heating per m2											(98) / (4) =	49.5374	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1401.4689	1103.2840	1131.1682	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7755	0.8598	0.8245	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1086.8648	948.5772	932.7004	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1233.2868	1180.7099	1108.6228	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	105.4239	172.7068	130.8863	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												409.0169 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3560	43.1767	32.7216	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												102.2542 (107)
Space cooling per m2												0.7972 (108)
Energy for space heating												49.5374 (99)
Energy for space cooling												0.7972 (108)
Total												50.3347 (109)
Target Fabric Energy Efficiency (TFEE)												57.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.8900	
Infiltration rate		0.3953	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3360	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3528	0.3276	0.3360	0.3192	0.3192	0.3108	0.3024	0.2940	0.2856	0.3108	0.2940	0.3108	(22b)
Effective ac	0.5622	0.5537	0.5565	0.5510	0.5510	0.5483	0.5457	0.5432	0.5408	0.5483	0.5432	0.5483	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.5062	60.5682	60.8731	60.2709	60.2709	59.9814	59.6996	59.4256	59.1592	59.9814	59.4256	59.9814	(38)
Heat transfer coeff	162.7384	161.8003	162.1053	161.5031	161.5031	161.2136	160.9318	160.6577	160.3914	161.2136	160.6577	161.2136	(39)
Average = Sum(39)m / 12 =												161.3275	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2688	1.2615	1.2639	1.2592	1.2592	1.2569	1.2547	1.2526	1.2505	1.2569	1.2526	1.2569	(40)
HLP (average)												1.2578	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
RHI water heating demand												1757 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	13.4839	0.7200	0.7000	0.7700	38.0531	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(76)
South	8.1100	56.7559	0.7200	0.7000	0.7700	160.7664	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	228.9447	336.8799	482.1939	637.1658	713.3281	786.8658	745.3512	671.6213	563.5410	406.3333	274.2707	192.0677	(83)
Total gains	933.9195	1036.3655	1153.7965	1265.4245	1296.7253	1330.6041	1266.3167	1202.3841	1119.6249	1005.9963	922.2811	877.1181	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7317	55.0490	54.9454	55.1503	55.1503	55.2493	55.3461	55.4405	55.5326	55.2493	55.4405	55.2493	
alpha	4.6488	4.6699	4.6630	4.6767	4.6767	4.6833	4.6897	4.6960	4.7022	4.6833	4.6960	4.6833	
util living area													
	0.9947	0.9909	0.9786	0.9403	0.8465	0.6476	0.4862	0.5091	0.7798	0.9490	0.9882	0.9958	(86)
MIT	19.7879	19.9140	20.1819	20.5208	20.8025	20.9589	20.9914	20.9896	20.9013	20.5741	20.1423	19.7747	(87)
Th 2	19.8653	19.8711	19.8692	19.8729	19.8729	19.8747	19.8765	19.8782	19.8798	19.8747	19.8782	19.8747	(88)
util rest of house													
	0.9928	0.9878	0.9707	0.9173	0.7870	0.5381	0.3511	0.3690	0.6845	0.9237	0.9833	0.9943	(89)
MIT 2	18.2821	18.4691	18.8542	19.3320	19.6939	19.8521	19.8742	19.8753	19.8119	19.4150	18.8069	18.2695	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.4886	18.6672	19.0362	19.4950	19.8460	20.0039	20.0274	20.0282	19.9613	19.5740	18.9901	18.4759	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4886	18.6672	19.0362	19.4950	19.8460	20.0039	20.0274	20.0282	19.9613	19.5740	18.9901	18.4759	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9830	0.9628	0.9076	0.7853	0.5516	0.3698	0.3883	0.6924	0.9148	0.9776	0.9914	(94)
Useful gains	924.0329	1018.7100	1110.9094	1148.4850	1018.3708	733.9032	468.2326	466.9214	775.1762	920.2943	901.5974	869.5975	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2211.3867	2162.8218	1951.1392	1614.2225	1186.3956	758.3358	471.1084	470.4301	843.8693	1317.7606	1781.7046	2172.5032	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.7912	768.8432	625.1309	335.3310	125.0104	0.0000	0.0000	0.0000	0.0000	295.7149	633.6772	969.3619	(98)
Space heating												4710.8607	(98)
RHI space heating demand												4711	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.8900	
Infiltration rate		0.3953	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3360	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4284	0.4200	0.4116	0.3696	0.3612	0.3192	0.3192	0.3108	0.3360	0.3612	0.3780	0.3948	(22b)
Effective ac	0.5918	0.5882	0.5847	0.5683	0.5652	0.5510	0.5510	0.5483	0.5565	0.5652	0.5715	0.5779	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.7371	64.3472	63.9651	62.1701	61.8343	60.2709	60.2709	59.9814	60.8731	61.8343	62.5137	63.2239	(38)
Heat transfer coeff	165.9693	165.5794	165.1973	163.4023	163.0665	161.5031	161.5031	161.2136	162.1053	163.0665	163.7458	164.4561	(39)
Average = Sum(39)m / 12 =												163.4007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2940	1.2910	1.2880	1.2740	1.2714	1.2592	1.2592	1.2569	1.2639	1.2714	1.2767	1.2822	(40)
HLP (average)												1.2740	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.8436	320.6571	452.7084	589.3935	689.8055	698.8286	667.8426	590.1432	499.2649	357.8630	223.2689	158.6496 (83)
Total gains	890.8184	1020.1427	1124.3110	1217.6522	1273.2028	1242.5669	1188.8080	1120.9060	1055.3488	957.5259	871.2794	843.7000 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6662	53.7926	53.9170	54.5093	54.6216	55.1503	55.1503	55.2493	54.9454	54.6216	54.3949	54.1600	
alpha	4.5777	4.5862	4.5945	4.6340	4.6414	4.6767	4.6767	4.6833	4.6630	4.6414	4.6263	4.6107	
util living area													
	0.9962	0.9924	0.9833	0.9565	0.8864	0.7406	0.5748	0.6258	0.8465	0.9681	0.9927	0.9971	(86)
MIT	19.6556	19.8196	20.0787	20.4182	20.7221	20.9186	20.9805	20.9712	20.8385	20.4491	19.9900	19.6260	(87)
Th 2	19.8455	19.8479	19.8503	19.8613	19.8633	19.8729	19.8729	19.8747	19.8692	19.8633	19.8592	19.8548	(88)
util rest of house													
	0.9950	0.9898	0.9773	0.9396	0.8405	0.6436	0.4390	0.4899	0.7703	0.9522	0.9897	0.9961	(89)
MIT 2	18.0755	18.3158	18.6925	19.1827	19.5895	19.8184	19.8659	19.8631	19.7408	19.2351	18.5730	18.0387	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.2922	18.5220	18.8826	19.3521	19.7448	19.9693	20.0188	20.0150	19.8913	19.4016	18.7673	18.2564	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2922	18.5220	18.8826	19.3521	19.7448	19.9693	20.0188	20.0150	19.8913	19.4016	18.7673	18.2564	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9854	0.9702	0.9297	0.8348	0.6528	0.4575	0.5080	0.7721	0.9434	0.9854	0.9939	(94)
Useful gains	883.9505	1005.2809	1090.7562	1132.0561	1062.8833	811.1770	543.8439	569.3894	814.8186	903.2949	858.5888	838.5448	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2322.2707	2255.5276	2045.5766	1707.9037	1311.8393	867.1597	552.1394	582.7920	938.8016	1435.2410	1910.4770	2311.6630	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1070.1102	840.1658	710.3864	414.6103	185.2232	0.0000	0.0000	0.0000	0.0000	395.7679	757.3595	1095.9999	(98)
Space heating												5469.6233	(98)
Space heating per m2											(98) / (4) =	42.6448	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5887.6462	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1070.1102	840.1658	710.3864	414.6103	185.2232	0.0000	0.0000	0.0000	0.0000	395.7679	757.3595	1095.9999	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1151.8948	904.3765	764.6786	446.2974	199.3792	0.0000	0.0000	0.0000	0.0000	426.0150	815.2417	1179.7631	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4256	89.3794	89.2843	89.0552	88.5028	86.7000	86.7000	86.7000	86.7000	89.0022	89.3219	89.4470	(217)
Fuel for water heating, kWh/month													
	200.8440	176.1213	182.8168	161.0419	156.4160	139.1747	130.3455	147.6104	148.7894	167.2507	180.3075	194.8690	(219)
Water heating fuel used												1985.5872	(219)
Annual totals kWh/year													
Space heating fuel - main system												5887.6462	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												7484.0553	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5887.6462	3.4800	204.8901	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1985.5872	3.4800	69.0984	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	485.8036	13.1900	64.0775	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-949.9817	13.1900	-125.3026	(252)
Total energy cost			342.6559	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8306	(257)
SAP value		88.4127	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5887.6462	0.2160	1271.7316	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.5872	0.2160	428.8868	(264)
Space and water heating			1700.6184	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total kg/year			1498.6350	(272)
CO2 emissions per m2			11.6800	(273)
EI value			88.4095	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8835 = 3.939, stars = 4
Water heating environmental impact	0.216 / 0.8835 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.8900	
Infiltration rate		0.3953	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3360	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3528	0.3276	0.3360	0.3192	0.3192	0.3108	0.3024	0.2940	0.2856	0.3108	0.2940	0.3108	(22b)
Effective ac	0.5622	0.5537	0.5565	0.5510	0.5510	0.5483	0.5457	0.5432	0.5408	0.5483	0.5432	0.5483	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.5062	60.5682	60.8731	60.2709	60.2709	59.9814	59.6996	59.4256	59.1592	59.9814	59.4256	59.9814	(38)
Heat transfer coeff	162.7384	161.8003	162.1053	161.5031	161.5031	161.2136	160.9318	160.6577	160.3914	161.2136	160.6577	161.2136	(39)
Average = Sum(39)m / 12 =												161.3275	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2688	1.2615	1.2639	1.2592	1.2592	1.2569	1.2547	1.2526	1.2505	1.2569	1.2526	1.2569	(40)
HLP (average)												1.2578	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	13.4839	0.7200	0.7000	0.7700	38.0531	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(76)
South	8.1100	56.7559	0.7200	0.7000	0.7700	160.7664	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	228.9447	336.8799	482.1939	637.1658	713.3281	786.8658	745.3512	671.6213	563.5410	406.3333	274.2707	192.0677	(83)
Total gains	933.9195	1036.3655	1153.7965	1265.4245	1296.7253	1330.6041	1266.3167	1202.3841	1119.6249	1005.9963	922.2811	877.1181	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7317	55.0490	54.9454	55.1503	55.1503	55.2493	55.3461	55.4405	55.5326	55.2493	55.4405	55.2493	
alpha	4.6488	4.6699	4.6630	4.6767	4.6767	4.6833	4.6897	4.6960	4.7022	4.6833	4.6960	4.6833	
util living area													
	0.9947	0.9909	0.9786	0.9403	0.8465	0.6476	0.4862	0.5091	0.7798	0.9490	0.9882	0.9958	(86)
MIT	19.7879	19.9140	20.1819	20.5208	20.8025	20.9589	20.9914	20.9896	20.9013	20.5741	20.1423	19.7747	(87)
Th 2	19.8653	19.8711	19.8692	19.8729	19.8729	19.8747	19.8765	19.8782	19.8798	19.8747	19.8782	19.8747	(88)
util rest of house													
	0.9928	0.9878	0.9707	0.9173	0.7870	0.5381	0.3511	0.3690	0.6845	0.9237	0.9833	0.9943	(89)
MIT 2	18.2821	18.4691	18.8542	19.3320	19.6939	19.8521	19.8742	19.8753	19.8119	19.4150	18.8069	18.2695	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.4886	18.6672	19.0362	19.4950	19.8460	20.0039	20.0274	20.0282	19.9613	19.5740	18.9901	18.4759	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4886	18.6672	19.0362	19.4950	19.8460	20.0039	20.0274	20.0282	19.9613	19.5740	18.9901	18.4759	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9830	0.9628	0.9076	0.7853	0.5516	0.3698	0.3883	0.6924	0.9148	0.9776	0.9914	(94)
Useful gains	924.0329	1018.7100	1110.9094	1148.4850	1018.3708	733.9032	468.2326	466.9214	775.1762	920.2943	901.5974	869.5975	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2211.3867	2162.8218	1951.1392	1614.2225	1186.3956	758.3358	471.1084	470.4301	843.8693	1317.7606	1781.7046	2172.5032	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	957.7912	768.8432	625.1309	335.3310	125.0104	0.0000	0.0000	0.0000	0.0000	295.7149	633.6772	969.3619	(98)
Space heating												4710.8607	(98)
Space heating per m2											(98) / (4) =	36.7290	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5070.8942	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	957.7912	768.8432	625.1309	335.3310	125.0104	0.0000	0.0000	0.0000	0.0000	295.7149	633.6772	969.3619	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1030.9916	827.6030	672.9074	360.9591	134.5645	0.0000	0.0000	0.0000	0.0000	318.3153	682.1067	1043.4466	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3791	89.3396	89.2182	88.9169	88.1896	86.7000	86.7000	86.7000	86.7000	88.8026	89.2326	89.3971	(217)
Fuel for water heating, kWh/month													
	200.9487	176.1998	182.9522	161.2925	156.9716	139.1747	130.3455	147.6104	148.7894	167.6267	180.4879	194.9777	(219)
Water heating fuel used												1987.3771	(219)
Annual totals kWh/year													
Space heating fuel - main system												5070.8942	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1208 * 1.00) =										-1063.1729		-1063.1729	(233)
Total delivered energy for all uses												6555.9020	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5070.8942	7.3800	374.2320	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1987.3771	7.3800	146.6684	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	485.8036	28.6600	139.2313	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1063.1729	28.6600	-304.7054	(252)
Total energy cost			483.9214	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5070.8942	0.2160	1095.3132	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.3771	0.2160	429.2735	(264)
Space and water heating			1524.5866	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	0.5190	-551.7867	(269)
Total kg/year			1263.8569	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5070.8942	1.2200	6186.4909	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.3771	1.2200	2424.6001	(264)
Space and water heating			8611.0910	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	485.8036	3.0700	1491.4170	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	3.0700	-3263.9408	(269)
Primary energy kWh/year			7068.8172	(272)
Primary energy kWh/m2/year			55.1132	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 1.0	-£ 62	-197 kg (15.6%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£161	£161	£0
Mains gas	£628	£628	£0
Space heating	£503	£503	£0
Water heating	£147	£147	£0
Lighting	£139	£139	£0
Generated (PV)	-£305	-£305	£0
Total cost of fuels	£484	£484	£0
Total cost of uses	£484	£484	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	875.15 (P1)
Transmission heat loss coefficient	101.23 (37)
Summer heat loss coefficient	976.38 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)
North West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.0800	87.1704	0.7200	0.7000	0.8865	283.2255
North East	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
East	0.8200	125.2818	0.7200	0.7000	0.8865	41.3098
South	8.1100	118.5567	0.7200	0.7000	0.8865	386.6327
West	1.4200	125.2818	0.7200	0.7000	0.8865	71.5366
North West	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
total:						869.6995

	Jun	Jul	Aug	
Solar gains	933	870	781	(P3)
Internal gains	541	518	528	
Total summer gains	1474	1388	1309	(P5)
Summer gain/loss ratio	1.51	1.42	1.34	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.89	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 403 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	27 Wren Walk, Boorley Green , Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.33	**TER**	17.17
Environmental	88 B	**% DER<TER**	22.35		
CO_2 Emissions (t/year)	1.21	**DFEE**	53.93	**TFEE**	57.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.17	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.33	$kgCO_2/m^2$	Pass
	-3.84 (-22.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.93	$kWh/m^2/yr$	
	-4.0 (-6.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.08 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	0.82 m², No overhang
Windows facing South	8.11 m², No overhang
Windows facing West	1.42 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.89 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 404 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	29 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.76	**TER**	18.73
Environmental	88 B	**% DER<TER**	21.18		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.76 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.20 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.05 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 5.05 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3720	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4031	0.3952	0.3873	0.3478	0.3399	0.3004	0.3004	0.2925	0.3162	0.3399	0.3557	0.3715	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3699	47.1128	46.8607	45.6769	45.4554	44.4243	44.4243	44.2334	44.8215	45.4554	45.9035	46.3719	(38)
Heat transfer coeff	127.4059	127.1487	126.8967	125.7128	125.4913	124.4602	124.4602	124.2693	124.8574	125.4913	125.9394	126.4079	(39)
Average = Sum(39)m / 12 =												125.7118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3310	1.3283	1.3257	1.3133	1.3110	1.3003	1.3003	1.2983	1.3044	1.3110	1.3157	1.3206	(40)
HLP (average)												1.3133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	414.3696	412.0990	397.0299	372.6834	347.8122	324.0158	308.6796	315.0648	327.6871	352.2580	380.4587	401.7538	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	540.1842	630.4392	709.5908	788.2035	842.6844	829.2476	789.9041	734.3087	675.1233	596.9958	531.8143	509.0393	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.1736	52.2791	52.3830	52.8762	52.9696	53.4084	53.4084	53.4905	53.2385	52.9696	52.7811	52.5855	
alpha	4.4782	4.4853	4.4922	4.5251	4.5313	4.5606	4.5606	4.5660	4.5492	4.5313	4.5187	4.5057	
util living area													
	0.9984	0.9965	0.9915	0.9747	0.9239	0.8033	0.6473	0.7054	0.9038	0.9841	0.9968	0.9988	(86)
MIT	19.4913	19.6517	19.9195	20.2827	20.6297	20.8754	20.9653	20.9487	20.7601	20.3160	19.8376	19.4630	(87)
Th 2	19.8166	19.8187	19.8208	19.8304	19.8322	19.8406	19.8406	19.8422	19.8374	19.8322	19.8286	19.8247	(88)
util rest of house													
	0.9978	0.9952	0.9881	0.9638	0.8880	0.7103	0.4987	0.5608	0.8432	0.9753	0.9954	0.9983	(89)
MIT 2	17.8162	18.0518	18.4433	18.9730	19.4521	19.7522	19.8274	19.8199	19.6318	19.0277	18.3309	17.7803	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.0709	18.2950	18.6677	19.1721	19.6311	19.9230	20.0004	19.9915	19.8033	19.2235	18.5599	18.0361	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0709	18.2950	18.6677	19.1721	19.6311	19.9230	20.0004	19.9915	19.8033	19.2235	18.5599	18.0361	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9927	0.9833	0.9553	0.8801	0.7180	0.5209	0.5816	0.8409	0.9686	0.9930	0.9973	(94)
Useful gains	538.2686	625.8170	697.7586	753.0098	741.6803	595.3836	411.4380	427.0877	567.7388	578.2238	528.1104	507.6505	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1754.4885	1703.1567	1544.0441	1291.3332	995.2875	662.4962	423.2152	446.3120	712.1008	1082.1732	1443.2548	1748.9861	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	904.8676	723.9723	629.6364	387.5929	188.6837	0.0000	0.0000	0.0000	0.0000	374.9383	658.9039	923.5536	(98)
Space heating												4792.1489	(98)
Space heating per m2											(98) / (4) =	50.0642	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5158.3949	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	904.8676	723.9723	629.6364	387.5929	188.6837	0.0000	0.0000	0.0000	0.0000	374.9383	658.9039	923.5536	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	974.0233	779.3028	677.7572	417.2152	203.1041	0.0000	0.0000	0.0000	0.0000	403.5935	709.2615	994.1374	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3729	89.3315	89.2445	89.0395	88.5503	86.7000	86.7000	86.7000	86.7000	88.9945	89.2747	89.3947	(217)
Fuel for water heating, kWh/month													
	192.5349	168.8415	175.2814	154.4065	149.9018	133.5081	125.0945	141.5841	142.6920	160.3507	172.8788	186.8233	(219)
Water heating fuel used												1903.8977	(219)
Annual totals kWh/year													
Space heating fuel - main system												5158.3949	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6846.0545	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5158.3949	0.2160	1114.2133	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1903.8977	0.2160	411.2419	(264)
Space and water heating			1525.4552	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1413.2276	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7600	ZC1
Total Floor Area	TFA	95.7200	
Assumed number of occupants	N	2.6962	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4284	ZC2
CO2 emissions from cooking, equation (L16)		1.9192	ZC3
Total CO2 emissions		32.1077	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.1077	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8674	(36)
Total fabric heat loss (33) + (36) =	69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962 (42)
Average daily hot water use (litres/day)	98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4758	47.0560	43.6002	45.0536	47.0560	47.4758	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
								Total per year (kWh/year) = Sum(64)m =				2122.5163	(64)
Heat gains from water heating, kWh/month													
	66.0221	58.1080	60.8279	53.7934	51.9915	45.6133	43.4304	48.6760	49.2219	56.2709	59.8465	64.3409	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	88.7394	86.4702	81.7580	74.7131	69.8810	63.3519	58.3741	65.4248	68.3637	75.6330	83.1201	86.4797	(72)
Total internal gains													
	427.5190	425.2510	410.1872	385.2117	359.6745	335.2136	319.8823	326.9318	340.2223	365.4222	393.6144	414.9057	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.0500	46.7521	0.6300	0.7000	0.7700	72.1546	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	110.0877	191.0477	273.4908	363.5801	433.0132	442.0778	421.0715	366.8384	304.0067	214.1456	132.4361	93.8748	(83)
Total gains	537.6067	616.2986	683.6780	748.7918	792.6878	777.2914	740.9538	693.7703	644.2290	579.5677	526.0506	508.7806	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9985	0.9968	0.9922	0.9767	0.9272	0.8037	0.6419	0.6980	0.9024	0.9845	0.9969	0.9989	(86)
MIT	19.6248	19.7713	20.0176	20.3527	20.6722	20.8961	20.9736	20.9605	20.7958	20.3893	19.9473	19.5993	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9980	0.9957	0.9893	0.9668	0.8936	0.7153	0.5030	0.5622	0.8439	0.9762	0.9957	0.9985	(89)
MIT 2	18.0685	18.2840	18.6443	19.1343	19.5762	19.8501	19.9145	19.9089	19.7451	19.1928	18.5487	18.0370	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3050	18.5101	18.8531	19.3195	19.7428	20.0091	20.0755	20.0688	19.9048	19.3747	18.7613	18.2745	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3050	18.5101	18.8531	19.3195	19.7428	20.0091	20.0755	20.0688	19.9048	19.3747	18.7613	18.2745	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9935	0.9851	0.9594	0.8869	0.7233	0.5238	0.5819	0.8428	0.9701	0.9935	0.9975	(94)
Useful gains	535.8642	612.2678	673.5137	718.3924	702.9996	562.1857	388.1428	403.7336	542.9298	562.2368	522.6440	507.5096	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1641.6088	1591.8197	1441.7000	1203.7348	927.3813	618.1381	397.1745	418.5627	665.6570	1011.7745	1349.8307	1635.7393	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	822.6740	658.2589	571.5306	349.4465	166.9399	0.0000	0.0000	0.0000	0.0000	334.4561	595.5744	839.4029	(98)
Space heating												4338.2834	(98)
Space heating per m2											(98) / (4) =	45.3226	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4644.8430	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	822.6740	658.2589	571.5306	349.4465	166.9399	0.0000	0.0000	0.0000	0.0000	334.4561	595.5744	839.4029	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	880.8073	704.7740	611.9172	374.1398	178.7365	0.0000	0.0000	0.0000	0.0000	358.0900	637.6600	898.7183	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1354	87.9607	87.5911	86.7779	85.0347	80.3000	80.3000	80.3000	80.3000	86.5647	87.7082	88.2124	(217)
Fuel for water heating, kWh/month													
	239.6390	211.6640	223.2933	200.0100	197.6146	184.3102	176.5832	196.8489	199.0229	210.1085	219.1648	233.6978	(219)
Water heating fuel used												2491.9571	(219)
Annual totals kWh/year													
Space heating fuel - main system												4644.8430	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Total delivered energy for all uses												7620.0939	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4644.8430	0.2160	1003.2861	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2491.9571	0.2160	538.2627	(264)
Space and water heating			1541.5488	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Total CO2, kg/m2/year			1792.3783	(272)
Emissions per m2 for space and water heating			16.1048	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2138	(272b)
Emissions per m2 for pumps and fans			0.4067	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1048 * 1.00) + 2.2138 + 0.4067, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3315	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2818	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3592	0.3522	0.3452	0.3099	0.3029	0.2677	0.2677	0.2606	0.2818	0.3029	0.3170	0.3311	(22b)
Effective ac	0.5645	0.5620	0.5596	0.5480	0.5459	0.5358	0.5358	0.5340	0.5397	0.5459	0.5502	0.5548	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.0067	45.8025	45.6023	44.6622	44.4863	43.6675	43.6675	43.5158	43.9829	44.4863	44.8421	45.2141	(38)
Heat transfer coeff	126.0426	125.8384	125.6382	124.6981	124.5222	123.7034	123.7034	123.5518	124.0188	124.5222	124.8781	125.2501	(39)
Average = Sum(39)m / 12 =												124.6973	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3168	1.3147	1.3126	1.3027	1.3009	1.2923	1.2923	1.2908	1.2956	1.3009	1.3046	1.3085	(40)
HLP (average)												1.3027	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	507.3638	598.4404	679.2980	760.2324	816.2213	804.9063	767.3642	709.4585	649.4506	568.9204	501.0283	477.0371	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7379	52.8235	52.9076	53.3065	53.3818	53.7352	53.7352	53.8011	53.5985	53.3818	53.2297	53.0716	
alpha	4.5159	4.5216	4.5272	4.5538	4.5588	4.5823	4.5823	4.5867	4.5732	4.5588	4.5486	4.5381	
util living area													
	0.9988	0.9972	0.9928	0.9776	0.9301	0.8140	0.6592	0.7200	0.9130	0.9867	0.9975	0.9991	(86)
MIT	19.4782	19.6385	19.9066	20.2691	20.6191	20.8695	20.9632	20.9450	20.7488	20.2994	19.8205	19.4479	(87)
Th 2	19.8277	19.8294	19.8310	19.8387	19.8401	19.8468	19.8468	19.8481	19.8442	19.8401	19.8372	19.8342	(88)
util rest of house													
	0.9983	0.9961	0.9899	0.9678	0.8964	0.7231	0.5102	0.5759	0.8563	0.9792	0.9964	0.9988	(89)
MIT 2	18.4464	18.6076	18.8758	19.2390	19.5708	19.7827	19.8371	19.8314	19.6949	19.2734	18.7957	18.4212	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.6032	18.7643	19.0325	19.3956	19.7302	19.9479	20.0083	20.0007	19.8551	19.4293	18.9515	18.5772	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6032	18.7643	19.0325	19.3956	19.7302	19.9479	20.0083	20.0007	19.8551	19.4293	18.9515	18.5772	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9948	0.9872	0.9629	0.8924	0.7324	0.5329	0.5974	0.8570	0.9754	0.9952	0.9982	(94)
Useful gains	506.1737	595.3170	670.6249	731.9987	728.3579	589.4763	408.9583	423.8118	556.5831	554.9405	498.6197	476.1916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1802.8145	1744.6642	1574.5561	1308.7767	999.9365	661.5545	421.6209	444.8706	713.7415	1099.4485	1479.9942	1800.7485	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	964.7008	772.3613	672.5248	415.2802	202.0545	0.0000	0.0000	0.0000	0.0000	405.1140	706.5896	985.4704	(98)
Space heating												5124.0956	(98)
Space heating per m2											(98) / (4) =	53.5321	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1162.8120	915.4052	938.9934	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7739	0.8543	0.8179	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	899.9006	782.0311	768.0072	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1043.7742	997.7268	931.9604	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	103.5889	160.4776	121.9812	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												386.0477 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	25.8972	40.1194	30.4953	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												96.5119 (107)
Space cooling per m2												1.0083 (108)
Energy for space heating												53.5321 (99)
Energy for space cooling												1.0083 (108)
Total												54.5404 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8674	(36)
Total fabric heat loss					(33) + (36) =		69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	5.0500	46.7521	0.6300	0.7000	0.7700	72.1546	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	110.0877	191.0477	273.4908	363.5801	433.0132	442.0778	421.0715	366.8384	304.0067	214.1456	132.4361	93.8748	(83)
Total gains	491.6370	571.1479	640.2279	708.2924	754.3622	741.7523	707.2112	657.0530	606.0211	538.3282	482.1089	463.6264	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9990	0.9977	0.9941	0.9812	0.9381	0.8240	0.6660	0.7256	0.9191	0.9885	0.9979	0.9992	(86)
MIT	19.5806	19.7282	19.9770	20.3174	20.6457	20.8830	20.9690	20.9532	20.7722	20.3520	19.9052	19.5557	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9986	0.9969	0.9918	0.9730	0.9082	0.7388	0.5249	0.5894	0.8670	0.9821	0.9970	0.9990	(89)
MIT 2	18.6055	18.7546	19.0041	19.3481	19.6615	19.8660	19.9164	19.9118	19.7833	19.3863	18.9396	18.5873	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.7538	18.9026	19.1520	19.4954	19.8111	20.0206	20.0764	20.0701	19.9336	19.5331	19.0863	18.7345	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7538	18.9026	19.1520	19.4954	19.8111	20.0206	20.0764	20.0701	19.9336	19.5331	19.0863	18.7345	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9896	0.9688	0.9045	0.7476	0.5465	0.6097	0.8677	0.9789	0.9960	0.9986	(94)
Useful gains	490.6943	568.7459	633.5915	686.2062	682.3309	554.5264	386.4623	400.6223	525.8526	526.9793	480.1943	462.9588	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1694.2045	1637.7282	1476.5813	1224.0554	935.2572	619.4533	397.2775	418.7160	668.9624	1030.0426	1387.4549	1689.2022	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	895.4116	718.3561	627.1844	387.2514	188.1772	0.0000	0.0000	0.0000	0.0000	374.2791	653.2276	912.3251	(98)
Space heating												4756.2125	(98)
Space heating per m2											(98) / (4) =	49.6888	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1074.2106	845.6551	867.0633	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7849	0.8658	0.8318	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	843.1645	732.1378	721.2162	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.9578	927.4180	870.7072	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	91.2912	145.2885	111.2214	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  347.8010 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   22.8228   36.3221   27.8053    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                   86.9502 (107)
Space cooling per m2                                                                                             0.9084 (108)
Energy for space heating                                                                                        49.6888 (99)
Energy for space cooling                                                                                         0.9084 (108)
Total                                                                                                           50.5972 (109)
Target Fabric Energy Efficiency (TFEE)                                                                             58.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3720	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3320	0.3083	0.3162	0.3004	0.3004	0.2925	0.2846	0.2767	0.2687	0.2925	0.2767	0.2925	(22b)
Effective ac	0.5551	0.5475	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.2390	44.6203	44.8215	44.4243	44.4243	44.2334	44.0475	43.8667	43.6911	44.2334	43.8667	44.2334	(38)
Heat transfer coeff	125.2749	124.6563	124.8574	124.4602	124.4602	124.2693	124.0834	123.9027	123.7270	124.2693	123.9027	124.2693	(39)
Average = Sum(39)m / 12 =												124.3444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3088	1.3023	1.3044	1.3003	1.3003	1.2983	1.2963	1.2944	1.2926	1.2983	1.2944	1.2983	(40)
HLP (average)												1.2990	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
RHI water heating demand												1684	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0611	53.3244	53.2385	53.4084	53.4084	53.4905	53.5706	53.6487	53.7249	53.4905	53.6487	53.4905	
alpha	4.5374	4.5550	4.5492	4.5606	4.5606	4.5660	4.5714	4.5766	4.5817	4.5660	4.5766	4.5660	
util living area													
	0.9921	0.9877	0.9735	0.9317	0.8326	0.6342	0.4759	0.4989	0.7666	0.9393	0.9838	0.9935	(86)
MIT	19.8064	19.9249	20.1880	20.5241	20.8053	20.9588	20.9911	20.9893	20.9014	20.5823	20.1572	19.7925	(87)
Th 2	19.8340	19.8390	19.8374	19.8406	19.8406	19.8422	19.8437	19.8452	19.8466	19.8422	19.8452	19.8422	(88)
util rest of house													
	0.9894	0.9835	0.9641	0.9061	0.7697	0.5230	0.3397	0.3573	0.6679	0.9101	0.9771	0.9912	(89)
MIT 2	18.2869	18.4618	18.8388	19.3096	19.6671	19.8199	19.8414	19.8424	19.7802	19.3989	18.8040	18.2726	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9553	0.8965	0.7696	0.5385	0.3606	0.3790	0.6780	0.9015	0.9702	0.9873	(94)
Useful gains	759.7010	822.3917	880.3525	897.7334	789.4944	564.7425	359.6007	358.6471	598.1878	725.3282	731.2905	719.8686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1705.9823	1668.4188	1503.7685	1243.8776	913.5487	583.2020	361.8481	361.3882	649.6412	1016.3671	1376.5251	1678.0912	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	704.0333	568.5302	463.8216	249.2239	92.2963	0.0000	0.0000	0.0000	0.0000	216.5329	464.5689	712.9176	(98)
Space heating												3471.9247	(98)
RHI space heating demand												3472	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3720	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4031	0.3952	0.3873	0.3478	0.3399	0.3004	0.3004	0.2925	0.3162	0.3399	0.3557	0.3715	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3699	47.1128	46.8607	45.6769	45.4554	44.4243	44.4243	44.2334	44.8215	45.4554	45.9035	46.3719	(38)
Heat transfer coeff	127.4059	127.1487	126.8967	125.7128	125.4913	124.4602	124.4602	124.2693	124.8574	125.4913	125.9394	126.4079	(39)
Average = Sum(39)m / 12 =												125.7118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3310	1.3283	1.3257	1.3133	1.3110	1.3003	1.3003	1.2983	1.3044	1.3110	1.3157	1.3206	(40)
HLP (average)												1.3133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	741.9664	829.6178	899.8076	965.5015	1006.5684	982.8166	939.0210	886.0292	835.8057	770.5968	718.8293	706.3694	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.1736	52.2791	52.3830	52.8762	52.9696	53.4084	53.4084	53.4905	53.2385	52.9696	52.7811	52.5855	
alpha	4.4782	4.4853	4.4922	4.5251	4.5313	4.5606	4.5606	4.5660	4.5492	4.5313	4.5187	4.5057	
util living area													
	0.9942	0.9896	0.9790	0.9492	0.8741	0.7250	0.5613	0.6113	0.8320	0.9602	0.9894	0.9953	(86)
MIT	19.6797	19.8348	20.0882	20.4238	20.7262	20.9198	20.9804	20.9713	20.8415	20.4613	20.0101	19.6482	(87)
Th 2	19.8166	19.8187	19.8208	19.8304	19.8322	19.8406	19.8406	19.8422	19.8374	19.8322	19.8286	19.8247	(88)
util rest of house													
	0.9922	0.9861	0.9716	0.9298	0.8248	0.6253	0.4243	0.4736	0.7515	0.9410	0.9851	0.9937	(89)
MIT 2	18.0905	18.3171	18.6843	19.1656	19.5665	19.7879	19.8338	19.8309	19.7140	19.2271	18.5802	18.0503	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3321	18.5478	18.8977	19.3569	19.7428	19.9600	20.0080	20.0042	19.8854	19.4147	18.7976	18.2932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3321	18.5478	18.8977	19.3569	19.7428	19.9600	20.0080	20.0042	19.8854	19.4147	18.7976	18.2932	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9806	0.9635	0.9197	0.8203	0.6366	0.4450	0.4942	0.7554	0.9318	0.9796	0.9906	(94)
Useful gains	733.4416	813.5259	866.9736	887.9660	825.7086	625.6960	417.8888	437.8381	631.3600	718.0458	704.1697	699.7288	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1787.7726	1735.3058	1573.2282	1314.5614	1009.3032	667.1048	424.1662	447.8935	722.3486	1106.1738	1473.1846	1781.4896	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	784.4223	619.4361	525.4534	307.1487	136.5944	0.0000	0.0000	0.0000	0.0000	288.7673	553.6907	804.8301	(98)
Space heating												4020.3430	(98)
Space heating per m2											(98) / (4) =	42.0011	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4327.6028	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	784.4223	619.4361	525.4534	307.1487	136.5944	0.0000	0.0000	0.0000	0.0000	288.7673	553.6907	804.8301	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	844.3728	666.7773	565.6118	330.6229	147.0338	0.0000	0.0000	0.0000	0.0000	310.8367	596.0073	866.3402	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3070	89.2549	89.1452	88.8856	88.2939	86.7000	86.7000	86.7000	86.7000	88.8158	89.1825	89.3334	(217)
Fuel for water heating, kWh/month													
	192.6771	168.9864	175.4767	154.6739	150.3371	133.5081	125.0945	141.5841	142.6920	160.6732	173.0575	186.9516	(219)
Water heating fuel used												1905.7122	(219)
Annual totals kWh/year													
Space heating fuel - main system												4327.6028	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6017.0768	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4327.6028	3.4800	150.6006	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1905.7122	3.4800	66.3188	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			308.3975	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9205	(257)
SAP value		87.1596	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4327.6028	0.2160	934.7622	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1905.7122	0.2160	411.6338	(264)
Space and water heating			1346.3960	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			1234.1684	(272)
CO2 emissions per m2			12.8900	(273)
EI value			88.2477	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8825 = 3.943, stars = 4
Water heating environmental impact	0.216 / 0.8825 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3720	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3320	0.3083	0.3162	0.3004	0.3004	0.2925	0.2846	0.2767	0.2687	0.2925	0.2767	0.2925	(22b)
Effective ac	0.5551	0.5475	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.2390	44.6203	44.8215	44.4243	44.4243	44.2334	44.0475	43.8667	43.6911	44.2334	43.8667	44.2334	(38)
Heat transfer coeff	125.2749	124.6563	124.8574	124.4602	124.4602	124.2693	124.0834	123.9027	123.7270	124.2693	123.9027	124.2693	(39)
Average = Sum(39)m / 12 =												124.3444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3088	1.3023	1.3044	1.3003	1.3003	1.2983	1.2963	1.2944	1.2926	1.2983	1.2944	1.2983	(40)
HLP (average)												1.2990	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0611	53.3244	53.2385	53.4084	53.4084	53.4905	53.5706	53.6487	53.7249	53.4905	53.6487	53.4905	
alpha	4.5374	4.5550	4.5492	4.5606	4.5606	4.5660	4.5714	4.5766	4.5817	4.5660	4.5766	4.5660	
util living area													
	0.9921	0.9877	0.9735	0.9317	0.8326	0.6342	0.4759	0.4989	0.7666	0.9393	0.9838	0.9935	(86)
MIT	19.8064	19.9249	20.1880	20.5241	20.8053	20.9588	20.9911	20.9893	20.9014	20.5823	20.1572	19.7925	(87)
Th 2	19.8340	19.8390	19.8374	19.8406	19.8406	19.8422	19.8437	19.8452	19.8466	19.8422	19.8452	19.8422	(88)
util rest of house													
	0.9894	0.9835	0.9641	0.9061	0.7697	0.5230	0.3397	0.3573	0.6679	0.9101	0.9771	0.9912	(89)
MIT 2	18.2869	18.4618	18.8388	19.3096	19.6671	19.8199	19.8414	19.8424	19.7802	19.3989	18.8040	18.2726	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9553	0.8965	0.7696	0.5385	0.3606	0.3790	0.6780	0.9015	0.9702	0.9873	(94)
Useful gains	759.7010	822.3917	880.3525	897.7334	789.4944	564.7425	359.6007	358.6471	598.1878	725.3282	731.2905	719.8686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1705.9823	1668.4188	1503.7685	1243.8776	913.5487	583.2020	361.8481	361.3882	649.6412	1016.3671	1376.5251	1678.0912	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	704.0333	568.5302	463.8216	249.2239	92.2963	0.0000	0.0000	0.0000	0.0000	216.5329	464.5689	712.9176	(98)
Space heating												3471.9247	(98)
Space heating per m2											(98) / (4) =	36.2717	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3737.2709	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	704.0333	568.5302	463.8216	249.2239	92.2963	0.0000	0.0000	0.0000	0.0000	216.5329	464.5689	712.9176	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000		(210)
Space heating fuel (main heating system)													
	757.8399	611.9809	499.2697	268.2711	99.3502	0.0000	0.0000	0.0000	0.0000	233.0817	500.0742	767.4032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2530	89.2096	89.0709	88.7356	87.9845	86.7000	86.7000	86.7000	86.7000	88.6010	89.0801	89.2746	(217)
Fuel for water heating, kWh/month													
	192.7937	169.0722	175.6231	154.9354	150.8658	133.5081	125.0945	141.5841	142.6920	161.0629	173.2564	187.0747	(219)
Water heating fuel used												1907.5628	(219)
Annual totals kWh/year													
Space heating fuel - main system												3737.2709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												5345.2456	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3737.2709	7.3800	275.8106	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1907.5628	7.3800	140.7781	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			437.7268	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3737.2709	0.2160	807.2505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.5628	0.2160	412.0336	(264)
Space and water heating			1219.2841	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			1063.7979	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3737.2709	1.2200	4559.4705	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.5628	1.2200	2327.2266	(264)
Space and water heating			6886.6971	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			5966.9618	(272)
Primary energy kWh/m2/year			62.3377	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-192 kg (18.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.01 kg/m²	B 88	B 90
Total Savings	£60	2.01 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£153	-£14
Mains gas	£524	£449	£74
Space heating	£404	£404	£0
Water heating	£141	£81	£60
Lighting	£117	£117	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£439	£378	£60
Total cost of uses	£438	£378	£60
Delivered energy	56 kWh/m²	46 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	51 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620 (8)
Pressure test		Yes
Measured/design AP50		4.2000
Infiltration rate		0.3720 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4031	0.3952	0.3873	0.3478	0.3399	0.3004	0.3004	0.2925	0.3162	0.3399	0.3557	0.3715	(22b)
Effective ac	0.5813	0.5781	0.5750	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3699	47.1128	46.8607	45.6769	45.4554	44.4243	44.4243	44.2334	44.8215	45.4554	45.9035	46.3719	(38)
Heat transfer coeff	127.4059	127.1487	126.8967	125.7128	125.4913	124.4602	124.4602	124.2693	124.8574	125.4913	125.9394	126.4079	(39)
Average = Sum(39)m / 12 =												125.7118	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3310	1.3283	1.3257	1.3133	1.3110	1.3003	1.3003	1.2983	1.3044	1.3110	1.3157	1.3206	(40)
HLP (average)												1.3133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1734	(H8)
Utilisation factor												0.5735	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-865.2518	(H17)
Solar input	-25.0906	-41.8690	-71.3076	-95.5663	-118.0641	-116.0758	-114.5418	-100.0758	-78.3794	-53.5239	-29.7610	-20.9965	(63)
								Solar input (sum of months) = Sum(63)m =				-865.2518	(63)
Output from w/h													
	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
									Total per year (kWh/year) = Sum(64)m =			825.4368	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.7200	0.7000	0.7700	33.6112	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	5.0500	46.7521	0.7200	0.7000	0.7700	82.4624	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	125.8145	218.3402	312.5610	415.5202	494.8723	505.2318	481.2246	419.2439	347.4363	244.7378	151.3556	107.2855	(83)
Total gains	741.9664	829.6178	899.8076	965.5015	1006.5684	982.8166	939.0210	886.0292	835.8057	770.5968	718.8293	706.3694	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.1736	52.2791	52.3830	52.8762	52.9696	53.4084	53.4084	53.4905	53.2385	52.9696	52.7811	52.5855	
alpha	4.4782	4.4853	4.4922	4.5251	4.5313	4.5606	4.5606	4.5660	4.5492	4.5313	4.5187	4.5057	
util living area													
	0.9942	0.9896	0.9790	0.9492	0.8741	0.7250	0.5613	0.6113	0.8320	0.9602	0.9894	0.9953	(86)
MIT	19.6797	19.8348	20.0882	20.4238	20.7262	20.9198	20.9804	20.9713	20.8415	20.4613	20.0101	19.6482	(87)
Th 2	19.8166	19.8187	19.8208	19.8304	19.8322	19.8406	19.8406	19.8422	19.8374	19.8322	19.8286	19.8247	(88)
util rest of house													
	0.9922	0.9861	0.9716	0.9298	0.8248	0.6253	0.4243	0.4736	0.7515	0.9410	0.9851	0.9937	(89)
MIT 2	18.0905	18.3171	18.6843	19.1656	19.5665	19.7879	19.8338	19.8309	19.7140	19.2271	18.5802	18.0503	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.3321	18.5478	18.8977	19.3569	19.7428	19.9600	20.0080	20.0042	19.8854	19.4147	18.7976	18.2932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3321	18.5478	18.8977	19.3569	19.7428	19.9600	20.0080	20.0042	19.8854	19.4147	18.7976	18.2932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9806	0.9635	0.9197	0.8203	0.6366	0.4450	0.4942	0.7554	0.9318	0.9796	0.9906	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	733.4416	813.5259	866.9736	887.9660	825.7086	625.6960	417.8888	437.8381	631.3600	718.0458	704.1697	699.7288	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1787.7726	1735.3058	1573.2282	1314.5614	1009.3032	667.1048	424.1662	447.8935	722.3486	1106.1738	1473.1846	1781.4896	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	784.4223	619.4361	525.4534	307.1487	136.5944	0.0000	0.0000	0.0000	0.0000	288.7673	553.6907	804.8301	(98)
Space heating												4020.3430	(98)
Space heating per m2											(98) / (4) =	42.0011	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4327.6028	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	784.4223	619.4361	525.4534	307.1487	136.5944	0.0000	0.0000	0.0000	0.0000	288.7673	553.6907	804.8301	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	844.3728	666.7773	565.6118	330.6229	147.0338	0.0000	0.0000	0.0000	0.0000	310.8367	596.0073	866.3402	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3794	89.4064	89.4398	89.5033	89.5793	86.7000	86.7000	86.7000	86.7000	89.1238	89.2947	89.3933	(217)
Fuel for water heating, kWh/month	164.4490	121.8702	95.1717	46.8324	16.3815	0.0000	0.0000	26.1564	52.2890	100.0623	139.5111	163.3384	(219)
Water heating fuel used												926.0621	(219)
Annual totals kWh/year													
Space heating fuel - main system												4327.6028	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5087.4267	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4327.6028	3.4800	150.6006	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	926.0621	3.4800	32.2270	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			280.9007	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8384	(257)
SAP value		88.3045	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4327.6028	0.2160	934.7622	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	926.0621	0.2160	200.0294	(264)
Space and water heating			1134.7916	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	408.2938	0.5190	211.9045 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			1048.5140 (272)
CO2 emissions per m2			10.9500 (273)
EI value			90.0156
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3720	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3162	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3320	0.3083	0.3162	0.3004	0.3004	0.2925	0.2846	0.2767	0.2687	0.2925	0.2767	0.2925	(22b)
Effective ac	0.5551	0.5475	0.5500	0.5451	0.5451	0.5428	0.5405	0.5383	0.5361	0.5428	0.5383	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.2390	44.6203	44.8215	44.4243	44.4243	44.2334	44.0475	43.8667	43.6911	44.2334	43.8667	44.2334	(38)
Heat transfer coeff	125.2749	124.6563	124.8574	124.4602	124.4602	124.2693	124.0834	123.9027	123.7270	124.2693	123.9027	124.2693	(39)
Average = Sum(39)m / 12 =												124.3444	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3088	1.3023	1.3044	1.3003	1.3003	1.2983	1.2963	1.2944	1.2926	1.2983	1.2944	1.2983	(40)
HLP (average)												1.2990	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3132	(H8)
Utilisation factor												0.5330	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-899.9616	(H17)
Solar input	-29.3589	-41.7465	-71.7522	-96.8104	-113.7096	-121.4598	-118.9055	-106.4240	-83.3227	-57.6064	-34.7239	-24.1416	(63)
								Solar input (sum of months) = Sum(63)m =				-899.9616	(63)
Output from w/h													
	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
								Total per year (kWh/year) = Sum(64)m =				800.4747	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	13.4839	0.7200	0.7000	0.7700	42.6214	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	5.0500	56.7559	0.7200	0.7000	0.7700	100.1073	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	155.2234	229.9698	334.2775	451.4073	514.0918	571.2446	539.4167	479.4530	393.9590	278.7588	186.2592	130.0422	(83)
Total gains	771.3753	841.2474	921.5241	1001.3886	1025.7879	1048.8294	997.2131	946.2383	882.3284	804.6178	753.7329	729.1261	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0611	53.3244	53.2385	53.4084	53.4084	53.4905	53.5706	53.6487	53.7249	53.4905	53.6487	53.4905	
alpha	4.5374	4.5550	4.5492	4.5606	4.5606	4.5660	4.5714	4.5766	4.5817	4.5660	4.5766	4.5660	
util living area													
	0.9921	0.9877	0.9735	0.9317	0.8326	0.6342	0.4759	0.4989	0.7666	0.9393	0.9838	0.9935	(86)
MIT	19.8064	19.9249	20.1880	20.5241	20.8053	20.9588	20.9911	20.9893	20.9014	20.5823	20.1572	19.7925	(87)
Th 2	19.8340	19.8390	19.8374	19.8406	19.8406	19.8422	19.8437	19.8452	19.8466	19.8422	19.8452	19.8422	(88)
util rest of house													
	0.9894	0.9835	0.9641	0.9061	0.7697	0.5230	0.3397	0.3573	0.6679	0.9101	0.9771	0.9912	(89)
MIT 2	18.2869	18.4618	18.8388	19.3096	19.6671	19.8199	19.8414	19.8424	19.7802	19.3989	18.8040	18.2726	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5179	18.6842	19.0439	19.4942	19.8401	19.9931	20.0162	20.0167	19.9506	19.5787	19.0097	18.5037	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9776	0.9553	0.8965	0.7696	0.5385	0.3606	0.3790	0.6780	0.9015	0.9702	0.9873	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	759.7010	822.3917	880.3525	897.7334	789.4944	564.7425	359.6007	358.6471	598.1878	725.3282	731.2905	719.8686	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1705.9823	1668.4188	1503.7685	1243.8776	913.5487	583.2020	361.8481	361.3882	649.6412	1016.3671	1376.5251	1678.0912	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	704.0333	568.5302	463.8216	249.2239	92.2963	0.0000	0.0000	0.0000	0.0000	216.5329	464.5689	712.9176	(98)
Space heating												3471.9247	(98)
Space heating per m2											(98) / (4) =	36.2717	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3737.2709	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	704.0333	568.5302	463.8216	249.2239	92.2963	0.0000	0.0000	0.0000	0.0000	216.5329	464.5689	712.9176	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	757.8399	611.9809	499.2697	268.2711	99.3502	0.0000	0.0000	0.0000	0.0000	233.0817	500.0742	767.4032	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3442	89.3690	89.3907	89.4369	89.3364	86.7000	86.7000	86.7000	86.7000	88.9735	89.2257	89.3495	(217)
Fuel for water heating, kWh/month	159.7364	122.0582	94.7267	45.4762	21.3003	0.0000	0.0000	18.8343	46.5874	95.6428	134.0568	159.8987	(219)
Water heating fuel used												898.3178	(219)
Annual totals kWh/year													
Space heating fuel - main system												3737.2709	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4386.0006	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3737.2709	7.3800	275.8106	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	898.3178	7.3800	66.2959	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			377.5745	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3737.2709	0.2160	807.2505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.3178	0.2160	194.0366	(264)
Space and water heating			1001.2872	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			871.7510	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3737.2709	1.2200	4559.4705	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.3178	1.2200	1095.9477	(264)
Space and water heating			5655.4182	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4889.1829	(272)
Primary energy kWh/m2/year			51.0780	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	651.97	(P1)
Transmission heat loss coefficient	80.04	(37)
Summer heat loss coefficient	732.00	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.0500	87.1704	0.7200	0.7000	0.7650	273.7489
East	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
South	5.0500	118.5567	0.7200	0.7000	0.7650	207.7552
West	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
total:						543.2361

	Jun	Jul	Aug	
Solar gains	585	543	481	(P3)
Internal gains	475	455	464	
Total summer gains	1059	998	945	(P5)
Summer gain/loss ratio	1.45	1.36	1.29	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.91	18.84	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 404 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	29 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.76	**TER**	18.73
Environmental	88 B	**% DER<TER**	21.18		
CO_2 Emissions (t/year)	1.02	**DFEE**	54.54	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.27		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.76	$kgCO_2/m^2$	Pass
	-3.97 (-21.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.19	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.54	$kWh/m^2/yr$	
	-3.7 (-6.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	9.05 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	5.05 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 405 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	31 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.16	**TER**	18.73
Environmental	90 B	**% DER<TER**	24.41		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.03	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.16 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.17 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.47 m², No overhang
Windows facing East: 0.50 m², No overhang
Windows facing South: 4.75 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4910	0.4813	0.4717	0.4236	0.4140	0.3658	0.3658	0.3562	0.3851	0.4140	0.4332	0.4525	(22b)
Effective ac	0.6205	0.6158	0.6113	0.5897	0.5857	0.5669	0.5669	0.5634	0.5741	0.5857	0.5938	0.6024	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.8708	41.5550	41.2455	39.7915	39.5195	38.2532	38.2532	38.0187	38.7409	39.5195	40.0698	40.6451	(38)
Heat transfer coeff	99.2065	98.8907	98.5811	97.1272	96.8551	95.5888	95.5888	95.3543	96.0766	96.8551	97.4055	97.9808	(39)
Average = Sum(39)m / 12 =												97.1259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2542	1.2502	1.2463	1.2279	1.2245	1.2085	1.2085	1.2055	1.2146	1.2245	1.2314	1.2387	(40)
HLP (average)												1.2279	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	477.0559	549.5166	607.2180	658.9169	691.7088	675.7266	644.8450	608.1294	570.6205	516.5107	467.9015	450.7550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3699	55.5468	55.7212	56.5553	56.7141	57.4655	57.4655	57.6068	57.1737	56.7141	56.3937	56.0626	
alpha	4.6913	4.7031	4.7147	4.7704	4.7809	4.8310	4.8310	4.8405	4.8116	4.7809	4.7596	4.7375	
util living area													
	0.9979	0.9956	0.9898	0.9712	0.9161	0.7849	0.6209	0.6727	0.8836	0.9796	0.9958	0.9984	(86)
MIT	19.6243	19.7814	20.0334	20.3733	20.6871	20.9044	20.9762	20.9653	20.8138	20.4127	19.9611	19.6025	(87)
Th 2	19.8769	19.8801	19.8832	19.8977	19.9005	19.9132	19.9132	19.9156	19.9083	19.9005	19.8949	19.8892	(88)
util rest of house													
	0.9972	0.9940	0.9859	0.9593	0.8788	0.6937	0.4830	0.5370	0.8186	0.9689	0.9941	0.9979	(89)
MIT 2	18.0515	18.2830	18.6515	19.1500	19.5808	19.8458	19.9042	19.9007	19.7520	19.2136	18.5564	18.0282	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3561	18.5732	18.9192	19.3869	19.7950	20.0509	20.1118	20.1069	19.9576	19.4458	18.8284	18.3331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3561	18.5732	18.9192	19.3869	19.7950	20.0509	20.1118	20.1069	19.9576	19.4458	18.8284	18.3331	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9914	0.9812	0.9519	0.8745	0.7067	0.5097	0.5629	0.8222	0.9627	0.9915	0.9967	(94)
Useful gains	475.0033	544.7642	595.7910	627.2171	604.8788	477.5073	328.6623	342.2874	469.1381	497.2266	463.9321	449.2609	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1394.4581	1352.1537	1224.2957	1018.5630	784.0460	521.0415	335.6887	353.4642	562.7824	856.7637	1142.4130	1384.7732	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	684.0744	542.5657	467.6075	281.7691	133.3004	0.0000	0.0000	0.0000	0.0000	267.4956	488.5063	696.0211	(98)
Space heating												3561.3400	(98)
Space heating per m2											(98) / (4) =	45.0233	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3833.5199	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	684.0744	542.5657	467.6075	281.7691	133.3004	0.0000	0.0000	0.0000	0.0000	267.4956	488.5063	696.0211	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	736.3556	584.0320	503.3449	303.3036	143.4880	0.0000	0.0000	0.0000	0.0000	287.9393	525.8410	749.2154	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2680	89.2157	89.1108	88.8655	88.3200	86.7000	86.7000	86.7000	86.7000	88.8020	89.1443	89.2916	(217)
Fuel for water heating, kWh/month													
	181.8665	159.5216	165.6810	146.0866	141.9692	126.1921	118.3152	133.8039	134.8180	151.7383	163.3972	176.4910	(219)
Water heating fuel used												1799.8807	(219)
Annual totals kWh/year													
Space heating fuel - main system												3833.5199	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5447.6581	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3833.5199	0.2160	828.0403	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.8807	0.2160	388.7742	(264)
Space and water heating			1216.8145	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1120.4142	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.1600	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.7042	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.7042	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	477.0823	539.8439	588.0165	629.9116	655.2236	637.9662	609.2357	578.4890	547.7005	503.7223	464.9574	452.6774	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9980	0.9958	0.9904	0.9727	0.9185	0.7849	0.6161	0.6656	0.8808	0.9795	0.9958	0.9984	(86)
MIT	19.7512	19.8932	20.1233	20.4334	20.7224	20.9193	20.9816	20.9730	20.8415	20.4758	20.0595	19.7277	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9973	0.9944	0.9868	0.9616	0.8831	0.6976	0.4863	0.5374	0.8174	0.9690	0.9941	0.9979	(89)
MIT 2	18.2906	18.4996	18.8360	19.2897	19.6863	19.9248	19.9751	19.9723	19.8448	19.3562	18.7512	18.2631	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9920	0.9826	0.9551	0.8795	0.7105	0.5115	0.5620	0.8218	0.9634	0.9917	0.9968	(94)
Useful gains	475.1132	535.4991	577.8028	601.6289	576.2885	453.2945	311.5936	325.0865	450.1118	485.2746	461.1168	451.2291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1307.1888	1266.8329	1146.5504	954.8726	735.0127	489.9841	317.0471	333.7823	529.5448	805.5876	1073.8016	1300.4123	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating												3217.3333	(98)
Space heating per m2											(98) / (4) =	40.6743	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3444.6823	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	662.8097	526.1845	453.0495	272.3078	126.4355	0.0000	0.0000	0.0000	0.0000	255.1529	472.3052	676.4372	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6916	87.4900	87.0827	86.1663	84.3321	80.3000	80.3000	80.3000	80.3000	85.8876	87.1908	87.7783	(217)
Fuel for water heating, kWh/month													
	229.7778	201.9477	211.0961	189.2230	187.1858	173.1411	165.8823	184.9199	186.9622	199.0435	209.2991	224.1395	(219)
Water heating fuel used												2362.6182	(219)
Annual totals kWh/year													
Space heating fuel - main system												3444.6823	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6245.3112	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3444.6823	0.2160	744.0514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2362.6182	0.2160	510.3255	(264)
Space and water heating			1254.3769	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1481.7044	(272)
Emissions per m2 for space and water heating			15.8581	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8581 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.3552	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3019	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3850	0.3774	0.3699	0.3321	0.3246	0.2868	0.2868	0.2793	0.3019	0.3246	0.3397	0.3548	(22b)
Effective ac	0.5741	0.5712	0.5684	0.5552	0.5527	0.5411	0.5411	0.5390	0.5456	0.5527	0.5577	0.5629	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.7381	38.5440	38.3537	37.4598	37.2925	36.5140	36.5140	36.3698	36.8139	37.2925	37.6309	37.9846	(38)
Heat transfer coeff	96.0738	95.8796	95.6893	94.7954	94.6282	93.8496	93.8496	93.7055	94.1495	94.6282	94.9665	95.3202	(39)
Average = Sum(39)m / 12 =												94.7946	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2146	1.2121	1.2097	1.1984	1.1963	1.1865	1.1865	1.1846	1.1903	1.1963	1.2006	1.2051	(40)
HLP (average)												1.1984	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Average daily hot water use (litres/day)												92.2821	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	445.8067	519.0408	578.3472	632.2267	666.4348	652.4453	623.2557	584.3703	546.0890	489.7225	438.5650	420.2744	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1754	57.2912	57.4051	57.9464	58.0488	58.5304	58.5304	58.6204	58.3440	58.0488	57.8420	57.6274	
alpha	4.8117	4.8194	4.8270	4.8631	4.8699	4.9020	4.9020	4.9080	4.8896	4.8699	4.8561	4.8418	
util living area													
	0.9985	0.9965	0.9914	0.9744	0.9221	0.7945	0.6300	0.6855	0.8935	0.9829	0.9968	0.9989	(86)
MIT	19.6396	19.7950	20.0438	20.3751	20.6874	20.9029	20.9760	20.9641	20.8094	20.4081	19.9613	19.6110	(87)
Th 2	19.9083	19.9103	19.9122	19.9213	19.9230	19.9308	19.9308	19.9323	19.9278	19.9230	19.9195	19.9160	(88)
util rest of house													
	0.9979	0.9953	0.9882	0.9638	0.8870	0.7053	0.4929	0.5508	0.8322	0.9739	0.9955	0.9985	(89)
MIT 2	18.6707	18.8272	19.0761	19.4088	19.7028	19.8835	19.9245	19.9215	19.8167	19.4458	19.0009	18.6483	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8583	19.0146	19.2635	19.5959	19.8935	20.0810	20.1282	20.1234	20.0090	19.6321	19.1869	18.8347	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8583	19.0146	19.2635	19.5959	19.8935	20.0810	20.1282	20.1234	20.0090	19.6321	19.1869	18.8347	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9855	0.9596	0.8858	0.7194	0.5198	0.5770	0.8378	0.9705	0.9942	0.9979	(94)
Useful gains	444.5660	515.8716	569.9892	606.6922	590.3502	469.3911	323.9562	337.1641	457.5276	475.2881	436.0218	419.3924	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1398.6754	1353.3038	1221.3308	1013.9256	775.3342	514.3866	331.1161	348.9075	556.3277	854.6953	1147.8524	1394.9852	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.8574	562.7545	484.5982	293.2081	137.6281	0.0000	0.0000	0.0000	0.0000	282.2789	512.5180	725.8410	(98)
Space heating												3708.6842	(98)
Space heating per m2											(98) / (4) =	46.8860	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	882.1866	694.4873	712.1615	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8169	0.8908	0.8636	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	720.6688	618.6727	615.0184	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	854.2159	818.2561	774.4877	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	96.1540	148.4901	118.6452	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												363.2892 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	24.0385	37.1225	29.6613	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												90.8223 (107)
Space cooling per m2												1.1482 (108)
Energy for space heating												46.8860 (99)
Energy for space cooling												1.1482 (108)
Total												48.0342 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	432.6789	496.5833	546.9855	591.6846	619.0388	604.3989	577.3560	543.8150	511.6262	464.7679	422.8326	409.0400	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9987	0.9971	0.9930	0.9787	0.9325	0.8099	0.6442	0.6981	0.9029	0.9853	0.9973	0.9990	(86)
MIT	19.6990	19.8429	20.0767	20.3934	20.6932	20.9059	20.9776	20.9665	20.8171	20.4336	20.0103	19.6762	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9982	0.9961	0.9903	0.9698	0.9014	0.7256	0.5113	0.5681	0.8463	0.9774	0.9962	0.9987	(89)
MIT 2	18.7663	18.9118	19.1464	19.4676	19.7525	19.9353	19.9762	19.9738	19.8696	19.5114	19.0885	18.7512	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9949	0.9881	0.9661	0.9000	0.7388	0.5374	0.5934	0.8513	0.9745	0.9951	0.9982	(94)
Useful gains	431.6527	494.0705	540.4765	571.6393	557.1247	446.5595	310.2499	322.6928	435.5491	452.9156	420.7420	408.3093	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.3886	1296.2964	1168.5284	967.0818	739.2948	490.5081	317.0519	333.7766	530.9097	816.0872	1097.4693	1335.1805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	676.8435	539.0958	467.2707	284.7186	135.5346	0.0000	0.0000	0.0000	0.0000	270.1996	487.2436	689.5922	(98)
Space heating												3550.4987	(98)
Space heating per m2											(98) / (4) =	44.8862	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8173	0.8930	0.8672	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.2788	586.8368	584.0899	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	798.0578	764.6071	727.0854	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.3609	132.2611	106.3886	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												322.0106	(104)

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    20.8402    33.0653    26.5972     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          80.5027 (107)
Space cooling per m2                                                                                                                    1.0177 (108)
Energy for space heating                                                                                                               44.8862 (99)
Energy for space cooling                                                                                                                1.0177 (108)
Total                                                                                                                                  45.9039 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                    52.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4043	0.3754	0.3851	0.3658	0.3658	0.3562	0.3466	0.3369	0.3273	0.3562	0.3369	0.3562	(22b)
Effective ac	0.5817	0.5705	0.5741	0.5669	0.5669	0.5634	0.5601	0.5568	0.5536	0.5634	0.5568	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2537	38.4939	38.7409	38.2532	38.2532	38.0187	37.7904	37.5684	37.3527	38.0187	37.5684	38.0187	(38)
Heat transfer coeff	96.5894	95.8296	96.0766	95.5888	95.5888	95.3543	95.1261	94.9041	94.6883	95.3543	94.9041	95.3543	(39)
Average = Sum(39)m / 12 =												95.4465	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2115	1.2146	1.2085	1.2085	1.2055	1.2026	1.1998	1.1971	1.2055	1.1998	1.2055	(40)
HLP (average)												1.2067	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
Total per year (kWh/year) = Sum(64)m =												1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8702	57.3211	57.1737	57.4655	57.4655	57.6068	57.7450	57.8801	58.0120	57.6068	57.8801	57.6068	
alpha	4.7913	4.8214	4.8116	4.8310	4.8310	4.8405	4.8497	4.8587	4.8675	4.8405	4.8587	4.8405	
util living area													
	0.9892	0.9836	0.9663	0.9180	0.8089	0.6041	0.4467	0.4632	0.7239	0.9197	0.9775	0.9910	(86)
MIT	19.9661	20.0824	20.3197	20.6173	20.8539	20.9728	20.9949	20.9941	20.9359	20.6782	20.2993	19.9579	(87)
Th 2	19.9032	19.9108	19.9083	19.9132	19.9132	19.9156	19.9179	19.9202	19.9223	19.9156	19.9202	19.9156	(88)
util rest of house													
	0.9856	0.9782	0.9549	0.8896	0.7452	0.5011	0.3257	0.3384	0.6277	0.8851	0.9688	0.9880	(89)
MIT 2	18.5666	18.7396	19.0767	19.4903	19.7847	19.9010	19.9165	19.9186	19.8802	19.5807	19.0605	18.5639	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9469	0.8832	0.7504	0.5203	0.3493	0.3627	0.6435	0.8803	0.9621	0.9838	(94)
Useful gains	667.3484	714.6507	750.0714	744.2148	638.3118	448.1147	286.6311	285.9035	481.8871	614.1410	637.5107	634.3811	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.2325	1312.8328	1183.4218	975.8292	716.1325	458.5148	287.7938	287.2611	509.8689	800.3342	1081.9504	1319.1206	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.0898	401.9783	322.4127	166.7623	57.8986	0.0000	0.0000	0.0000	0.0000	138.5278	319.9966	509.4462	(98)
Space heating												2422.1123	(98)
RHI space heating demand												2422	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4910	0.4813	0.4717	0.4236	0.4140	0.3658	0.3658	0.3562	0.3851	0.4140	0.4332	0.4525	(22b)
Effective ac	0.6205	0.6158	0.6113	0.5897	0.5857	0.5669	0.5669	0.5634	0.5741	0.5857	0.5938	0.6024	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.8708	41.5550	41.2455	39.7915	39.5195	38.2532	38.2532	38.0187	38.7409	39.5195	40.0698	40.6451	(38)
Heat transfer coeff	99.2065	98.8907	98.5811	97.1272	96.8551	95.5888	95.5888	95.3543	96.0766	96.8551	97.4055	97.9808	(39)
Average = Sum(39)m / 12 =												97.1259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2542	1.2502	1.2463	1.2279	1.2245	1.2085	1.2085	1.2055	1.2146	1.2245	1.2314	1.2387	(40)
HLP (average)												1.2279	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3699	55.5468	55.7212	56.5553	56.7141	57.4655	57.4655	57.6068	57.1737	56.7141	56.3937	56.0626	
alpha	4.6913	4.7031	4.7147	4.7704	4.7809	4.8310	4.8310	4.8405	4.8116	4.7809	4.7596	4.7375	
util living area													
	0.9921	0.9863	0.9735	0.9388	0.8556	0.6945	0.5276	0.5703	0.7959	0.9470	0.9854	0.9936	(86)
MIT	19.8284	19.9790	20.2139	20.5216	20.7844	20.9443	20.9880	20.9828	20.8888	20.5646	20.1473	19.8037	(87)
Th 2	19.8769	19.8801	19.8832	19.8977	19.9005	19.9132	19.9132	19.9156	19.9083	19.9005	19.8949	19.8892	(88)
util rest of house													
	0.9896	0.9818	0.9645	0.9170	0.8043	0.5991	0.4040	0.4456	0.7131	0.9236	0.9799	0.9915	(89)
MIT 2	18.3481	18.5683	18.9080	19.3501	19.6937	19.8771	19.9090	19.9088	19.8242	19.4185	18.8244	18.3210	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6348	18.8415	19.1609	19.5770	19.9049	20.0838	20.1180	20.1168	20.0304	19.6405	19.0806	18.6082	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6348	18.8415	19.1609	19.5770	19.9049	20.0838	20.1180	20.1168	20.0304	19.6405	19.0806	18.6082	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9761	0.9568	0.9091	0.8046	0.6152	0.4280	0.4697	0.7236	0.9166	0.9742	0.9881	(94)
Useful gains	646.8708	709.1729	742.7996	742.4094	673.9224	499.9256	332.9340	349.2091	516.5480	615.1629	617.9249	618.7370	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1422.1068	1378.6878	1248.1304	1037.0286	794.6890	524.1867	336.2810	354.4164	569.7718	875.6185	1166.9760	1411.7256	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	576.7756	449.9140	375.9661	212.1258	89.8504	0.0000	0.0000	0.0000	0.0000	193.7789	395.3168	589.9835	(98)
Space heating												2883.7111	(98)
Space heating per m2											(98) / (4) =	36.4565	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3104.1023	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	576.7756	449.9140	375.9661	212.1258	89.8504	0.0000	0.0000	0.0000	0.0000	193.7789	395.3168	589.9835	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	620.8564	484.2992	404.6998	228.3378	96.7173	0.0000	0.0000	0.0000	0.0000	208.5887	425.5294	635.0738	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1770	89.1096	88.9740	88.6577	88.0077	86.7000	86.7000	86.7000	86.7000	88.5594	89.0154	89.2059	(217)
Fuel for water heating, kWh/month													
	182.0520	159.7116	165.9356	146.4290	142.4729	126.1921	118.3152	133.8039	134.8180	152.1542	163.6338	176.6604	(219)
Water heating fuel used												1802.1788	(219)
Annual totals kWh/year													
Space heating fuel - main system												3104.1023	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4720.5386	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3104.1023	3.4800	108.0228	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.1788	3.4800	62.7158	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			266.2391	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9011	(257)
SAP value		87.4303	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3104.1023	0.2160	670.4861	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.1788	0.2160	389.2706	(264)
Space and water heating			1059.7567	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			963.3564	(272)
CO2 emissions per m2			12.1800	(273)
EI value			89.5979	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8813 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8813 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4043	0.3754	0.3851	0.3658	0.3658	0.3562	0.3466	0.3369	0.3273	0.3562	0.3369	0.3562	(22b)
Effective ac	0.5817	0.5705	0.5741	0.5669	0.5669	0.5634	0.5601	0.5568	0.5536	0.5634	0.5568	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2537	38.4939	38.7409	38.2532	38.2532	38.0187	37.7904	37.5684	37.3527	38.0187	37.5684	38.0187	(38)
Heat transfer coeff	96.5894	95.8296	96.0766	95.5888	95.5888	95.3543	95.1261	94.9041	94.6883	95.3543	94.9041	95.3543	(39)
Average = Sum(39)m / 12 =												95.4465	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2115	1.2146	1.2085	1.2085	1.2055	1.2026	1.1998	1.1971	1.2055	1.1998	1.2055	(40)
HLP (average)												1.2067	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8702	57.3211	57.1737	57.4655	57.4655	57.6068	57.7450	57.8801	58.0120	57.6068	57.8801	57.6068	
alpha	4.7913	4.8214	4.8116	4.8310	4.8310	4.8405	4.8497	4.8587	4.8675	4.8405	4.8587	4.8405	
util living area													
	0.9892	0.9836	0.9663	0.9180	0.8089	0.6041	0.4467	0.4632	0.7239	0.9197	0.9775	0.9910	(86)
MIT	19.9661	20.0824	20.3197	20.6173	20.8539	20.9728	20.9949	20.9941	20.9359	20.6782	20.2993	19.9579	(87)
Th 2	19.9032	19.9108	19.9083	19.9132	19.9132	19.9156	19.9179	19.9202	19.9223	19.9156	19.9202	19.9156	(88)
util rest of house													
	0.9856	0.9782	0.9549	0.8896	0.7452	0.5011	0.3257	0.3384	0.6277	0.8851	0.9688	0.9880	(89)
MIT 2	18.5666	18.7396	19.0767	19.4903	19.7847	19.9010	19.9165	19.9186	19.8802	19.5807	19.0605	18.5639	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9469	0.8832	0.7504	0.5203	0.3493	0.3627	0.6435	0.8803	0.9621	0.9838	(94)
Useful gains	667.3484	714.6507	750.0714	744.2148	638.3118	448.1147	286.6311	285.9035	481.8871	614.1410	637.5107	634.3811	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.2325	1312.8328	1183.4218	975.8292	716.1325	458.5148	287.7938	287.2611	509.8689	800.3342	1081.9504	1319.1206	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.0898	401.9783	322.4127	166.7623	57.8986	0.0000	0.0000	0.0000	0.0000	138.5278	319.9966	509.4462	(98)
Space heating												2422.1123	(98)
Space heating per m2											(98) / (4) =	30.6209	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2607.2253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	505.0898	401.9783	322.4127	166.7623	57.8986	0.0000	0.0000	0.0000	0.0000	138.5278	319.9966	509.4462	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	543.6919	432.7000	347.0535	179.5074	62.3236	0.0000	0.0000	0.0000	0.0000	149.1149	344.4527	548.3813	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1001	89.0407	88.8698	88.4707	87.6860	86.7000	86.7000	86.7000	86.7000	88.2931	88.8739	89.1229	(217)
Fuel for water heating, kWh/month													
	182.2093	159.8352	166.1303	146.7385	142.9957	126.1921	118.3152	133.8039	134.8180	152.6129	163.8943	176.8251	(219)
Water heating fuel used												1804.3706	(219)
Annual totals kWh/year													
Space heating fuel - main system												2607.2253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4156.6683	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2607.2253	7.3800	192.4132	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.3706	7.3800	133.1625	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			359.5135	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2607.2253	0.2160	563.1607	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3706	0.2160	389.7440	(264)
Space and water heating			952.9047	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			820.5973	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2607.2253	1.2200	3180.8149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3706	1.2200	2201.3321	(264)
Space and water heating			5382.1470	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4599.5193	(272)
Primary energy kWh/m2/year			58.1482	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 89	A 92
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£433	£361	£72
Space heating	£321	£321	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£360	£302	£58
Total cost of uses	£359	£302	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4910	0.4813	0.4717	0.4236	0.4140	0.3658	0.3658	0.3562	0.3851	0.4140	0.4332	0.4525	(22b)
Effective ac	0.6205	0.6158	0.6113	0.5897	0.5857	0.5669	0.5669	0.5634	0.5741	0.5857	0.5938	0.6024	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.8708	41.5550	41.2455	39.7915	39.5195	38.2532	38.2532	38.0187	38.7409	39.5195	40.0698	40.6451	(38)
Heat transfer coeff	99.2065	98.8907	98.5811	97.1272	96.8551	95.5888	95.5888	95.3543	96.0766	96.8551	97.4055	97.9808	(39)
Average = Sum(39)m / 12 =												97.1259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2542	1.2502	1.2463	1.2279	1.2245	1.2085	1.2085	1.2055	1.2146	1.2245	1.2314	1.2387	(40)
HLP (average)												1.2279	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747 (83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3699	55.5468	55.7212	56.5553	56.7141	57.4655	57.4655	57.6068	57.1737	56.7141	56.3937	56.0626	
alpha	4.6913	4.7031	4.7147	4.7704	4.7809	4.8310	4.8310	4.8405	4.8116	4.7809	4.7596	4.7375	
util living area													
	0.9921	0.9863	0.9735	0.9388	0.8556	0.6945	0.5276	0.5703	0.7959	0.9470	0.9854	0.9936	(86)
MIT	19.8284	19.9790	20.2139	20.5216	20.7844	20.9443	20.9880	20.9828	20.8888	20.5646	20.1473	19.8037	(87)
Th 2	19.8769	19.8801	19.8832	19.8977	19.9005	19.9132	19.9132	19.9156	19.9083	19.9005	19.8949	19.8892	(88)
util rest of house													
	0.9896	0.9818	0.9645	0.9170	0.8043	0.5991	0.4040	0.4456	0.7131	0.9236	0.9799	0.9915	(89)
MIT 2	18.3481	18.5683	18.9080	19.3501	19.6937	19.8771	19.9090	19.9088	19.8242	19.4185	18.8244	18.3210	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6348	18.8415	19.1609	19.5770	19.9049	20.0838	20.1180	20.1168	20.0304	19.6405	19.0806	18.6082	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6348	18.8415	19.1609	19.5770	19.9049	20.0838	20.1180	20.1168	20.0304	19.6405	19.0806	18.6082	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9761	0.9568	0.9091	0.8046	0.6152	0.4280	0.4697	0.7236	0.9166	0.9742	0.9881	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	646.8708	709.1729	742.7996	742.4094	673.9224	499.9256	332.9340	349.2091	516.5480	615.1629	617.9249	618.7370	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1422.1068	1378.6878	1248.1304	1037.0286	794.6890	524.1867	336.2810	354.4164	569.7718	875.6185	1166.9760	1411.7256	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	576.7756	449.9140	375.9661	212.1258	89.8504	0.0000	0.0000	0.0000	0.0000	193.7789	395.3168	589.9835	(98)
Space heating												2883.7111	(98)
Space heating per m2											(98) / (4) =	36.4565	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3104.1023	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.7756	449.9140	375.9661	212.1258	89.8504	0.0000	0.0000	0.0000	0.0000	193.7789	395.3168	589.9835	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	620.8564	484.2992	404.6998	228.3378	96.7173	0.0000	0.0000	0.0000	0.0000	208.5887	425.5294	635.0738	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2642	89.2930	89.3321	89.4120	89.5548	86.7000	86.7000	86.7000	86.7000	88.9187	89.1501	89.2785	(217)
Fuel for water heating, kWh/month	154.5170	113.7468	87.5799	41.1659	11.6991	0.0000	0.0000	21.4599	46.8301	92.9531	130.8954	153.6271	(219)
Water heating fuel used												854.4744	(219)
Annual totals kWh/year													
Space heating fuel - main system												3104.1023	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3822.8342	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3104.1023	3.4800	108.0228	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.4744	3.4800	29.7357	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			239.8540	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8118	(257)
SAP value		88.6760	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3104.1023	0.2160	670.4861	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.4744	0.2160	184.5665	(264)
Space and water heating			855.0526	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			784.6022 (272)
CO2 emissions per m2			9.9200 (273)
EI value			91.5281
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.1700	
Infiltration rate		0.4530	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3851	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4043	0.3754	0.3851	0.3658	0.3658	0.3562	0.3466	0.3369	0.3273	0.3562	0.3369	0.3562	(22b)
Effective ac	0.5817	0.5705	0.5741	0.5669	0.5669	0.5634	0.5601	0.5568	0.5536	0.5634	0.5568	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.2537	38.4939	38.7409	38.2532	38.2532	38.0187	37.7904	37.5684	37.3527	38.0187	37.5684	38.0187	(38)
Heat transfer coeff	96.5894	95.8296	96.0766	95.5888	95.5888	95.3543	95.1261	94.9041	94.6883	95.3543	94.9041	95.3543	(39)
Average = Sum(39)m / 12 =												95.4465	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2115	1.2146	1.2085	1.2085	1.2055	1.2026	1.1998	1.1971	1.2055	1.1998	1.2055	(40)
HLP (average)												1.2067	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3979	(H8)
Utilisation factor												0.5110	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-874.1284	(H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486	(63)
									Solar input (sum of months) = Sum(63)m =			-874.1284	(63)
Output from w/h													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
									Total per year (kWh/year) = Sum(64)m =			737.7444	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8702	57.3211	57.1737	57.4655	57.4655	57.6068	57.7450	57.8801	58.0120	57.6068	57.8801	57.6068	
alpha	4.7913	4.8214	4.8116	4.8310	4.8310	4.8405	4.8497	4.8587	4.8675	4.8405	4.8587	4.8405	
util living area													
	0.9892	0.9836	0.9663	0.9180	0.8089	0.6041	0.4467	0.4632	0.7239	0.9197	0.9775	0.9910	(86)
MIT	19.9661	20.0824	20.3197	20.6173	20.8539	20.9728	20.9949	20.9941	20.9359	20.6782	20.2993	19.9579	(87)
Th 2	19.9032	19.9108	19.9083	19.9132	19.9132	19.9156	19.9179	19.9202	19.9223	19.9156	19.9202	19.9156	(88)
util rest of house													
	0.9856	0.9782	0.9549	0.8896	0.7452	0.5011	0.3257	0.3384	0.6277	0.8851	0.9688	0.9880	(89)
MIT 2	18.5666	18.7396	19.0767	19.4903	19.7847	19.9010	19.9165	19.9186	19.8802	19.5807	19.0605	18.5639	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8377	18.9997	19.3175	19.7086	19.9918	20.1085	20.1254	20.1269	20.0847	19.7933	19.3005	18.8339	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9469	0.8832	0.7504	0.5203	0.3493	0.3627	0.6435	0.8803	0.9621	0.9838	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.3484	714.6507	750.0714	744.2148	638.3118	448.1147	286.6311	285.9035	481.8871	614.1410	637.5107	634.3811	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1346.2325	1312.8328	1183.4218	975.8292	716.1325	458.5148	287.7938	287.2611	509.8689	800.3342	1081.9504	1319.1206	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	505.0898	401.9783	322.4127	166.7623	57.8986	0.0000	0.0000	0.0000	0.0000	138.5278	319.9966	509.4462	(98)
Space heating												2422.1123	(98)
Space heating per m2											(98) / (4) =	30.6209	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2607.2253	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	505.0898	401.9783	322.4127	166.7623	57.8986	0.0000	0.0000	0.0000	0.0000	138.5278	319.9966	509.4462	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	543.6919	432.7000	347.0535	179.5074	62.3236	0.0000	0.0000	0.0000	0.0000	149.1149	344.4527	548.3813	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2103	89.2346	89.2586	89.3175	89.2245	86.7000	86.7000	86.7000	86.7000	88.7128	89.0483	89.2137	(217)
Fuel for water heating, kWh/month	150.0190	114.0479	87.3272	40.0695	16.7460	0.0000	0.0000	14.5776	41.4721	88.8190	125.6983	150.3614	(219)
Water heating fuel used												829.1380	(219)
Annual totals kWh/year													
Space heating fuel - main system												2607.2253	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3231.4358	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2607.2253	7.3800	192.4132	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.1380	7.3800	61.1904	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			301.8714	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2607.2253	0.2160	563.1607	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1380	0.2160	179.0938	(264)
Space and water heating			742.2545	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			635.8971	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2607.2253	1.2200	3180.8149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1380	1.2200	1011.5484	(264)
Space and water heating			4192.3633	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3563.2356	(272)
Primary energy kWh/m2/year			45.0472	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4700	87.1704	0.7200	0.7000	0.7650	195.7077
East	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
South	4.7500	118.5567	0.7200	0.7000	0.7650	195.4133
total:						412.8577

	Jun	Jul	Aug	
Solar gains	443	413	370	(P3)
Internal gains	425	408	416	
Total summer gains	869	821	786	(P5)
Summer gain/loss ratio	1.45	1.37	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 405 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	31 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.16	**TER**	18.73
Environmental	90 B	**% DER<TER**	24.41		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.03	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.01		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.16	$kgCO_2/m^2$	Pass
	-4.57 (-24.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.79	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.03	$kWh/m^2/yr$	
	-4.8 (-9.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.47 m², No overhang
Windows facing East	0.50 m², No overhang
Windows facing South	4.75 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.17 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 406 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	33 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.18	**TER**	18.73
Environmental	90 B	**% DER<TER**	24.30		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.09	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.18 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.23 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.47 m², No overhang
Windows facing South: 4.75 m², No overhang
Windows facing West: 0.50 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4560	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3876	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4942	0.4845	0.4748	0.4264	0.4167	0.3682	0.3682	0.3586	0.3876	0.4167	0.4361	0.4555	(22b)
Effective ac	0.6221	0.6174	0.6127	0.5909	0.5868	0.5678	0.5678	0.5643	0.5751	0.5868	0.5951	0.6037	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.9789	41.6589	41.3452	39.8720	39.5963	38.3132	38.3132	38.0755	38.8074	39.5963	40.1539	40.7369	(38)
Heat transfer coeff	99.3145	98.9945	98.6809	97.2076	96.9320	95.6488	95.6488	95.4112	96.1431	96.9320	97.4896	98.0726	(39)
Average = Sum(39)m / 12 =												97.2063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2556	1.2515	1.2475	1.2289	1.2254	1.2092	1.2092	1.2062	1.2155	1.2254	1.2325	1.2399	(40)
HLP (average)												1.2289	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	477.0559	549.5166	607.2180	658.9169	691.7088	675.7266	644.8450	608.1294	570.6205	516.5107	467.9015	450.7550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3097	55.4885	55.6648	56.5085	56.6692	57.4294	57.4294	57.5724	57.1342	56.6692	56.3450	56.0101	
alpha	4.6873	4.6992	4.7110	4.7672	4.7779	4.8286	4.8286	4.8382	4.8089	4.7779	4.7563	4.7340	
util living area													
	0.9979	0.9956	0.9898	0.9712	0.9162	0.7851	0.6211	0.6730	0.8838	0.9796	0.9958	0.9984	(86)
MIT	19.6225	19.7798	20.0319	20.3723	20.6865	20.9041	20.9761	20.9652	20.8134	20.4119	19.9599	19.6010	(87)
Th 2	19.8758	19.8790	19.8822	19.8969	19.8997	19.9126	19.9126	19.9150	19.9077	19.8997	19.8941	19.8882	(88)
util rest of house													
	0.9972	0.9940	0.9859	0.9593	0.8790	0.6939	0.4831	0.5371	0.8187	0.9689	0.9941	0.9979	(89)
MIT 2	18.0482	18.2799	18.6487	19.1480	19.5793	19.8451	19.9035	19.9000	19.7510	19.2118	18.5541	18.0254	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3531	18.5704	18.9166	19.3851	19.7937	20.0502	20.1113	20.1063	19.9567	19.4443	18.8264	18.3305	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3531	18.5704	18.9166	19.3851	19.7937	20.0502	20.1113	20.1063	19.9567	19.4443	18.8264	18.3305	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9914	0.9812	0.9519	0.8746	0.7069	0.5099	0.5631	0.8223	0.9627	0.9915	0.9967	(94)
Useful gains	475.0019	544.7637	595.7957	627.2417	604.9638	477.6437	328.7943	342.4096	469.2225	497.2384	463.9317	449.2599	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1395.6768	1353.2911	1225.2820	1019.2306	784.5377	521.3022	335.8483	353.6249	563.0839	857.2929	1143.1976	1385.8168	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	684.9822	543.3304	468.3378	282.2320	133.6030	0.0000	0.0000	0.0000	0.0000	267.8805	489.0714	696.7983	(98)
Space heating												3566.2356	(98)
Space heating per m2											(98) / (4) =	45.0852	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3838.7897	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	684.9822	543.3304	468.3378	282.2320	133.6030	0.0000	0.0000	0.0000	0.0000	267.8805	489.0714	696.7983	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	737.3328	584.8551	504.1311	303.8019	143.8138	0.0000	0.0000	0.0000	0.0000	288.3536	526.4493	750.0520	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2687	89.2165	89.1117	88.8666	88.3218	86.7000	86.7000	86.7000	86.7000	88.8031	89.1449	89.2921	(217)
Fuel for water heating, kWh/month													
	181.8651	159.5203	165.6793	146.0847	141.9663	126.1921	118.3152	133.8039	134.8180	151.7366	163.3960	176.4899	(219)
Water heating fuel used												1799.8674	(219)
Annual totals kWh/year													
Space heating fuel - main system												3838.7897	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5452.9146	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3838.7897	0.2160	829.1786	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.8674	0.2160	388.7714	(264)
Space and water heating			1217.9499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1121.5496	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.1800	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.7242	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.7242	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	477.0823	539.8439	588.0165	629.9116	655.2236	637.9662	609.2357	578.4890	547.7005	503.7223	464.9574	452.6774	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9980	0.9958	0.9904	0.9727	0.9185	0.7849	0.6161	0.6656	0.8808	0.9795	0.9958	0.9984	(86)
MIT	19.7512	19.8932	20.1233	20.4334	20.7224	20.9193	20.9816	20.9730	20.8415	20.4758	20.0595	19.7277	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9973	0.9944	0.9868	0.9616	0.8831	0.6976	0.4863	0.5374	0.8174	0.9690	0.9941	0.9979	(89)
MIT 2	18.2906	18.4996	18.8360	19.2897	19.6863	19.9248	19.9751	19.9723	19.8448	19.3562	18.7512	18.2631	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5735	18.7695	19.0854	19.5112	19.8870	20.1174	20.1701	20.1661	20.0378	19.5731	19.0046	18.5468	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9959	0.9920	0.9826	0.9551	0.8795	0.7105	0.5115	0.5620	0.8218	0.9634	0.9917	0.9968	(94)
Useful gains	475.1132	535.4991	577.8028	601.6289	576.2885	453.2945	311.5936	325.0865	450.1118	485.2746	461.1168	451.2291	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1307.1888	1266.8329	1146.5504	954.8726	735.0127	489.9841	317.0471	333.7823	529.5448	805.5876	1073.8016	1300.4123	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating												3217.3333	(98)
Space heating per m2											(98) / (4) =	40.6743	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3444.6823	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.0643	491.4564	423.1482	254.3355	118.0908	0.0000	0.0000	0.0000	0.0000	238.3128	441.1330	631.7924	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	662.8097	526.1845	453.0495	272.3078	126.4355	0.0000	0.0000	0.0000	0.0000	255.1529	472.3052	676.4372	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6916	87.4900	87.0827	86.1663	84.3321	80.3000	80.3000	80.3000	80.3000	85.8876	87.1908	87.7783	(217)
Fuel for water heating, kWh/month													
	229.7778	201.9477	211.0961	189.2230	187.1858	173.1411	165.8823	184.9199	186.9622	199.0435	209.2991	224.1395	(219)
Water heating fuel used												2362.6182	(219)
Annual totals kWh/year													
Space heating fuel - main system												3444.6823	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6245.3112	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3444.6823	0.2160	744.0514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2362.6182	0.2160	510.3255	(264)
Space and water heating			1254.3769	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1481.7044	(272)
Emissions per m2 for space and water heating			15.8581	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8581 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3582	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3045	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3882	0.3806	0.3730	0.3349	0.3273	0.2893	0.2893	0.2816	0.3045	0.3273	0.3425	0.3578	(22b)
Effective ac	0.5754	0.5724	0.5696	0.5561	0.5536	0.5418	0.5418	0.5397	0.5464	0.5536	0.5587	0.5640	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.8229	38.6255	38.4319	37.5229	37.3528	36.5611	36.5611	36.4144	36.8660	37.3528	37.6969	38.0566	(38)
Heat transfer coeff	96.1586	95.9611	95.7676	94.8586	94.6885	93.8967	93.8967	93.7501	94.2017	94.6885	95.0325	95.3923	(39)
Average = Sum(39)m / 12 =												94.8577	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2157	1.2132	1.2107	1.1992	1.1971	1.1871	1.1871	1.1852	1.1909	1.1971	1.2014	1.2060	(40)
HLP (average)												1.1992	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	445.8067	519.0408	578.3472	632.2267	666.4348	652.4453	623.2557	584.3703	546.0890	489.7225	438.5650	420.2744	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1250	57.2425	57.3582	57.9079	58.0119	58.5010	58.5010	58.5925	58.3116	58.0119	57.8018	57.5839	
alpha	4.8083	4.8162	4.8239	4.8605	4.8675	4.9001	4.9001	4.9062	4.8874	4.8675	4.8535	4.8389	
util living area													
	0.9985	0.9965	0.9914	0.9745	0.9222	0.7946	0.6302	0.6857	0.8936	0.9829	0.9968	0.9989	(86)
MIT	19.6382	19.7936	20.0426	20.3743	20.6868	20.9027	20.9760	20.9640	20.8091	20.4074	19.9604	19.6098	(87)
Th 2	19.9075	19.9095	19.9114	19.9206	19.9223	19.9304	19.9304	19.9319	19.9273	19.9223	19.9189	19.9152	(88)
util rest of house													
	0.9979	0.9953	0.9882	0.9638	0.8871	0.7055	0.4931	0.5509	0.8323	0.9739	0.9955	0.9985	(89)
MIT 2	18.6686	18.8252	19.0743	19.4075	19.7018	19.8829	19.9240	19.9210	19.8160	19.4446	18.9994	18.6465	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8564	19.0128	19.2618	19.5947	19.8926	20.0805	20.1277	20.1230	20.0083	19.6311	19.1856	18.8331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8564	19.0128	19.2618	19.5947	19.8926	20.0805	20.1277	20.1230	20.0083	19.6311	19.1856	18.8331	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9939	0.9856	0.9596	0.8859	0.7196	0.5199	0.5771	0.8379	0.9705	0.9942	0.9979	(94)
Useful gains	444.5652	515.8713	569.9924	606.7100	590.4158	469.4980	324.0608	337.2600	457.5913	475.2959	436.0215	419.3918	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1399.7233	1354.2779	1222.1711	1014.4877	775.7411	514.5966	331.2432	349.0355	556.5743	855.1418	1148.5224	1395.8812	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	710.6376	563.4092	485.2209	293.6000	137.8821	0.0000	0.0000	0.0000	0.0000	282.6054	513.0006	726.5081	(98)
Space heating												3712.8639	(98)
Space heating per m2											(98) / (4) =	46.9389	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	882.6292	694.8357	712.5008	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8166	0.8906	0.8634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	720.7903	618.8332	615.1480	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	854.2159	818.2561	774.4877	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	96.0664	148.3707	118.5487	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												362.9858 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	24.0166	37.0927	29.6372	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												90.7465 (107)
Space cooling per m2												1.1472 (108)
Energy for space heating												46.9389 (99)
Energy for space cooling												1.1472 (108)
Total												48.0861 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.6300	0.7000	0.7700	21.0256	(74)
South	4.7500	46.7521	0.6300	0.7000	0.7700	67.8682	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	91.8949	157.2025	219.5320	283.7949	331.7718	336.3249	321.2980	283.8872	241.2398	174.6829	110.1268	78.6403	(83)
Total gains	432.6789	496.5833	546.9855	591.6846	619.0388	604.3989	577.3560	543.8150	511.6262	464.7679	422.8326	409.0400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9987	0.9971	0.9930	0.9787	0.9325	0.8099	0.6442	0.6981	0.9029	0.9853	0.9973	0.9990	(86)
MIT	19.6990	19.8429	20.0767	20.3934	20.6932	20.9059	20.9776	20.9665	20.8171	20.4336	20.0103	19.6762	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9982	0.9961	0.9903	0.9698	0.9014	0.7256	0.5113	0.5681	0.8463	0.9774	0.9962	0.9987	(89)
MIT 2	18.7663	18.9118	19.1464	19.4676	19.7525	19.9353	19.9762	19.9738	19.8696	19.5114	19.0885	18.7512	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9469	19.0921	19.3266	19.6469	19.9347	20.1233	20.1701	20.1661	20.0531	19.6900	19.2670	18.9303	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9949	0.9881	0.9661	0.9000	0.7388	0.5374	0.5934	0.8513	0.9745	0.9951	0.9982	(94)
Useful gains	431.6527	494.0705	540.4765	571.6393	557.1247	446.5595	310.2499	322.6928	435.5491	452.9156	420.7420	408.3093	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1341.3886	1296.2964	1168.5284	967.0818	739.2948	490.5081	317.0519	333.7766	530.9097	816.0872	1097.4693	1335.1805	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	676.8435	539.0958	467.2707	284.7186	135.5346	0.0000	0.0000	0.0000	0.0000	270.1996	487.2436	689.5922	(98)
Space heating												3550.4987	(98)
Space heating per m2											(98) / (4) =	44.8862	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8173	0.8930	0.8672	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	682.2788	586.8368	584.0899	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	798.0578	764.6071	727.0854	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.3609	132.2611	106.3886	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												322.0106	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    20.8402    33.0653    26.5972     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          80.5027 (107)
Space cooling per m2                                                                                                                    1.0177 (108)
Energy for space heating                                                                                                               44.8862 (99)
Energy for space cooling                                                                                                                1.0177 (108)
Total                                                                                                                                  45.9039 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                    52.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4560	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3876	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4070	0.3779	0.3876	0.3682	0.3682	0.3586	0.3489	0.3392	0.3295	0.3586	0.3392	0.3586	(22b)
Effective ac	0.5828	0.5714	0.5751	0.5678	0.5678	0.5643	0.5609	0.5575	0.5543	0.5643	0.5575	0.5643	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3270	38.5571	38.8074	38.3132	38.3132	38.0755	37.8442	37.6193	37.4007	38.0755	37.6193	38.0755	(38)
Heat transfer coeff	96.6627	95.8928	96.1431	95.6488	95.6488	95.4112	95.1799	94.9550	94.7363	95.4112	94.9550	95.4112	(39)
Average = Sum(39)m / 12 =												95.5047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2220	1.2123	1.2155	1.2092	1.2092	1.2062	1.2033	1.2004	1.1977	1.2062	1.2004	1.2062	(40)
HLP (average)												1.2074	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8271	57.2833	57.1342	57.4294	57.4294	57.5724	57.7123	57.8491	57.9826	57.5724	57.8491	57.5724	
alpha	4.7885	4.8189	4.8089	4.8286	4.8286	4.8382	4.8475	4.8566	4.8655	4.8382	4.8566	4.8382	
util living area													
	0.9892	0.9836	0.9663	0.9181	0.8092	0.6044	0.4470	0.4634	0.7241	0.9198	0.9775	0.9910	(86)
MIT	19.9649	20.0814	20.3188	20.6167	20.8535	20.9727	20.9948	20.9940	20.9357	20.6776	20.2986	19.9569	(87)
Th 2	19.9024	19.9102	19.9077	19.9126	19.9126	19.9150	19.9174	19.9196	19.9219	19.9150	19.9196	19.9150	(88)
util rest of house													
	0.9857	0.9782	0.9549	0.8897	0.7454	0.5013	0.3258	0.3385	0.6279	0.8852	0.9688	0.9880	(89)
MIT 2	18.5644	18.7377	19.0749	19.4890	19.7838	19.9003	19.9160	19.9180	19.8797	19.5796	19.0592	18.5621	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9470	0.8833	0.7506	0.5205	0.3494	0.3629	0.6436	0.8804	0.9621	0.9838	(94)
Useful gains	667.3532	714.6606	750.1018	744.2948	638.4744	448.2979	286.7461	286.0115	482.0225	614.2040	637.5228	634.3837	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1347.0546	1313.5302	1184.0795	976.3240	716.5019	458.7380	287.9141	287.3748	510.0789	800.7137	1082.4138	1319.7549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.6978	402.4404	322.8794	167.0610	58.0525	0.0000	0.0000	0.0000	0.0000	138.7633	320.3215	509.9162	(98)
Space heating												2425.1321	(98)
RHI space heating demand												2425	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		4.2300
Infiltration rate		0.4560 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3876 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4942	0.4845	0.4748	0.4264	0.4167	0.3682	0.3682	0.3586	0.3876	0.4167	0.4361	0.4555	(22b)
Effective ac	0.6221	0.6174	0.6127	0.5909	0.5868	0.5678	0.5678	0.5643	0.5751	0.5868	0.5951	0.6037	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784 (36)
Total fabric heat loss (33) + (36) =	57.3357 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.9789	41.6589	41.3452	39.8720	39.5963	38.3132	38.3132	38.0755	38.8074	39.5963	40.1539	40.7369	(38)
Heat transfer coeff	99.3145	98.9945	98.6809	97.2076	96.9320	95.6488	95.6488	95.4112	96.1431	96.9320	97.4896	98.0726	(39)
Average = Sum(39)m / 12 =												97.2063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2556	1.2515	1.2475	1.2289	1.2254	1.2092	1.2092	1.2062	1.2155	1.2254	1.2325	1.2399	(40)
HLP (average)												1.2289	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3097	55.4885	55.6648	56.5085	56.6692	57.4294	57.4294	57.5724	57.1342	56.6692	56.3450	56.0101	
alpha	4.6873	4.6992	4.7110	4.7672	4.7779	4.8286	4.8286	4.8382	4.8089	4.7779	4.7563	4.7340	
util living area													
	0.9921	0.9863	0.9735	0.9389	0.8558	0.6948	0.5279	0.5705	0.7961	0.9471	0.9854	0.9936	(86)
MIT	19.8265	19.9773	20.2124	20.5207	20.7838	20.9441	20.9880	20.9827	20.8885	20.5638	20.1461	19.8021	(87)
Th 2	19.8758	19.8790	19.8822	19.8969	19.8997	19.9126	19.9126	19.9150	19.9077	19.8997	19.8941	19.8882	(88)
util rest of house													
	0.9896	0.9818	0.9646	0.9171	0.8045	0.5994	0.4042	0.4458	0.7134	0.9237	0.9799	0.9915	(89)
MIT 2	18.3447	18.5651	18.9052	19.3482	19.6923	19.8763	19.9084	19.9082	19.8233	19.4168	18.8221	18.3181	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6317	18.8386	19.1584	19.5753	19.9037	20.0831	20.1175	20.1163	20.0296	19.6390	19.0785	18.6056	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6317	18.8386	19.1584	19.5753	19.9037	20.0831	20.1175	20.1163	20.0296	19.6390	19.0785	18.6056	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9761	0.9569	0.9092	0.8048	0.6154	0.4282	0.4699	0.7238	0.9167	0.9742	0.9881	(94)
Useful gains	646.8733	709.1831	742.8297	742.4834	674.0867	500.1109	333.0809	349.3519	516.7027	615.2139	617.9337	618.7380	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.3496	1379.8486	1249.1398	1037.7168	795.2009	524.4561	336.4429	354.5803	570.0882	876.1663	1167.7785	1412.7892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	577.6984	450.6872	376.6947	212.5680	90.1090	0.0000	0.0000	0.0000	0.0000	194.1486	395.8883	590.7741	(98)
Space heating												2888.5683	(98)
Space heating per m2											(98) / (4) =	36.5179	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3109.3308	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	577.6984	450.6872	376.6947	212.5680	90.1090	0.0000	0.0000	0.0000	0.0000	194.1486	395.8883	590.7741	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	621.8497	485.1316	405.4841	228.8138	96.9957	0.0000	0.0000	0.0000	0.0000	208.9866	426.1446	635.9248	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1779	89.1107	88.9753	88.6593	88.0099	86.7000	86.7000	86.7000	86.7000	88.5608	89.0163	89.2067	(217)
Fuel for water heating, kWh/month													
	182.0502	159.7097	165.9332	146.4264	142.4693	126.1921	118.3152	133.8039	134.8180	152.1516	163.6321	176.6589	(219)
Water heating fuel used												1802.1608	(219)
Annual totals kWh/year													
Space heating fuel - main system												3109.3308	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4725.7491	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3109.3308	3.4800	108.2047	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.1608	3.4800	62.7152	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			266.4205	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9017	(257)
SAP value		87.4218	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3109.3308	0.2160	671.6154	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.1608	0.2160	389.2667	(264)
Space and water heating			1060.8822	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			964.4818	(272)
CO2 emissions per m2			12.1900	(273)
EI value			89.5858	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8813 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8813 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4560	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3876	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4070	0.3779	0.3876	0.3682	0.3682	0.3586	0.3489	0.3392	0.3295	0.3586	0.3392	0.3586	(22b)
Effective ac	0.5828	0.5714	0.5751	0.5678	0.5678	0.5643	0.5609	0.5575	0.5543	0.5643	0.5575	0.5643	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3270	38.5571	38.8074	38.3132	38.3132	38.0755	37.8442	37.6193	37.4007	38.0755	37.6193	38.0755	(38)
Heat transfer coeff	96.6627	95.8928	96.1431	95.6488	95.6488	95.4112	95.1799	94.9550	94.7363	95.4112	94.9550	95.4112	(39)
Average = Sum(39)m / 12 =												95.5047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2220	1.2123	1.2155	1.2092	1.2092	1.2062	1.2033	1.2004	1.1977	1.2062	1.2004	1.2062	(40)
HLP (average)												1.2074	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168 (83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8271	57.2833	57.1342	57.4294	57.4294	57.5724	57.7123	57.8491	57.9826	57.5724	57.8491	57.5724	
alpha	4.7885	4.8189	4.8089	4.8286	4.8286	4.8382	4.8475	4.8566	4.8655	4.8382	4.8566	4.8382	
util living area													
	0.9892	0.9836	0.9663	0.9181	0.8092	0.6044	0.4470	0.4634	0.7241	0.9198	0.9775	0.9910	(86)
MIT	19.9649	20.0814	20.3188	20.6167	20.8535	20.9727	20.9948	20.9940	20.9357	20.6776	20.2986	19.9569	(87)
Th 2	19.9024	19.9102	19.9077	19.9126	19.9126	19.9150	19.9174	19.9196	19.9219	19.9150	19.9196	19.9150	(88)
util rest of house													
	0.9857	0.9782	0.9549	0.8897	0.7454	0.5013	0.3258	0.3385	0.6279	0.8852	0.9688	0.9880	(89)
MIT 2	18.5644	18.7377	19.0749	19.4890	19.7838	19.9003	19.9160	19.9180	19.8797	19.5796	19.0592	18.5621	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9470	0.8833	0.7506	0.5205	0.3494	0.3629	0.6436	0.8804	0.9621	0.9838	(94)
Useful gains	667.3532	714.6606	750.1018	744.2948	638.4744	448.2979	286.7461	286.0115	482.0225	614.2040	637.5228	634.3837	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1347.0546	1313.5302	1184.0795	976.3240	716.5019	458.7380	287.9141	287.3748	510.0789	800.7137	1082.4138	1319.7549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.6978	402.4404	322.8794	167.0610	58.0525	0.0000	0.0000	0.0000	0.0000	138.7633	320.3215	509.9162	(98)
Space heating												2425.1321	(98)
Space heating per m2											(98) / (4) =	30.6591	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2610.4759	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	505.6978	402.4404	322.8794	167.0610	58.0525	0.0000	0.0000	0.0000	0.0000	138.7633	320.3215	509.9162	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	544.3464	433.1974	347.5559	179.8289	62.4892	0.0000	0.0000	0.0000	0.0000	149.3684	344.8025	548.8872	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1008	89.0414	88.8708	88.4721	87.6878	86.7000	86.7000	86.7000	86.7000	88.2945	88.8746	89.1234	(217)
Fuel for water heating, kWh/month													
	182.2078	159.8339	166.1284	146.7361	142.9928	126.1921	118.3152	133.8039	134.8180	152.6106	163.8930	176.8240	(219)
Water heating fuel used												1804.3559	(219)
Annual totals kWh/year													
Space heating fuel - main system												2610.4759	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4159.9042	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2610.4759	7.3800	192.6531	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.3559	7.3800	133.1615	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			359.7523	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2610.4759	0.2160	563.8628	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3559	0.2160	389.7409	(264)
Space and water heating			953.6037	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			821.2962	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2610.4759	1.2200	3184.7806	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.3559	1.2200	2201.3142	(264)
Space and water heating			5386.0947	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4603.4671	(272)
Primary energy kWh/m2/year			58.1981	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (22.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.33 kg/m²	B 89	A 92
Total Savings	£58	2.33 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£433	£361	£72
Space heating	£321	£321	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£360	£302	£58
Total cost of uses	£359	£302	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	45 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.2300	
Infiltration rate			0.4560	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3876	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4942	0.4845	0.4748	0.4264	0.4167	0.3682	0.3682	0.3586	0.3876	0.4167	0.4361	0.4555	(22b)
Effective ac	0.6221	0.6174	0.6127	0.5909	0.5868	0.5678	0.5678	0.5643	0.5751	0.5868	0.5951	0.6037	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.9789	41.6589	41.3452	39.8720	39.5963	38.3132	38.3132	38.0755	38.8074	39.5963	40.1539	40.7369	(38)
Heat transfer coeff	99.3145	98.9945	98.6809	97.2076	96.9320	95.6488	95.6488	95.4112	96.1431	96.9320	97.4896	98.0726	(39)
Average = Sum(39)m / 12 =												97.2063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2556	1.2515	1.2475	1.2289	1.2254	1.2092	1.2092	1.2062	1.2155	1.2254	1.2325	1.2399	(40)
HLP (average)												1.2289	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2491	(H8)
Utilisation factor												0.5509	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-842.1367	(H17)
Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
								Total per year (kWh/year) = Sum(64)m =				760.7271	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	10.6334	0.7200	0.7000	0.7700	24.0292	(74)
South	4.7500	46.7521	0.7200	0.7000	0.7700	77.5636	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	105.0228	179.6600	250.8937	324.3370	379.1678	384.3713	367.1978	324.4425	275.7026	199.6375	125.8592	89.8747	(83)
Total gains	656.3865	726.5117	776.2971	816.6205	837.6255	812.6033	777.8509	743.4708	713.8779	671.1436	634.3213	626.2148	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3097	55.4885	55.6648	56.5085	56.6692	57.4294	57.4294	57.5724	57.1342	56.6692	56.3450	56.0101	
alpha	4.6873	4.6992	4.7110	4.7672	4.7779	4.8286	4.8286	4.8382	4.8089	4.7779	4.7563	4.7340	
util living area													
	0.9921	0.9863	0.9735	0.9389	0.8558	0.6948	0.5279	0.5705	0.7961	0.9471	0.9854	0.9936	(86)
MIT	19.8265	19.9773	20.2124	20.5207	20.7838	20.9441	20.9880	20.9827	20.8885	20.5638	20.1461	19.8021	(87)
Th 2	19.8758	19.8790	19.8822	19.8969	19.8997	19.9126	19.9126	19.9150	19.9077	19.8997	19.8941	19.8882	(88)
util rest of house													
	0.9896	0.9818	0.9646	0.9171	0.8045	0.5994	0.4042	0.4458	0.7134	0.9237	0.9799	0.9915	(89)
MIT 2	18.3447	18.5651	18.9052	19.3482	19.6923	19.8763	19.9084	19.9082	19.8233	19.4168	18.8221	18.3181	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6317	18.8386	19.1584	19.5753	19.9037	20.0831	20.1175	20.1163	20.0296	19.6390	19.0785	18.6056	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6317	18.8386	19.1584	19.5753	19.9037	20.0831	20.1175	20.1163	20.0296	19.6390	19.0785	18.6056	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9761	0.9569	0.9092	0.8048	0.6154	0.4282	0.4699	0.7238	0.9167	0.9742	0.9881	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	646.8733	709.1831	742.8297	742.4834	674.0867	500.1109	333.0809	349.3519	516.7027	615.2139	617.9337	618.7380	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1423.3496	1379.8486	1249.1398	1037.7168	795.2009	524.4561	336.4429	354.5803	570.0882	876.1663	1167.7785	1412.7892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	577.6984	450.6872	376.6947	212.5680	90.1090	0.0000	0.0000	0.0000	0.0000	194.1486	395.8883	590.7741	(98)
Space heating												2888.5683	(98)
Space heating per m2											(98) / (4) =	36.5179	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3109.3308	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	577.6984	450.6872	376.6947	212.5680	90.1090	0.0000	0.0000	0.0000	0.0000	194.1486	395.8883	590.7741	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	621.8497	485.1316	405.4841	228.8138	96.9957	0.0000	0.0000	0.0000	0.0000	208.9866	426.1446	635.9248	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2650	89.2939	89.3330	89.4129	89.5557	86.7000	86.7000	86.7000	86.7000	88.9200	89.1509	89.2791	(217)
Fuel for water heating, kWh/month	154.5156	113.7458	87.5790	41.1655	11.6990	0.0000	0.0000	21.4599	46.8301	92.9518	130.8942	153.6260	(219)
Water heating fuel used												854.4668	(219)
Annual totals kWh/year													
Space heating fuel - main system												3109.3308	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3828.0551	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3109.3308	3.4800	108.2047	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.4668	3.4800	29.7354	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			240.0357	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8124	(257)
SAP value		88.6675	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3109.3308	0.2160	671.6154	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.4668	0.2160	184.5648	(264)
Space and water heating			856.1803	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			785.7299 (272)
CO2 emissions per m2			9.9300 (273)
EI value			91.5159
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4560	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3876	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4070	0.3779	0.3876	0.3682	0.3682	0.3586	0.3489	0.3392	0.3295	0.3586	0.3392	0.3586	(22b)
Effective ac	0.5828	0.5714	0.5751	0.5678	0.5678	0.5643	0.5609	0.5575	0.5543	0.5643	0.5575	0.5643	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3270	38.5571	38.8074	38.3132	38.3132	38.0755	37.8442	37.6193	37.4007	38.0755	37.6193	38.0755	(38)
Heat transfer coeff	96.6627	95.8928	96.1431	95.6488	95.6488	95.4112	95.1799	94.9550	94.7363	95.4112	94.9550	95.4112	(39)
Average = Sum(39)m / 12 =												95.5047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2220	1.2123	1.2155	1.2092	1.2092	1.2062	1.2033	1.2004	1.1977	1.2062	1.2004	1.2062	(40)
HLP (average)												1.2074	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3979 (H8)
Utilisation factor												0.5110 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2821 (H14)
Volume ratio Veff/V												0.8127 (H15)
Solar storage volume factor												0.9585 (H16)
Solar input												-874.1284 (H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4700	13.4839	0.7200	0.7000	0.7700	30.4708	(74)
South	4.7500	56.7559	0.7200	0.7000	0.7700	94.1604	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	129.0306	188.2459	266.6951	350.3832	392.2132	433.0602	410.0146	369.1531	310.7212	226.1071	154.1889	108.5168	(83)
Total gains	680.3944	735.0977	792.0986	842.6667	850.6709	861.2923	820.6678	788.1814	748.8966	697.6131	662.6510	644.8569	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8271	57.2833	57.1342	57.4294	57.4294	57.5724	57.7123	57.8491	57.9826	57.5724	57.8491	57.5724	
alpha	4.7885	4.8189	4.8089	4.8286	4.8286	4.8382	4.8475	4.8566	4.8655	4.8382	4.8566	4.8382	
util living area													
	0.9892	0.9836	0.9663	0.9181	0.8092	0.6044	0.4470	0.4634	0.7241	0.9198	0.9775	0.9910	(86)
MIT	19.9649	20.0814	20.3188	20.6167	20.8535	20.9727	20.9948	20.9940	20.9357	20.6776	20.2986	19.9569	(87)
Th 2	19.9024	19.9102	19.9077	19.9126	19.9126	19.9150	19.9174	19.9196	19.9219	19.9150	19.9196	19.9150	(88)
util rest of house													
	0.9857	0.9782	0.9549	0.8897	0.7454	0.5013	0.3258	0.3385	0.6279	0.8852	0.9688	0.9880	(89)
MIT 2	18.5644	18.7377	19.0749	19.4890	19.7838	19.9003	19.9160	19.9180	19.8797	19.5796	19.0592	18.5621	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8356	18.9979	19.3158	19.7074	19.9910	20.1080	20.1249	20.1264	20.0842	19.7922	19.2992	18.8323	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9722	0.9470	0.8833	0.7506	0.5205	0.3494	0.3629	0.6436	0.8804	0.9621	0.9838	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.3532	714.6606	750.1018	744.2948	638.4744	448.2979	286.7461	286.0115	482.0225	614.2040	637.5228	634.3837 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1347.0546	1313.5302	1184.0795	976.3240	716.5019	458.7380	287.9141	287.3748	510.0789	800.7137	1082.4138	1319.7549 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	505.6978	402.4404	322.8794	167.0610	58.0525	0.0000	0.0000	0.0000	0.0000	138.7633	320.3215	509.9162 (98)
Space heating												2425.1321 (98)
Space heating per m2											(98) / (4) =	30.6591 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2610.4759 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	505.6978	402.4404	322.8794	167.0610	58.0525	0.0000	0.0000	0.0000	0.0000	138.7633	320.3215	509.9162	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	544.3464	433.1974	347.5559	179.8289	62.4892	0.0000	0.0000	0.0000	0.0000	149.3684	344.8025	548.8872	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2110	89.2352	89.2593	89.3184	89.2259	86.7000	86.7000	86.7000	86.7000	88.7141	89.0489	89.2142	(217)
Fuel for water heating, kWh/month	150.0179	114.0471	87.3265	40.0691	16.7458	0.0000	0.0000	14.5776	41.4721	88.8178	125.6974	150.3606	(219)
Water heating fuel used												829.1318	(219)
Annual totals kWh/year													
Space heating fuel - main system												2610.4759	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3234.6801	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2610.4759	7.3800	192.6531	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.1318	7.3800	61.1899	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			302.1108	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2610.4759	0.2160	563.8628	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1318	0.2160	179.0925	(264)
Space and water heating			742.9553	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			636.5978	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2610.4759	1.2200	3184.7806	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.1318	1.2200	1011.5408	(264)
Space and water heating			4196.3213	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3567.1937	(272)
Primary energy kWh/m2/year			45.0973	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4700	87.1704	0.7200	0.7000	0.7650	195.7077
South	4.7500	118.5567	0.7200	0.7000	0.7650	195.4133
West	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
total:						412.8577

	Jun	Jul	Aug	
Solar gains	443	413	370	(P3)
Internal gains	425	408	416	
Total summer gains	869	821	786	(P5)
Summer gain/loss ratio	1.45	1.37	1.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 406 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	33 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	87 B	**DER**	14.18	**TER**	18.73
Environmental	90 B	**% DER<TER**	24.30		
CO_2 Emissions (t/year)	0.80	**DFEE**	48.09	**TFEE**	52.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.91		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.18	$kgCO_2/m^2$	Pass
	-4.55 (-24.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.79	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.09	$kWh/m^2/yr$	
	-4.7 (-8.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.47 m², No overhang
Windows facing South	4.75 m², No overhang
Windows facing West	0.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 407 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	35 Wren Walk, Boorley Green, SOUTHAMPTON, SO32 2DX		

SAP Rating	89 B	**DER**	13.06	**TER**	17.00
Environmental	89 B	**% DER<TER**	23.18		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.73	**TFEE**	57.05
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.56		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.7 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.08 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South: 8.11 m², No overhang
Windows facing South West: 1.02 m², No overhang
Windows facing West: 0.82 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

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10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4041	0.3961	0.3882	0.3486	0.3407	0.3011	0.3011	0.2931	0.3169	0.3407	0.3565	0.3724	(22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.6268	63.2800	62.9401	61.3437	61.0450	59.6545	59.6545	59.3970	60.1901	61.0450	61.6492	62.2809	(38)
Heat transfer coeff	164.8589	164.5122	164.1723	162.5758	162.2771	160.8867	160.8867	160.6292	161.4223	162.2771	162.8814	163.5131	(39)
Average = Sum(39)m / 12 =												162.5744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2853	1.2826	1.2800	1.2675	1.2652	1.2544	1.2544	1.2524	1.2586	1.2652	1.2699	1.2749	(40)
HLP (average)												1.2675	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	471.4291	469.0425	451.8108	423.8129	394.8802	367.4647	349.9693	356.6640	371.3337	399.5668	431.9855	456.7820	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(80)

Solar gains	204.0205	348.9487	484.3254	616.6798	709.5171	713.6244	684.0937	612.7752	529.4978	387.2188	244.5544	174.5199	(83)
Total gains	675.4495	817.9912	936.1363	1040.4927	1104.3973	1081.0891	1034.0630	969.4392	900.8315	786.7856	676.5399	631.3019	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0277	54.1415	54.2536	54.7864	54.8872	55.3616	55.3616	55.4503	55.1779	54.8872	54.6836	54.4724	
alpha	4.6018	4.6094	4.6169	4.6524	4.6591	4.6908	4.6908	4.6967	4.6785	4.6591	4.6456	4.6315	
util living area													
	0.9988	0.9969	0.9918	0.9750	0.9245	0.8036	0.6433	0.6979	0.8988	0.9845	0.9974	0.9992	(86)
MIT	19.5147	19.6894	19.9614	20.3170	20.6499	20.8844	20.9693	20.9552	20.7816	20.3452	19.8612	19.4849	(87)
Th 2	19.8523	19.8545	19.8565	19.8663	19.8682	19.8767	19.8767	19.8783	19.8734	19.8682	19.8645	19.8606	(88)
util rest of house													
	0.9984	0.9958	0.9886	0.9643	0.8893	0.7127	0.4990	0.5572	0.8376	0.9761	0.9963	0.9988	(89)
MIT 2	17.8746	18.1312	18.5289	19.0479	19.5075	19.7941	19.8650	19.8588	19.6868	19.0950	18.3898	17.8366	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.0995	18.3449	18.7253	19.2219	19.6642	19.9437	20.0164	20.0091	19.8370	19.2665	18.5916	18.0627	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0995	18.3449	18.7253	19.2219	19.6642	19.9437	20.0164	20.0091	19.8370	19.2665	18.5916	18.0627	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9935	0.9840	0.9559	0.8813	0.7189	0.5183	0.5753	0.8351	0.9694	0.9943	0.9981	(94)
Useful gains	673.6706	812.7123	921.1619	994.6369	973.3149	777.2278	535.9958	557.7233	752.2736	762.7333	672.7052	630.0786	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2274.9754	2211.8524	2007.0611	1678.0960	1292.4056	859.7222	549.6547	579.7301	926.0778	1406.3715	1871.7702	2266.7273	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1191.3707	940.2221	807.9090	492.0906	237.4034	0.0000	0.0000	0.0000	0.0000	478.8668	863.3268	1217.6666	(98)
Space heating												6228.8561	(98)
Space heating per m2											(98) / (4) =	48.5643	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6704.9043	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1191.3707	940.2221	807.9090	492.0906	237.4034	0.0000	0.0000	0.0000	0.0000	478.8668	863.3268	1217.6666	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1282.4227	1012.0797	869.6545	529.6992	255.5473	0.0000	0.0000	0.0000	0.0000	515.4648	929.3077	1310.7284	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4674	89.4266	89.3457	89.1574	88.6942	86.7000	86.7000	86.7000	86.7000	89.1200	89.3813	89.4864	(217)
Fuel for water heating, kWh/month													
	200.7503	176.0283	182.6911	160.8575	156.0785	139.1747	130.3455	147.6104	148.7894	167.0296	180.1875	194.7832	(219)
Water heating fuel used												1984.3259	(219)
Annual totals kWh/year													
Space heating fuel - main system												6704.9043	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												8300.0521	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6704.9043	0.2160	1448.2593	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1984.3259	0.2160	428.6144	(264)
Space and water heating			1876.8737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total CO2, kg/year			1674.8903	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0600	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		28.1863	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.1863	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650 (1b) - (3b)	
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.5747	482.1908	464.9647	436.9743	407.4792	379.3683	361.8784	369.2681	384.5026	412.7279	445.1377	469.9303	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760	(78)
Southwest	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(79)
West	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(80)

Solar gains	178.5179	305.3301	423.7847	539.5948	620.8274	624.4213	598.5820	536.1783	463.3106	338.8165	213.9851	152.7049 (83)
Total gains	663.0926	787.5209	888.7494	976.5692	1028.3067	1003.7897	960.4603	905.4464	847.8132	751.5444	659.1228	622.6352 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area													
	0.9990	0.9974	0.9931	0.9782	0.9312	0.8111	0.6469	0.6999	0.9028	0.9860	0.9977	0.9993	(86)
MIT	19.6247	19.7842	20.0354	20.3667	20.6779	20.8977	20.9747	20.9628	20.8051	20.3993	19.9493	19.5979	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house													
	0.9986	0.9965	0.9904	0.9690	0.8993	0.7252	0.5103	0.5666	0.8452	0.9785	0.9968	0.9990	(89)
MIT 2	18.0859	18.3205	18.6882	19.1731	19.6048	19.8756	19.9401	19.9350	19.7777	19.2258	18.5695	18.0526	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.2969	18.5213	18.8730	19.3368	19.7520	20.0157	20.0820	20.0760	19.9186	19.3867	18.7587	18.2645	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2969	18.5213	18.8730	19.3368	19.7520	20.0157	20.0820	20.0760	19.9186	19.3867	18.7587	18.2645	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9946	0.9865	0.9618	0.8921	0.7313	0.5286	0.5839	0.8433	0.9726	0.9951	0.9983	(94)
Useful gains	661.5931	783.2642	876.7871	939.2427	917.3519	734.1119	507.7291	528.6897	714.9563	730.9872	655.8721	621.5974	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2141.7914	2079.6371	1884.8983	1573.4778	1211.5529	807.4443	519.1389	547.1271	870.5873	1322.1065	1761.2122	2133.4243	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1101.2675	871.1626	750.0347	456.6493	218.8855	0.0000	0.0000	0.0000	0.0000	439.7927	795.8449	1124.7992	(98)
Space heating												5758.4365	(98)
Space heating per m2											(98) / (4) =	44.8966	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6165.3495	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1101.2675	871.1626	750.0347	456.6493	218.8855	0.0000	0.0000	0.0000	0.0000	439.7927	795.8449	1124.7992	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1179.0872	932.7223	803.0350	488.9179	234.3528	0.0000	0.0000	0.0000	0.0000	470.8702	852.0823	1204.2818	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5544	88.3858	88.0469	87.2799	85.6023	80.3000	80.3000	80.3000	80.3000	87.1183	88.1820	88.6222	(217)
Fuel for water heating, kWh/month													
	246.9979	218.0878	229.8464	207.7467	205.5171	192.9601	184.8705	206.0873	207.8790	215.8261	225.5931	240.8355	(219)
Water heating fuel used												2582.2476	(219)
Annual totals kWh/year													
Space heating fuel - main system												6165.3495	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Total delivered energy for all uses												9308.4007	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6165.3495	0.2160	1331.7155	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2582.2476	0.2160	557.7655	(264)
Space and water heating			1889.4810	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Total CO2, kg/m2/year			2180.5380	(272)
Emissions per m2 for space and water heating			14.7316	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9658	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7316 * 1.00) + 1.9658 + 0.3035, rounded to 2 d.p.			17.0000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3427	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2913	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3714	0.3641	0.3568	0.3204	0.3131	0.2767	0.2767	0.2694	0.2913	0.3131	0.3277	0.3422	(22b)
Effective ac	0.5690	0.5663	0.5637	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5537	0.5586	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.2402	61.9473	61.6601	60.3116	60.0593	58.8847	58.8847	58.6672	59.3371	60.0593	60.5697	61.1033	(38)
Heat transfer coeff	163.4724	163.1794	162.8923	161.5438	161.2914	160.1169	160.1169	159.8994	160.5693	161.2914	161.8019	162.3355	(39)
Average = Sum(39)m / 12 =												161.5425	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2745	1.2723	1.2700	1.2595	1.2575	1.2484	1.2484	1.2467	1.2519	1.2575	1.2615	1.2657	(40)
HLP (average)												1.2595	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133 (71)

Water heating gains (Table 5)

	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058 (72)

Total internal gains

	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(80)

Solar gains	204.0205	348.9487	484.3254	616.6798	709.5171	713.6244	684.0937	612.7752	529.4978	387.2188	244.5544	174.5199	(83)
Total gains	641.4124	784.8142	904.7453	1011.5298	1077.0129	1055.9265	1010.7866	943.7436	874.2752	757.7161	644.6326	598.1213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4859	54.5837	54.6800	55.1364	55.2227	55.6278	55.6278	55.7034	55.4710	55.2227	55.0485	54.8675	
alpha	4.6324	4.6389	4.6453	4.6758	4.6815	4.7085	4.7085	4.7136	4.6981	4.6815	4.6699	4.6578	
util living area	0.9991	0.9974	0.9928	0.9773	0.9295	0.8122	0.6528	0.7094	0.9064	0.9866	0.9979	0.9993	(86)
MIT	19.5042	19.6789	19.9512	20.3064	20.6417	20.8798	20.9678	20.9525	20.7732	20.3322	19.8476	19.4729	(87)
Th 2	19.8608	19.8626	19.8644	19.8727	19.8742	19.8815	19.8815	19.8828	19.8787	19.8742	19.8711	19.8678	(88)
util rest of house	0.9987	0.9965	0.9900	0.9675	0.8960	0.7229	0.5081	0.5689	0.8481	0.9791	0.9970	0.9991	(89)
MIT 2	18.4982	18.6739	18.9463	19.3027	19.6204	19.8222	19.8730	19.8685	19.7447	19.3328	18.8494	18.4724	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.6361	18.8118	19.0841	19.4404	19.7605	19.9673	20.0231	20.0171	19.8857	19.4698	18.9863	18.6096	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6361	18.8118	19.0841	19.4404	19.7605	19.9673	20.0231	20.0171	19.8857	19.4698	18.9863	18.6096	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9952	0.9874	0.9625	0.8918	0.7308	0.5279	0.5877	0.8486	0.9753	0.9960	0.9987	(94)
Useful gains	640.2597	781.0836	893.3177	973.5859	960.4570	771.6641	533.5981	554.6578	741.8809	739.0247	642.0263	597.3450	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2343.5639	2270.1128	2049.8565	1702.7312	1300.0865	859.3911	548.0978	578.3767	929.0138	1430.6298	1923.2240	2339.1907	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1267.2583	1000.6276	860.4649	524.9846	252.6843	0.0000	0.0000	0.0000	0.0000	514.5542	922.4623	1295.9332	(98)
Space heating												6638.9695	(98)
Space heating per m2											(98) / (4) =	51.7618	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1505.0987	1184.8649	1215.2352	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7781	0.8600	0.8270	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1171.1256	1018.9881	1005.0291	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1352.6822	1297.2791	1221.2980	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	130.7207	207.0486	160.9041	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												498.6734 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	32.6802	51.7621	40.2260	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.6684 (107)
Space cooling per m2												0.9720 (108)
Energy for space heating												51.7618 (99)
Energy for space cooling												0.9720 (108)
Total												52.7338 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133 (71)

Water heating gains (Table 5)

	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058 (72)

Total internal gains

	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.6300	0.7000	0.7700	26.2576	(74)
East	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
South	8.1100	46.7521	0.6300	0.7000	0.7700	115.8760	(78)
Southwest	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(79)
West	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(80)

Solar gains	178.5179	305.3301	423.7847	539.5948	620.8274	624.4213	598.5820	536.1783	463.3106	338.8165	213.9851	152.7049	(83)
Total gains	615.9099	741.1956	844.2046	934.4449	988.3233	966.7234	925.2749	867.1467	808.0879	709.3138	614.0633	576.3063	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area	0.9993	0.9980	0.9944	0.9817	0.9398	0.8274	0.6664	0.7220	0.9163	0.9890	0.9984	0.9995	(86)
MIT	19.5906	19.7509	20.0041	20.3390	20.6569	20.8872	20.9712	20.9572	20.7869	20.3705	19.9168	19.5643	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house	0.9990	0.9973	0.9923	0.9738	0.9108	0.7441	0.5280	0.5884	0.8637	0.9829	0.9976	0.9993	(89)
MIT 2	18.6355	18.7973	19.0512	19.3898	19.6937	19.8930	19.9422	19.9383	19.8177	19.4250	18.9712	18.6158	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.7664	18.9281	19.1818	19.5200	19.8258	20.0293	20.0833	20.0781	19.9506	19.5547	19.1009	18.7459	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7664	18.9281	19.1818	19.5200	19.8258	20.0293	20.0833	20.0781	19.9506	19.5547	19.1009	18.7459	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9963	0.9902	0.9696	0.9068	0.7514	0.5470	0.6063	0.8639	0.9797	0.9968	0.9990	(94)
Useful gains	615.0458	738.4844	835.9009	906.0539	896.2068	726.3778	506.0992	525.7157	698.1166	694.9398	612.1087	575.7256	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2213.6364	2141.7482	1931.9528	1601.0963	1222.6602	809.4690	519.3363	547.4340	875.3813	1347.3801	1812.9074	2206.4486	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1189.3514	942.9932	815.4626	500.4305	242.8813	0.0000	0.0000	0.0000	0.0000	485.4156	864.5750	1213.2579	(98)
Space heating												6254.3675	(98)
Space heating per m2											(98) / (4) =	48.7632	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1401.4689	1103.2840	1131.1682	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7813	0.8650	0.8333	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1094.9747	954.3230	942.5614	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1248.4189	1197.3304	1131.7692	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	110.4798	180.7975	140.7706	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												432.0478 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	27.6199	45.1994	35.1926	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												108.0120 (107)
Space cooling per m2												0.8421 (108)
Energy for space heating												48.7632 (99)
Energy for space cooling												0.8421 (108)
Total												49.6053 (109)
Target Fabric Energy Efficiency (TFEE)												57.0 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3328	0.3090	0.3169	0.3011	0.3011	0.2931	0.2852	0.2773	0.2694	0.2931	0.2773	0.2931	(22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5384	0.5363	0.5430	0.5384	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7531	59.9189	60.1901	59.6545	59.6545	59.3970	59.1464	58.9026	58.6657	59.3970	58.9026	59.3970	(38)
Heat transfer coeff	161.9853	161.1510	161.4223	160.8867	160.8867	160.6292	160.3786	160.1348	159.8979	160.6292	160.1348	160.6292	(39)
Average = Sum(39)m / 12 =												160.7305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2629	1.2564	1.2586	1.2544	1.2544	1.2524	1.2504	1.2485	1.2467	1.2524	1.2485	1.2524	(40)
HLP (average)												1.2532	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
RHI water heating demand												1757 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	13.4839	0.7200	0.7000	0.7700	38.0531	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	8.1100	56.7559	0.7200	0.7000	0.7700	160.7664	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(80)

Solar gains	250.7193	365.3629	513.5247	663.3978	730.5641	800.4793	760.4167	694.0843	594.7741	437.9671	299.6015	210.8140	(83)
Total gains	955.6941	1064.8485	1185.1273	1291.6565	1313.9613	1344.2176	1281.3821	1224.8471	1150.8579	1037.6301	947.6120	895.8643	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9861	55.2708	55.1779	55.3616	55.3616	55.4503	55.5370	55.6215	55.7039	55.4503	55.6215	55.4503	
alpha	4.6657	4.6847	4.6785	4.6908	4.6908	4.6967	4.7025	4.7081	4.7136	4.6967	4.7081	4.6967	
util living area													
	0.9941	0.9899	0.9762	0.9357	0.8403	0.6408	0.4794	0.4992	0.7660	0.9432	0.9869	0.9954	(86)
MIT	19.8105	19.9398	20.2080	20.5390	20.8107	20.9611	20.9920	20.9906	20.9094	20.5950	20.1637	19.7936	(87)
Th 2	19.8700	19.8751	19.8734	19.8767	19.8767	19.8783	19.8799	19.8814	19.8828	19.8783	19.8814	19.8783	(88)
util rest of house													
	0.9921	0.9864	0.9676	0.9115	0.7799	0.5320	0.3463	0.3617	0.6695	0.9157	0.9814	0.9937	(89)
MIT 2	18.3181	18.5091	18.8940	19.3589	19.7062	19.8570	19.8777	19.8788	19.8214	19.4449	18.8398	18.2995	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.5228	18.7053	19.0742	19.5207	19.8577	20.0084	20.0305	20.0313	19.9707	19.6026	19.0213	18.5044	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5228	18.7053	19.0742	19.5207	19.8577	20.0084	20.0305	20.0313	19.9707	19.6026	19.0213	18.5044	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9812	0.9594	0.9019	0.7787	0.5455	0.3647	0.3806	0.6780	0.9069	0.9753	0.9907	(94)
Useful gains	944.6786	1044.8513	1136.9644	1164.9942	1023.1952	733.2334	467.3251	466.2220	780.2864	941.0589	924.2384	887.5483	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2206.6915	2160.2793	1949.0467	1612.1973	1183.7499	756.3099	469.9966	469.4017	842.7660	1317.5786	1780.9145	2169.1971	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	938.9376	749.5676	604.1893	321.9863	119.4527	0.0000	0.0000	0.0000	0.0000	280.1306	616.8068	953.5467	(98)
Space heating												4584.6177	(98)
RHI space heating demand												4585	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1508	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3728	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4041	0.3961	0.3882	0.3486	0.3407	0.3011	0.3011	0.2931	0.3169	0.3407	0.3565	0.3724	(22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.6268	63.2800	62.9401	61.3437	61.0450	59.6545	59.6545	59.3970	60.1901	61.0450	61.6492	62.2809	(38)
Heat transfer coeff	164.8589	164.5122	164.1723	162.5758	162.2771	160.8867	160.8867	160.6292	161.4223	162.2771	162.8814	163.5131	(39)
Average = Sum(39)m / 12 =												162.5744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2853	1.2826	1.2800	1.2675	1.2652	1.2544	1.2544	1.2524	1.2586	1.2652	1.2699	1.2749	(40)
HLP (average)												1.2675	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	10.6334	0.7200	0.7000	0.7700	30.0087	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
Southeast	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(77)
South	8.1100	46.7521	0.7200	0.7000	0.7700	132.4297	(78)
Southwest	1.0200	36.7938	0.7200	0.7000	0.7700	13.1081	(79)
West	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(80)

Solar gains	204.0205	348.9487	484.3254	616.6798	709.5171	713.6244	684.0937	612.7752	529.4978	387.2188	244.5544	174.5199	(83)
Total gains	908.9953	1048.4344	1155.9281	1244.9385	1292.9143	1257.3627	1205.0592	1143.5380	1085.5817	986.8818	892.5648	859.5703	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0277	54.1415	54.2536	54.7864	54.8872	55.3616	55.3616	55.4503	55.1779	54.8872	54.6836	54.4724	
alpha	4.6018	4.6094	4.6169	4.6524	4.6591	4.6908	4.6908	4.6967	4.6785	4.6591	4.6456	4.6315	
util living area													
	0.9959	0.9915	0.9814	0.9527	0.8805	0.7334	0.5664	0.6141	0.8343	0.9642	0.9919	0.9968	(86)
MIT	19.6795	19.8496	20.1087	20.4401	20.7341	20.9227	20.9818	20.9736	20.8506	20.4721	20.0121	19.6467	(87)
Th 2	19.8523	19.8545	19.8565	19.8663	19.8682	19.8767	19.8767	19.8783	19.8734	19.8682	19.8645	19.8606	(88)
util rest of house													
	0.9945	0.9887	0.9747	0.9347	0.8334	0.6363	0.4323	0.4798	0.7558	0.9468	0.9887	0.9958	(89)
MIT 2	18.1150	18.3637	18.7397	19.2161	19.6077	19.8253	19.8702	19.8677	19.7562	19.2698	18.6086	18.0729	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.3295	18.5674	18.9274	19.3840	19.7621	19.9758	20.0227	20.0194	19.9063	19.4347	18.8010	18.2888	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3295	18.5674	18.9274	19.3840	19.7621	19.9758	20.0227	20.0194	19.9063	19.4347	18.8010	18.2888	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9839	0.9672	0.9247	0.8281	0.6457	0.4506	0.4978	0.7585	0.9378	0.9841	0.9935	(94)
Useful gains	901.4515	1031.5846	1118.0080	1151.2491	1070.7008	811.9171	542.9827	569.2059	823.4384	925.4770	878.3803	853.9442	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2312.8916	2248.4603	2040.2350	1704.4435	1308.3015	864.8885	550.6625	581.3830	937.2687	1433.6730	1905.8806	2303.6966	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1050.1115	817.7405	686.1369	398.3000	176.7749	0.0000	0.0000	0.0000	0.0000	378.0978	739.8002	1078.6158	(98)
Space heating												5325.5775	(98)
Space heating per m2											(98) / (4) =	41.5217	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5732.5915	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1050.1115	817.7405	686.1369	398.3000	176.7749	0.0000	0.0000	0.0000	0.0000	378.0978	739.8002	1078.6158	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1130.3676	880.2373	738.5757	428.7406	190.2852	0.0000	0.0000	0.0000	0.0000	406.9944	796.3404	1161.0503	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4180	89.3675	89.2668	89.0301	88.4660	86.7000	86.7000	86.7000	86.7000	88.9724	89.3107	89.4407	(217)
Fuel for water heating, kWh/month													
	200.8613	176.1447	182.8526	161.0875	156.4811	139.1747	130.3455	147.6104	148.7894	167.3067	180.3301	194.8826	(219)
Water heating fuel used												1985.8666	(219)
Annual totals kWh/year													
Space heating fuel - main system												5732.5915	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												7329.2800	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5732.5915	3.4800	199.4942	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1985.8666	3.4800	69.1082	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	485.8036	13.1900	64.0775	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-949.9817	13.1900	-125.3026	(252)
Total energy cost			337.2698	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8176	(257)
SAP value		88.5948	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5732.5915	0.2160	1238.2398	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.8666	0.2160	428.9472	(264)
Space and water heating			1667.1869	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total kg/year			1465.2035	(272)
CO2 emissions per m2			11.4200	(273)
EI value			88.6681	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8834 = 3.939, stars = 4
Water heating environmental impact	0.216 / 0.8834 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3328	0.3090	0.3169	0.3011	0.3011	0.2931	0.2852	0.2773	0.2694	0.2931	0.2773	0.2931	(22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5384	0.5363	0.5430	0.5384	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.7531	59.9189	60.1901	59.6545	59.6545	59.3970	59.1464	58.9026	58.6657	59.3970	58.9026	59.3970	(38)
Heat transfer coeff	161.9853	161.1510	161.4223	160.8867	160.8867	160.6292	160.3786	160.1348	159.8979	160.6292	160.1348	160.6292	(39)
Average = Sum(39)m / 12 =												160.7305	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2629	1.2564	1.2586	1.2544	1.2544	1.2524	1.2504	1.2485	1.2467	1.2524	1.2485	1.2524	(40)
HLP (average)												1.2532	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.0800	13.4839	0.7200	0.7000	0.7700	38.0531	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
Southeast	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(77)
South	8.1100	56.7559	0.7200	0.7000	0.7700	160.7664	(78)
Southwest	1.0200	45.1778	0.7200	0.7000	0.7700	16.0949	(79)
West	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(80)

Solar gains	250.7193	365.3629	513.5247	663.3978	730.5641	800.4793	760.4167	694.0843	594.7741	437.9671	299.6015	210.8140	(83)
Total gains	955.6941	1064.8485	1185.1273	1291.6565	1313.9613	1344.2176	1281.3821	1224.8471	1150.8579	1037.6301	947.6120	895.8643	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9861	55.2708	55.1779	55.3616	55.3616	55.4503	55.5370	55.6215	55.7039	55.4503	55.6215	55.4503	
alpha	4.6657	4.6847	4.6785	4.6908	4.6908	4.6967	4.7025	4.7081	4.7136	4.6967	4.7081	4.6967	
util living area													
	0.9941	0.9899	0.9762	0.9357	0.8403	0.6408	0.4794	0.4992	0.7660	0.9432	0.9869	0.9954	(86)
MIT	19.8105	19.9398	20.2080	20.5390	20.8107	20.9611	20.9920	20.9906	20.9094	20.5950	20.1637	19.7936	(87)
Th 2	19.8700	19.8751	19.8734	19.8767	19.8767	19.8783	19.8799	19.8814	19.8828	19.8783	19.8814	19.8783	(88)
util rest of house													
	0.9921	0.9864	0.9676	0.9115	0.7799	0.5320	0.3463	0.3617	0.6695	0.9157	0.9814	0.9937	(89)
MIT 2	18.3181	18.5091	18.8940	19.3589	19.7062	19.8570	19.8777	19.8788	19.8214	19.4449	18.8398	18.2995	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.5228	18.7053	19.0742	19.5207	19.8577	20.0084	20.0305	20.0313	19.9707	19.6026	19.0213	18.5044	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5228	18.7053	19.0742	19.5207	19.8577	20.0084	20.0305	20.0313	19.9707	19.6026	19.0213	18.5044	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9812	0.9594	0.9019	0.7787	0.5455	0.3647	0.3806	0.6780	0.9069	0.9753	0.9907	(94)
Useful gains	944.6786	1044.8513	1136.9644	1164.9942	1023.1952	733.2334	467.3251	466.2220	780.2864	941.0589	924.2384	887.5483	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2206.6915	2160.2793	1949.0467	1612.1973	1183.7499	756.3099	469.9966	469.4017	842.7660	1317.5786	1780.9145	2169.1971	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	938.9376	749.5676	604.1893	321.9863	119.4527	0.0000	0.0000	0.0000	0.0000	280.1306	616.8068	953.5467	(98)
Space heating												4584.6177	(98)
Space heating per m2											(98) / (4) =	35.7447	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4935.0029	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	938.9376	749.5676	604.1893	321.9863	119.4527	0.0000	0.0000	0.0000	0.0000	280.1306	616.8068	953.5467	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1010.6971	806.8543	650.3652	346.5945	128.5820	0.0000	0.0000	0.0000	0.0000	301.5400	663.9471	1026.4228	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3703	89.3278	89.1997	88.8890	88.1534	86.7000	86.7000	86.7000	86.7000	88.7632	89.2182	89.3901	(217)
Fuel for water heating, kWh/month													
	200.9683	176.2231	182.9901	161.3431	157.0359	139.1747	130.3455	147.6104	148.7894	167.7010	180.5170	194.9930	(219)
Water heating fuel used												1987.6916	(219)
Annual totals kWh/year													
Space heating fuel - main system												4935.0029	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1208 * 1.00) =										-1063.1729		-1063.1729	(233)
Total delivered energy for all uses												6420.3252	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4935.0029	7.3800	364.2032	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1987.6916	7.3800	146.6916	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	485.8036	28.6600	139.2313	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1063.1729	28.6600	-304.7054	(252)
Total energy cost			473.9158	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4935.0029	0.2160	1065.9606	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.6916	0.2160	429.3414	(264)
Space and water heating			1495.3020	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	0.5190	-551.7867	(269)
Total kg/year			1234.5723	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4935.0029	1.2200	6020.7035	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.6916	1.2200	2424.9837	(264)
Space and water heating			8445.6873	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	485.8036	3.0700	1491.4170	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	3.0700	-3263.9408	(269)
Primary energy kWh/year			6903.4134	(272)
Primary energy kWh/m2/year			53.8236	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 1.0	-£ 62	-198 kg (16.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£161	£161	£0
Mains gas	£618	£618	£0
Space heating	£493	£493	£0
Water heating	£147	£147	£0
Lighting	£139	£139	£0
Generated (PV)	-£305	-£305	£0
Total cost of fuels	£474	£474	£0
Total cost of uses	£474	£474	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	54 kWh/m²	54 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	875.15 (P1)
Transmission heat loss coefficient	101.23 (37)
Summer heat loss coefficient	976.38 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
South West	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.0800	87.1704	0.7200	0.7000	0.8865	283.2255
East	1.4200	125.2818	0.7200	0.7000	0.8865	71.5366
South East	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
South	8.1100	118.5567	0.7200	0.7000	0.8865	386.6327
South West	1.0200	127.3119	0.7200	0.7000	0.8865	52.2181
West	0.8200	125.2818	0.7200	0.7000	0.8865	41.3098
total:						887.1408

	Jun	Jul	Aug	
Solar gains	949	887	807	(P3)
Internal gains	541	518	528	
Total summer gains	1490	1405	1335	(P5)
Summer gain/loss ratio	1.53	1.44	1.37	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.18	18.99	18.92	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 407 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	35 Wren Walk, Boorley Green, SOUTHAMPTON, SO32 2DX		

SAP Rating	89 B	**DER**	13.06	**TER**	17.00
Environmental	89 B	**% DER<TER**	23.18		
CO_2 Emissions (t/year)	1.18	**DFEE**	52.73	**TFEE**	57.05
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.56		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.00	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.06	$kgCO_2/m^2$	Pass
	-3.94 (-23.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.05	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.73	$kWh/m^2/yr$	
	-4.3 (-7.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.08 m², No overhang
Windows facing East	1.42 m², No overhang
Windows facing South East	1.02 m², No overhang
Windows facing South	8.11 m², No overhang
Windows facing South West	1.02 m², No overhang
Windows facing West	0.82 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 408 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	37 Wren Walk, Boorley Green, Southhampton, SO32 2DX		

SAP Rating	89 B	**DER**	12.70	**TER**	16.49
Environmental	88 B	**% DER<TER**	22.99		
CO_2 Emissions (t/year)	1.35	**DFEE**	51.35	**TFEE**	59.17
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 149 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.49 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.34 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 14.40 m², No overhang
Windows facing South East: 2.79 m², No overhang
Windows facing South: 2.04 m², No overhang
Windows facing South West: 8.78 m², No overhang
Windows facing West: 2.04 m², No overhang
Windows facing North West: 0.82 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3731	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3171	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4043	0.3964	0.3885	0.3488	0.3409	0.3013	0.3013	0.2933	0.3171	0.3409	0.3568	0.3726	(22b)
Effective ac	0.5817	0.5786	0.5755	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.3762	(36)
Total fabric heat loss (33) + (36) =	117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.7993	73.3966	73.0020	71.1482	70.8013	69.1867	69.1867	68.8877	69.8086	70.8013	71.5030	72.2365	(38)
Heat transfer coeff	190.9564	190.5537	190.1591	188.3053	187.9584	186.3438	186.3438	186.0448	186.9657	187.9584	188.6601	189.3936	(39)
Average = Sum(39)m / 12 =												188.3036	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2812	1.2785	1.2759	1.2635	1.2611	1.2503	1.2503	1.2483	1.2545	1.2611	1.2658	1.2708	(40)
HLP (average)												1.2634	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327 (42)
Average daily hot water use (litres/day)	103.8511 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320	(61)
Total heat required for water heating calculated for each month													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194	(64)
Heat gains from water heating, kWh/month													
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	497.7450	495.4620	477.3786	447.7967	416.9956	387.8749	369.3055	375.9388	391.4347	421.2540	455.5758	482.0518	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
Southeast	2.7900	36.7938	0.7200	0.7000	0.7700	35.8544	(77)
South	2.0400	46.7521	0.7200	0.7000	0.7700	33.3115	(78)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
West	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(80)
Northwest	0.8200	11.2829	0.7200	0.7000	0.7700	3.2315	(81)

Solar gains	255.9714	457.2888	681.0766	934.9136	1128.9471	1156.3970	1100.0952	950.1258	768.2828	520.4450	310.4962	216.5191	(83)
Total gains	753.7164	952.7508	1158.4552	1382.7103	1545.9427	1544.2719	1469.4007	1326.0646	1159.7174	941.6990	766.0720	698.5709	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2009	54.3154	54.4281	54.9639	55.0654	55.5425	55.5425	55.6318	55.3577	55.0654	54.8606	54.6481	
alpha	4.6134	4.6210	4.6285	4.6643	4.6710	4.7028	4.7028	4.7088	4.6905	4.6710	4.6574	4.6432	
util living area													
	0.9990	0.9969	0.9894	0.9593	0.8702	0.7046	0.5415	0.6137	0.8651	0.9826	0.9977	0.9993	(86)
MIT	19.5008	19.6958	20.0076	20.4122	20.7513	20.9353	20.9850	20.9740	20.8227	20.3642	19.8534	19.4686	(87)
Th 2	19.8556	19.8577	19.8598	19.8696	19.8714	19.8800	19.8800	19.8816	19.8767	19.8714	19.8677	19.8638	(88)
util rest of house													
	0.9987	0.9958	0.9855	0.9433	0.8210	0.6071	0.4120	0.4798	0.7937	0.9733	0.9967	0.9991	(89)
MIT 2	17.8565	18.1429	18.5977	19.1812	19.6301	19.8379	19.8747	19.8711	19.7322	19.1241	18.3807	17.8150	(90)
Living area fraction										fLA = Living area / (4) =		0.1144	(91)
MIT	18.0446	18.3205	18.7589	19.3220	19.7584	19.9635	20.0017	19.9973	19.8569	19.2659	18.5491	18.0042	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0446	18.3205	18.7589	19.3220	19.7584	19.9635	20.0017	19.9973	19.8569	19.2659	18.5491	18.0042	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9934	0.9798	0.9331	0.8151	0.6150	0.4267	0.4945	0.7922	0.9658	0.9948	0.9984	(94)
Useful gains	752.0151	946.4888	1135.0984	1290.2127	1260.1550	949.7245	626.9203	655.7340	918.7092	909.5325	762.1035	697.4537	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2624.6267	2557.3306	2331.1491	1962.5198	1514.6415	999.4475	633.8916	669.2523	1076.3459	1628.8367	2159.9939	2614.4242	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1393.2230	1082.4857	889.8617	484.0611	189.3380	0.0000	0.0000	0.0000	0.0000	535.1624	1006.4811	1426.2260	(98)
Space heating												7006.8391	(98)
Space heating per m2											(98) / (4) =	47.0131	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7542.3456	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1393.2230	1082.4857	889.8617	484.0611	189.3380	0.0000	0.0000	0.0000	0.0000	535.1624	1006.4811	1426.2260	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1499.7019	1165.2161	957.8705	521.0561	203.8084	0.0000	0.0000	0.0000	0.0000	576.0628	1083.4027	1535.2272	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5196	89.4774	89.3847	89.1428	88.5131	86.7000	86.7000	86.7000	86.7000	89.1787	89.4411	89.5372	(217)
Fuel for water heating, kWh/month													
	202.4686	177.5345	184.2704	162.3341	157.8013	140.4110	131.4911	148.9251	150.1179	168.4250	181.7055	196.4499	(219)
Water heating fuel used												2001.9342	(219)
Annual totals kWh/year													
Space heating fuel - main system												7542.3456	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1029 * 1.00) =										-905.6843		-905.6843	(233)
Total delivered energy for all uses												9218.4923	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7542.3456	0.2160	1629.1466	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2001.9342	0.2160	432.4178	(264)
Space and water heating			2061.5644	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-905.6843	0.5190	-470.0502	(269)
Total CO2, kg/year			1892.4807	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.7000	ZC1
Total Floor Area	TFA	149.0400	
Assumed number of occupants	N	2.9327	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.7023	ZC2
CO2 emissions from cooking, equation (L16)		1.2707	ZC3
Total CO2 emissions		26.6730	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.6730	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1041	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3541	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			5.9200	1.2000	7.1040			(26a)
TER Opening Type (Uw = 1.40)			30.8700	1.3258	40.9261			(27)
Ground floor			75.7600	0.1300	9.8488			(28a)
External Wall	195.4300	36.7900	158.6400	0.1800	28.5552			(29a)
Main Roof	73.2800		73.2800	0.1300	9.5264			(30)
Bay Roof	2.4800		2.4800	0.1300	0.3224			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.2829			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5203	(36)
Total fabric heat loss					(33) + (36) =		111.8032	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.7687	72.4060	72.0506	70.3810	70.0687	68.6145	68.6145	68.3453	69.1746	70.0687	70.7006	71.3612	(38)
Heat transfer coeff	184.5719	184.2092	183.8538	182.1842	181.8719	180.4177	180.4177	180.1484	180.9778	181.8719	182.5038	183.1644	(39)
Average = Sum(39)m / 12 =												182.1827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2360	1.2336	1.2224	1.2203	1.2105	1.2105	1.2087	1.2143	1.2203	1.2245	1.2290	(40)
HLP (average)												1.2224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9327	(42)
Average daily hot water use (litres/day)												103.8511	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.7461	46.0928	47.6293	49.7461	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225 (64)
								Total per year (kWh/year) = Sum(64)m =				2225.0055 (64)
Heat gains from water heating, kWh/month												
	69.0682	60.7721	63.5771	56.6500	54.9638	48.2210	45.9132	51.4588	51.8171	58.7596	62.5630	67.2909 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	92.8337	90.4347	85.4531	78.6806	73.8761	66.9736	61.7113	69.1651	71.9682	78.9779	86.8931	90.4447	(72)
Total internal gains													
	510.8898	508.6094	490.5317	460.9574	429.7553	399.9325	381.3686	388.7037	404.6030	434.4144	468.7273	495.1993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	11.2829	0.6300	0.7000	0.7700	49.6543	(75)
Southeast	2.7900	36.7938	0.6300	0.7000	0.7700	31.3726	(77)
South	2.0400	46.7521	0.6300	0.7000	0.7700	29.1476	(78)
Southwest	8.7800	36.7938	0.6300	0.7000	0.7700	98.7282	(79)
West	2.0400	19.6403	0.6300	0.7000	0.7700	12.2447	(80)
Northwest	0.8200	11.2829	0.6300	0.7000	0.7700	2.8275	(81)

Solar gains	223.9750	400.1277	595.9421	818.0494	987.8287	1011.8474	962.5833	831.3601	672.2474	455.3894	271.6841	189.4542 (83)
Total gains	734.8648	908.7372	1086.4737	1279.0069	1417.5840	1411.7799	1343.9519	1220.0638	1076.8504	889.8038	740.4114	684.6535 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0757	56.1861	56.2947	56.8106	56.9082	57.3669	57.3669	57.4526	57.1893	56.9082	56.7112	56.5066	
alpha	4.7384	4.7457	4.7530	4.7874	4.7939	4.8245	4.8245	4.8302	4.8126	4.7939	4.7807	4.7671	
util living area													
	0.9991	0.9975	0.9916	0.9676	0.8916	0.7360	0.5707	0.6416	0.8831	0.9856	0.9980	0.9994	(86)
MIT	19.5438	19.7223	20.0140	20.3987	20.7340	20.9280	20.9832	20.9714	20.8145	20.3688	19.8823	19.5135	(87)
Th 2	19.8894	19.8913	19.8932	19.9021	19.9038	19.9116	19.9116	19.9130	19.9086	19.9038	19.9004	19.8969	(88)
util rest of house													
	0.9988	0.9966	0.9885	0.9545	0.8479	0.6412	0.4396	0.5080	0.8178	0.9777	0.9972	0.9992	(89)
MIT 2	17.9426	18.2048	18.6310	19.1883	19.6394	19.8632	19.9055	19.9011	19.7530	19.1546	18.4455	17.9034	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.1258	18.3784	18.7892	19.3268	19.7647	19.9850	20.0288	20.0235	19.8744	19.2935	18.6099	18.0876	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1258	18.3784	18.7892	19.3268	19.7647	19.9850	20.0288	20.0235	19.8744	19.2935	18.6099	18.0876	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9946	0.9838	0.9453	0.8412	0.6483	0.4543	0.5226	0.8153	0.9712	0.9956	0.9986	(94)
Useful gains	733.4284	903.8360	1068.8360	1209.0218	1192.4643	915.2304	610.6174	637.5792	877.9759	864.1621	737.1250	683.6935	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2551.8461	2482.8532	2259.4170	1899.5975	1466.7348	971.5466	618.6093	652.7740	1045.0473	1581.1055	2100.5968	2543.7147	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1352.9027	1061.0996	885.7922	497.2145	204.0572	0.0000	0.0000	0.0000	0.0000	533.4059	981.6997	1383.8558	(98)
Space heating												6900.0277	(98)
Space heating per m2											(98) / (4) =	46.2965	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7387.6099	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1352.9027	1061.0996	885.7922	497.2145	204.0572	0.0000	0.0000	0.0000	0.0000	533.4059	981.6997	1383.8558	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1448.5040	1136.0809	948.3856	532.3496	218.4767	0.0000	0.0000	0.0000	0.0000	571.0984	1051.0703	1481.6443	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.8349	88.6746	88.3217	87.4456	85.4008	80.3000	80.3000	80.3000	80.3000	87.5160	88.5127	88.8963	(217)
Fuel for water heating, kWh/month													
	248.0646	218.9959	230.8076	208.8294	208.0164	194.8471	186.6783	208.1026	209.3113	216.3769	226.4032	241.8802	(219)
Water heating fuel used												2598.3135	(219)
Annual totals kWh/year													
Space heating fuel - main system												7387.6099	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Total delivered energy for all uses												10565.8202	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7387.6099	0.2160	1595.7237	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2598.3135	0.2160	561.2357	(264)
Space and water heating			2156.9595	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Total CO2, kg/m2/year			2457.9259	(272)
Emissions per m2 for space and water heating			14.4724	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7582	(272b)
Emissions per m2 for pumps and fans			0.2612	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4724 * 1.00) + 1.7582 + 0.2612, rounded to 2 d.p.			16.4900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1041	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3211	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2729	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3479	0.3411	0.3343	0.3002	0.2934	0.2592	0.2592	0.2524	0.2729	0.2934	0.3070	0.3207	(22b)
Effective ac	0.5605	0.5582	0.5559	0.5451	0.5430	0.5336	0.5336	0.5319	0.5372	0.5430	0.5471	0.5514	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.1089	70.8107	70.5185	69.1456	68.8888	67.6931	67.6931	67.4717	68.1537	68.8888	69.4084	69.9516	(38)
Heat transfer coeff	188.2660	187.9678	187.6756	186.3027	186.0459	184.8502	184.8502	184.6288	185.3108	186.0459	186.5655	187.1087	(39)
Average = Sum(39)m / 12 =												186.3015	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2632	1.2612	1.2592	1.2500	1.2483	1.2403	1.2403	1.2388	1.2434	1.2483	1.2518	1.2554	(40)
HLP (average)												1.2500	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9327	(42)
Average daily hot water use (litres/day)												103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.9994	31.4853	32.4900	28.3256	27.1791	23.4535	21.7331	24.9391	25.2369	29.4112	32.1046	34.8635 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072 (71)

Water heating gains (Table 5)

	48.3863	46.8532	43.6694	39.3411	36.5310	32.5743	29.2112	33.5202	35.0513	39.5312	44.5897	46.8596 (72)

Total internal gains

	463.4424	462.0279	445.7480	418.6180	389.4102	362.5331	345.8684	350.0589	364.6860	391.9677	423.4239	448.6141 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
Southeast	2.7900	36.7938	0.7200	0.7000	0.7700	35.8544	(77)
South	2.0400	46.7521	0.7200	0.7000	0.7700	33.3115	(78)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
West	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(80)
Northwest	0.8200	11.2829	0.7200	0.7000	0.7700	3.2315	(81)

Solar gains	255.9714	457.2888	681.0766	934.9136	1128.9471	1156.3970	1100.0952	950.1258	768.2828	520.4450	310.4962	216.5191 (83)
Total gains	719.4139	919.3167	1126.8247	1353.5316	1518.3573	1518.9301	1445.9636	1300.1847	1132.9688	912.4127	733.9201	665.1332 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9754	55.0626	55.1484	55.5547	55.6314	55.9913	55.9913	56.0584	55.8521	55.6314	55.4765	55.3154	
alpha	4.6650	4.6708	4.6766	4.7036	4.7088	4.7328	4.7328	4.7372	4.7235	4.7088	4.6984	4.6877	
util living area	0.9992	0.9973	0.9904	0.9616	0.8741	0.7095	0.5457	0.6202	0.8712	0.9844	0.9981	0.9995	(86)
MIT	19.5027	19.6972	20.0082	20.4104	20.7505	20.9347	20.9850	20.9734	20.8193	20.3583	19.8488	19.4675	(87)
Th 2	19.8698	19.8714	19.8729	19.8802	19.8816	19.8879	19.8879	19.8891	19.8855	19.8816	19.8788	19.8759	(88)
util rest of house	0.9989	0.9964	0.9868	0.9464	0.8259	0.6126	0.4163	0.4863	0.8017	0.9760	0.9973	0.9993	(89)
MIT 2	18.5037	18.6990	19.0093	19.4070	19.7155	19.8588	19.8843	19.8817	19.7840	19.3638	18.8567	18.4734	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.6180	18.8132	19.1236	19.5218	19.8339	19.9819	20.0102	20.0066	19.9024	19.4776	18.9702	18.5871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6180	18.8132	19.1236	19.5218	19.8339	19.9819	20.0102	20.0066	19.9024	19.4776	18.9702	18.5871	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9951	0.9835	0.9402	0.8234	0.6215	0.4311	0.5014	0.8030	0.9717	0.9963	0.9989	(94)
Useful gains	718.3017	914.7904	1108.2613	1272.5908	1250.2870	944.0210	623.3249	651.9381	909.8094	886.5653	731.1781	664.4193	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2695.5863	2615.2321	2369.1355	1978.8677	1513.2827	994.8369	630.3754	665.8846	1075.2550	1651.6412	2214.5609	2691.9571	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1471.0998	1142.6968	938.0904	508.5194	195.6688	0.0000	0.0000	0.0000	0.0000	569.2165	1068.0356	1508.4881	(98)
Space heating												7401.8154	(98)
Space heating per m2											(98) / (4) =	49.6633	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1737.5918	1367.8914	1403.1786	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8605	0.9192	0.8843	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1495.1128	1257.3073	1240.7723	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1900.8200	1812.5970	1644.6605	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	292.1092	413.1355	300.4928	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1005.7375 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	73.0273	103.2839	75.1232	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												251.4344 (107)
Space cooling per m2												1.6870 (108)
Energy for space heating												49.6633 (99)
Energy for space cooling												1.6870 (108)
Total												51.3503 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1041	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3541	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			5.9200	1.2000	7.1040			(26a)
TER Opening Type (Uw = 1.40)			30.8700	1.3258	40.9261			(27)
Ground floor			75.7600	0.1300	9.8488			(28a)
External Wall	195.4300	36.7900	158.6400	0.1800	28.5552			(29a)
Main Roof	73.2800		73.2800	0.1300	9.5264			(30)
Bay Roof	2.4800		2.4800	0.1300	0.3224			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.2829			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.5203	(36)
Total fabric heat loss (33) + (36) =	111.8032	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.7687	72.4060	72.0506	70.3810	70.0687	68.6145	68.6145	68.3453	69.1746	70.0687	70.7006	71.3612	(38)
Heat transfer coeff	184.5719	184.2092	183.8538	182.1842	181.8719	180.4177	180.4177	180.1484	180.9778	181.8719	182.5038	183.1644	(39)
Average = Sum(39)m / 12 =												182.1827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2360	1.2336	1.2224	1.2203	1.2105	1.2105	1.2087	1.2143	1.2203	1.2245	1.2290	(40)
HLP (average)												1.2224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327 (42)
Average daily hot water use (litres/day)	103.8511 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.9994	31.4853	32.4900	28.3256	27.1791	23.4535	21.7331	24.9391	25.2369	29.4112	32.1046	34.8635 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072 (71)

Water heating gains (Table 5)

	48.3863	46.8532	43.6694	39.3411	36.5310	32.5743	29.2112	33.5202	35.0513	39.5312	44.5897	46.8596 (72)

Total internal gains

	463.4424	462.0279	445.7480	418.6180	389.4102	362.5331	345.8684	350.0589	364.6860	391.9677	423.4239	448.6141 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	11.2829	0.6300	0.7000	0.7700	49.6543	(75)
Southeast	2.7900	36.7938	0.6300	0.7000	0.7700	31.3726	(77)
South	2.0400	46.7521	0.6300	0.7000	0.7700	29.1476	(78)
Southwest	8.7800	36.7938	0.6300	0.7000	0.7700	98.7282	(79)
West	2.0400	19.6403	0.6300	0.7000	0.7700	12.2447	(80)
Northwest	0.8200	11.2829	0.6300	0.7000	0.7700	2.8275	(81)

Solar gains	223.9750	400.1277	595.9421	818.0494	987.8287	1011.8474	962.5833	831.3601	672.2474	455.3894	271.6841	189.4542	(83)
Total gains	687.4174	862.1556	1041.6901	1236.6674	1377.2389	1374.3805	1308.4517	1181.4190	1036.9334	847.3570	695.1080	638.0683	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0757	56.1861	56.2947	56.8106	56.9082	57.3669	57.3669	57.4526	57.1893	56.9082	56.7112	56.5066	
alpha	4.7384	4.7457	4.7530	4.7874	4.7939	4.8245	4.8245	4.8302	4.8126	4.7939	4.7807	4.7671	
util living area	0.9994	0.9980	0.9930	0.9714	0.9003	0.7492	0.5841	0.6582	0.8950	0.9881	0.9985	0.9996	(86)
MIT	19.5145	19.6938	19.9873	20.3761	20.7191	20.9221	20.9815	20.9682	20.8003	20.3441	19.8544	19.4846	(87)
Th 2	19.8894	19.8913	19.8932	19.9021	19.9038	19.9116	19.9116	19.9130	19.9086	19.9038	19.9004	19.8969	(88)
util rest of house	0.9991	0.9973	0.9903	0.9596	0.8588	0.6550	0.4509	0.5232	0.8336	0.9815	0.9979	0.9994	(89)
MIT 2	18.5309	18.7114	19.0051	19.3936	19.7114	19.8754	19.9069	19.9038	19.7922	19.3685	18.8793	18.5070	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.6434	18.8238	19.1175	19.5060	19.8266	19.9951	20.0299	20.0256	19.9075	19.4801	18.9908	18.6188	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6434	18.8238	19.1175	19.5060	19.8266	19.9951	20.0299	20.0256	19.9075	19.4801	18.9908	18.6188	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9962	0.9876	0.9540	0.8553	0.6631	0.4661	0.5383	0.8335	0.9779	0.9971	0.9991	(94)
Useful gains	686.5623	858.9088	1028.7907	1179.8044	1177.8980	911.2907	609.8934	635.9155	864.2874	828.6205	693.0606	637.5136	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2647.3967	2564.8953	2319.7707	1932.2387	1478.0089	973.3804	618.8074	653.1389	1051.0328	1615.0406	2170.1214	2641.0186	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1458.8608	1146.4229	960.4891	541.7527	223.2825	0.0000	0.0000	0.0000	0.0000	585.0966	1063.4838	1490.6077	(98)
Space heating												7469.9961	(98)
Space heating per m2										(98) / (4) =		50.1207	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1695.9267	1335.0912	1369.1282	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8369	0.9034	0.8654	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1419.2828	1206.1028	1184.8223	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1731.8659	1651.8688	1505.8434	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	225.0598	331.6499	238.8397	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												795.5494 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	56.2649	82.9125	59.7099	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												198.8873 (107)
Space cooling per m2												1.3345 (108)
Energy for space heating												50.1207 (99)
Energy for space cooling												1.3345 (108)
Total												51.4552 (109)
Target Fabric Energy Efficiency (TFEE)												59.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3731	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3171	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3330	0.3092	0.3171	0.3013	0.3013	0.2933	0.2854	0.2775	0.2695	0.2933	0.2775	0.2933	(22b)
Effective ac	0.5554	0.5478	0.5503	0.5454	0.5454	0.5430	0.5407	0.5385	0.5363	0.5430	0.5385	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.4625	69.4937	69.8086	69.1867	69.1867	68.8877	68.5967	68.3136	68.0386	68.8877	68.3136	68.8877	(38)
Heat transfer coeff	187.6195	186.6508	186.9657	186.3438	186.3438	186.0448	185.7538	185.4707	185.1956	186.0448	185.4707	186.0448	(39)
Average = Sum(39)m / 12 =												186.1624	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2589	1.2524	1.2545	1.2503	1.2503	1.2483	1.2463	1.2444	1.2426	1.2483	1.2444	1.2483	(40)
HLP (average)												1.2491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327	(42)
Average daily hot water use (litres/day)	103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194 (64)
RHI water heating demand												1773 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	14.6176	0.7200	0.7000	0.7700	73.5197	(75)
Southeast	2.7900	45.1778	0.7200	0.7000	0.7700	44.0244	(77)
South	2.0400	56.7559	0.7200	0.7000	0.7700	40.4394	(78)
Southwest	8.7800	45.1778	0.7200	0.7000	0.7700	138.5427	(79)
West	2.0400	25.1925	0.7200	0.7000	0.7700	17.9501	(80)
Northwest	0.8200	14.6176	0.7200	0.7000	0.7700	4.1865	(81)

Solar gains	318.6628	486.1543	734.2987	1020.5955	1175.3170	1308.9567	1235.0336	1090.5221	877.2126	598.2119	385.6238	264.7613	(83)
Total gains	1063.8381	1225.8846	1444.7180	1685.1479	1792.0896	1883.4856	1785.2420	1650.5259	1463.9399	1231.0436	1069.7559	988.4924	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1648	55.4511	55.3577	55.5425	55.5425	55.6318	55.7189	55.8040	55.8868	55.6318	55.8040	55.6318	
alpha	4.6777	4.6967	4.6905	4.7028	4.7028	4.7088	4.7146	4.7203	4.7258	4.7088	4.7203	4.7088	
util living area													
	0.9951	0.9902	0.9714	0.9075	0.7702	0.5459	0.4023	0.4332	0.7209	0.9388	0.9882	0.9963	(86)
MIT	19.7877	19.9382	20.2493	20.6203	20.8740	20.9801	20.9962	20.9948	20.9309	20.6098	20.1498	19.7669	(87)
Th 2	19.8732	19.8783	19.8767	19.8800	19.8800	19.8816	19.8831	19.8846	19.8861	19.8816	19.8846	19.8816	(88)
util rest of house													
	0.9934	0.9869	0.9614	0.8763	0.7014	0.4466	0.2890	0.3120	0.6223	0.9099	0.9833	0.9950	(89)
MIT 2	18.2872	18.5091	18.9542	19.4653	19.7728	19.8713	19.8821	19.8833	19.8412	19.4664	18.8222	18.2630	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.4589	18.6726	19.1024	19.5974	19.8988	19.9982	20.0096	20.0104	19.9658	19.5972	18.9741	18.4350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4589	18.6726	19.1024	19.5974	19.8988	19.9982	20.0096	20.0104	19.9658	19.5972	18.9741	18.4350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9816	0.9522	0.8668	0.7027	0.4573	0.3020	0.3259	0.6300	0.9003	0.9774	0.9923	(94)
Useful gains	1053.2781	1203.3761	1375.6689	1460.7422	1259.2937	861.3025	539.1178	537.9398	922.2980	1108.3398	1045.5983	980.8807	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2543.9080	2495.9988	2262.7310	1881.5891	1378.7209	874.0708	540.4671	539.8009	975.2073	1525.0472	2053.9222	2499.5171	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1109.0287	868.6425	659.9742	303.0098	88.8538	0.0000	0.0000	0.0000	0.0000	310.0303	725.9932	1129.8655	(98)
Space heating												5195.3980	(98)
RHI space heating demand												5195	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1561	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3731	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3171	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4043	0.3964	0.3885	0.3488	0.3409	0.3013	0.3013	0.2933	0.3171	0.3409	0.3568	0.3726	(22b)
Effective ac	0.5817	0.5786	0.5755	0.5608	0.5581	0.5454	0.5454	0.5430	0.5503	0.5581	0.5636	0.5694	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.7993	73.3966	73.0020	71.1482	70.8013	69.1867	69.1867	68.8877	69.8086	70.8013	71.5030	72.2365	(38)
Heat transfer coeff	190.9564	190.5537	190.1591	188.3053	187.9584	186.3438	186.3438	186.0448	186.9657	187.9584	188.6601	189.3936	(39)
Average = Sum(39)m / 12 =												188.3036	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2812	1.2785	1.2759	1.2635	1.2611	1.2503	1.2503	1.2483	1.2545	1.2611	1.2658	1.2708	(40)
HLP (average)												1.2634	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9327	(42)
Average daily hot water use (litres/day)												103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
Southeast	2.7900	36.7938	0.7200	0.7000	0.7700	35.8544	(77)
South	2.0400	46.7521	0.7200	0.7000	0.7700	33.3115	(78)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
West	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(80)
Northwest	0.8200	11.2829	0.7200	0.7000	0.7700	3.2315	(81)

Solar gains	255.9714	457.2888	681.0766	934.9136	1128.9471	1156.3970	1100.0952	950.1258	768.2828	520.4450	310.4962	216.5191 (83)
Total gains	1001.1467	1197.0191	1391.4959	1599.4660	1745.7196	1730.9259	1650.3036	1510.1296	1355.0101	1153.2766	994.6283	940.2502 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2009	54.3154	54.4281	54.9639	55.0654	55.5425	55.5425	55.6318	55.3577	55.0654	54.8606	54.6481	
alpha	4.6134	4.6210	4.6285	4.6643	4.6710	4.7028	4.7028	4.7088	4.6905	4.6710	4.6574	4.6432	
util living area													
	0.9967	0.9921	0.9786	0.9339	0.8242	0.6468	0.4873	0.5491	0.8034	0.9633	0.9932	0.9975	(86)
MIT	19.6515	19.8422	20.1403	20.5155	20.8090	20.9548	20.9903	20.9835	20.8755	20.4788	19.9913	19.6165	(87)
Th 2	19.8556	19.8577	19.8598	19.8696	19.8714	19.8800	19.8800	19.8816	19.8767	19.8714	19.8677	19.8638	(88)
util rest of house													
	0.9956	0.9894	0.9711	0.9105	0.7672	0.5505	0.3682	0.4243	0.7201	0.9456	0.9904	0.9967	(89)
MIT 2	18.0765	18.3553	18.7869	19.3187	19.6936	19.8518	19.8767	19.8753	19.7822	19.2815	18.5809	18.0311	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.2567	18.5254	18.9417	19.4556	19.8212	19.9780	20.0041	20.0021	19.9072	19.4185	18.7422	18.2124	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2567	18.5254	18.9417	19.4556	19.8212	19.9780	20.0041	20.0021	19.9072	19.4185	18.7422	18.2124	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9847	0.9628	0.8999	0.7643	0.5595	0.3817	0.4383	0.7227	0.9359	0.9862	0.9948	(94)
Useful gains	994.2916	1178.7635	1339.7659	1439.3149	1334.2373	968.3729	629.9602	661.9387	979.2321	1079.3624	980.8777	935.3283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2665.1177	2596.3749	2365.9032	1987.6689	1526.4411	1002.1601	634.3320	670.1456	1085.7549	1657.5041	2196.4243	2653.8640	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1243.0946	952.6348	763.4461	394.8149	142.9996	0.0000	0.0000	0.0000	0.0000	430.1374	875.1936	1278.5905	(98)
Space heating												6080.9117	(98)
Space heating per m2											(98) / (4) =	40.8005	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6545.6531	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1243.0946	952.6348	763.4461	394.8149	142.9996	0.0000	0.0000	0.0000	0.0000	430.1374	875.1936	1278.5905	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1338.0997	1025.4412	821.7935	424.9892	153.9285	0.0000	0.0000	0.0000	0.0000	463.0112	942.0814	1376.3084	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4797	89.4283	89.3150	89.0188	88.2898	86.7000	86.7000	86.7000	86.7000	89.0494	89.3833	89.5005	(217)
Fuel for water heating, kWh/month													
	202.5588	177.6320	184.4142	162.5602	158.2004	140.4110	131.4911	148.9251	150.1179	168.6695	181.8229	196.5304	(219)
Water heating fuel used												2003.3335	(219)
Annual totals kWh/year													
Space heating fuel - main system												6545.6531	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1029 * 1.00) =										-905.6843		-905.6843	(233)
Total delivered energy for all uses												8223.1991	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6545.6531	3.4800	227.7887	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2003.3335	3.4800	69.7160	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	504.8968	13.1900	66.5959	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-905.6843	13.1900	-119.4598	(252)
Total energy cost			374.5334	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8107	(257)
SAP value		88.6910	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6545.6531	0.2160	1413.8611	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2003.3335	0.2160	432.7200	(264)
Space and water heating			1846.5811	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-905.6843	0.5190	-470.0502	(269)
Total kg/year			1677.4974	(272)
CO2 emissions per m2			11.2600	(273)
EI value			88.4156	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8836 = 3.939, stars = 4
Water heating environmental impact	0.216 / 0.8836 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3731	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3171	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3330	0.3092	0.3171	0.3013	0.3013	0.2933	0.2854	0.2775	0.2695	0.2933	0.2775	0.2933	(22b)
Effective ac	0.5554	0.5478	0.5503	0.5454	0.5454	0.5430	0.5407	0.5385	0.5363	0.5430	0.5385	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.4625	69.4937	69.8086	69.1867	69.1867	68.8877	68.5967	68.3136	68.0386	68.8877	68.3136	68.8877	(38)
Heat transfer coeff	187.6195	186.6508	186.9657	186.3438	186.3438	186.0448	185.7538	185.4707	185.1956	186.0448	185.4707	186.0448	(39)
Average = Sum(39)m / 12 =												186.1624	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2589	1.2524	1.2545	1.2503	1.2503	1.2483	1.2463	1.2444	1.2426	1.2483	1.2444	1.2483	(40)
HLP (average)												1.2491	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327	(42)
Average daily hot water use (litres/day)	103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	14.4000	14.6176	0.7200	0.7000	0.7700	73.5197	(75)
Southeast	2.7900	45.1778	0.7200	0.7000	0.7700	44.0244	(77)
South	2.0400	56.7559	0.7200	0.7000	0.7700	40.4394	(78)
Southwest	8.7800	45.1778	0.7200	0.7000	0.7700	138.5427	(79)
West	2.0400	25.1925	0.7200	0.7000	0.7700	17.9501	(80)
Northwest	0.8200	14.6176	0.7200	0.7000	0.7700	4.1865	(81)

Solar gains	318.6628	486.1543	734.2987	1020.5955	1175.3170	1308.9567	1235.0336	1090.5221	877.2126	598.2119	385.6238	264.7613 (83)
Total gains	1063.8381	1225.8846	1444.7180	1685.1479	1792.0896	1883.4856	1785.2420	1650.5259	1463.9399	1231.0436	1069.7559	988.4924 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1648	55.4511	55.3577	55.5425	55.5425	55.6318	55.7189	55.8040	55.8868	55.6318	55.8040	55.6318	
alpha	4.6777	4.6967	4.6905	4.7028	4.7028	4.7088	4.7146	4.7203	4.7258	4.7088	4.7203	4.7088	
util living area													
	0.9951	0.9902	0.9714	0.9075	0.7702	0.5459	0.4023	0.4332	0.7209	0.9388	0.9882	0.9963	(86)
MIT	19.7877	19.9382	20.2493	20.6203	20.8740	20.9801	20.9962	20.9948	20.9309	20.6098	20.1498	19.7669	(87)
Th 2	19.8732	19.8783	19.8767	19.8800	19.8800	19.8816	19.8831	19.8846	19.8861	19.8816	19.8846	19.8816	(88)
util rest of house													
	0.9934	0.9869	0.9614	0.8763	0.7014	0.4466	0.2890	0.3120	0.6223	0.9099	0.9833	0.9950	(89)
MIT 2	18.2872	18.5091	18.9542	19.4653	19.7728	19.8713	19.8821	19.8833	19.8412	19.4664	18.8222	18.2630	(90)
Living area fraction										fLA = Living area / (4) =		0.1144	(91)
MIT	18.4589	18.6726	19.1024	19.5974	19.8988	19.9982	20.0096	20.0104	19.9658	19.5972	18.9741	18.4350	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4589	18.6726	19.1024	19.5974	19.8988	19.9982	20.0096	20.0104	19.9658	19.5972	18.9741	18.4350	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9816	0.9522	0.8668	0.7027	0.4573	0.3020	0.3259	0.6300	0.9003	0.9774	0.9923	(94)
Useful gains	1053.2781	1203.3761	1375.6689	1460.7422	1259.2937	861.3025	539.1178	537.9398	922.2980	1108.3398	1045.5983	980.8807	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2543.9080	2495.9988	2262.7310	1881.5891	1378.7209	874.0708	540.4671	539.8009	975.2073	1525.0472	2053.9222	2499.5171	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1109.0287	868.6425	659.9742	303.0098	88.8538	0.0000	0.0000	0.0000	0.0000	310.0303	725.9932	1129.8655	(98)
Space heating												5195.3980	(98)
Space heating per m2											(98) / (4) =	34.8591	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5592.4628	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1109.0287	868.6425	659.9742	303.0098	88.8538	0.0000	0.0000	0.0000	0.0000	310.0303	725.9932	1129.8655	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1193.7876	935.0296	710.4136	326.1677	95.6446	0.0000	0.0000	0.0000	0.0000	333.7248	781.4781	1216.2169	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4363	89.3899	89.2421	88.8402	87.9167	86.7000	86.7000	86.7000	86.7000	88.8300	89.2971	89.4552	(217)
Fuel for water heating, kWh/month													
	202.6572	177.7082	184.5648	162.8870	158.8717	140.4110	131.4911	148.9251	150.1179	169.0860	181.9983	196.6298	(219)
Water heating fuel used												2005.3482	(219)
Annual totals kWh/year													
Space heating fuel - main system												5592.4628	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1156 * 1.00) =										-1017.4830		-1017.4830	(233)
Total delivered energy for all uses												7160.2249	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5592.4628	7.3800	412.7238	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2005.3482	7.3800	147.9947	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	504.8968	28.6600	144.7034	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1017.4830	28.6600	-291.6106	(252)
Total energy cost			542.3063	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5592.4628	0.2160	1207.9720	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2005.3482	0.2160	433.1552	(264)
Space and water heating			1641.1272	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-1017.4830	0.5190	-528.0737	(269)
Total kg/year			1414.0200	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5592.4628	1.2200	6822.8046	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2005.3482	1.2200	2446.5248	(264)
Space and water heating			9269.3295	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	504.8968	3.0700	1550.0333	(268)
Energy saving/generation technologies				
PV Unit	-1017.4830	3.0700	-3123.6728	(269)
Primary energy kWh/year			7925.9399	(272)
Primary energy kWh/m2/year			53.1800	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 62	-199 kg (14.1%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£166	£166	£0
Mains gas	£668	£668	£0
Space heating	£541	£541	£0
Water heating	£148	£148	£0
Lighting	£145	£145	£0
Generated (PV)	-£292	-£292	£0
Total cost of fuels	£542	£542	£0
Total cost of uses	£542	£542	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1014.88 (P1)
Transmission heat loss coefficient	117.16 (37)
Summer heat loss coefficient	1132.04 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.850	0.90	1.000	0.765 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	14.4000	106.0502	0.7200	0.7000	0.7650	529.9178
South East	2.7900	127.3119	0.7200	0.7000	0.7650	123.2558
South	2.0400	118.5567	0.7200	0.7000	0.7650	83.9249
South West	8.7800	127.3119	0.7200	0.7000	0.7650	387.8804
West	2.0400	125.2818	0.7200	0.7000	0.7650	88.6855
North West	0.8200	106.0502	0.7200	0.7000	0.7650	30.1759
total:						1243.8403

	Jun	Jul	Aug	
Solar gains	1340	1244	1095	(P3)
Internal gains	572	547	557	
Total summer gains	1912	1791	1652	(P5)
Summer gain/loss ratio	1.69	1.58	1.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.34	19.13	19.01	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 408 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	37 Wren Walk, Boorley Green, Southhampton, SO32 2DX		

SAP Rating	89 B	**DER**	12.70	**TER**	16.49
Environmental	88 B	**% DER<TER**	22.99		
CO_2 Emissions (t/year)	1.35	**DFEE**	51.35	**TFEE**	59.17
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.22		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.49	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.70	$kgCO_2/m^2$	Pass
	-3.79 (-23.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.17	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.35	$kWh/m^2/yr$	
	-7.8 (-13.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	14.40 m², No overhang
Windows facing South East	2.79 m², No overhang
Windows facing South	2.04 m², No overhang
Windows facing South West	8.78 m², No overhang
Windows facing West	2.04 m², No overhang
Windows facing North West	0.82 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 409 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	87 B	**DER**	15.16	**TER**	18.59
Environmental	88 B	**% DER<TER**	18.43		
CO_2 Emissions (t/year)	1.07	**DFEE**	54.00	**TFEE**	57.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.60		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.16 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.0 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.20 (max. 0.25)        0.20 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.32 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         3.93 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   0.71 m², No overhang
Windows facing East:                    9.05 m², No overhang
Windows facing South:                   0.71 m², No overhang
Windows facing West:                    5.05 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.022 W/m²K
Air permeability                        3.9 m³/m²h
Photovoltaic array                      0.81 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3885	0.3809	0.3733	0.3352	0.3276	0.2895	0.2895	0.2818	0.3047	0.3276	0.3428	0.3580	(22b)
Effective ac	0.5755	0.5725	0.5697	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5588	0.5641	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8980	46.6592	46.4251	45.3256	45.1199	44.1623	44.1623	43.9850	44.5311	45.1199	45.5360	45.9711	(38)
Heat transfer coeff	126.9339	126.6951	126.4610	125.3615	125.1558	124.1982	124.1982	124.0209	124.5671	125.1558	125.5720	126.0070	(39)
Average = Sum(39)m / 12 =												125.3606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3261	1.3236	1.3212	1.3097	1.3075	1.2975	1.2975	1.2957	1.3014	1.3075	1.3119	1.3164	(40)
HLP (average)												1.3097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	414.3696	412.0990	397.0299	372.6834	347.8122	324.0158	308.6796	315.0648	327.6871	352.2580	380.4587	401.7538	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	525.3234	625.3367	741.3830	868.2289	951.7781	941.4040	896.7789	822.0224	725.6560	603.2511	518.0565	493.5105	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3676	52.4663	52.5634	53.0244	53.1116	53.5211	53.5211	53.5976	53.3626	53.1116	52.9356	52.7528	
alpha	4.4912	4.4978	4.5042	4.5350	4.5408	4.5681	4.5681	4.5732	4.5575	4.5408	4.5290	4.5169	
util living area													
	0.9986	0.9966	0.9898	0.9643	0.8912	0.7449	0.5829	0.6481	0.8819	0.9834	0.9971	0.9989	(86)
MIT	19.4835	19.6527	19.9535	20.3520	20.6989	20.9106	20.9773	20.9639	20.7904	20.3244	19.8288	19.4535	(87)
Th 2	19.8204	19.8224	19.8243	19.8333	19.8349	19.8428	19.8428	19.8442	19.8398	19.8349	19.8315	19.8280	(88)
util rest of house													
	0.9981	0.9954	0.9860	0.9498	0.8460	0.6463	0.4426	0.5068	0.8139	0.9743	0.9959	0.9986	(89)
MIT 2	17.8074	18.0559	18.4948	19.0708	19.5375	19.7829	19.8347	19.8295	19.6659	19.0414	18.3201	17.7687	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.0622	18.2986	18.7165	19.2656	19.7140	19.9543	20.0084	20.0019	19.8368	19.2364	18.5494	18.0248	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0622	18.2986	18.7165	19.2656	19.7140	19.9543	20.0084	20.0019	19.8368	19.2364	18.5494	18.0248	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9929	0.9806	0.9403	0.8403	0.6569	0.4638	0.5276	0.8137	0.9674	0.9937	0.9976	(94)
Useful gains	523.6561	620.8938	727.0077	816.3846	799.7927	618.3629	415.9562	433.7370	590.4811	583.6083	514.7895	492.3222	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1746.8853	1697.5360	1544.9130	1299.4426	1003.0020	665.0002	423.3125	446.7104	714.6157	1080.9008	1437.7258	1742.0238	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	910.0825	723.5036	608.5216	347.8018	151.1877	0.0000	0.0000	0.0000	0.0000	369.9856	664.5142	929.7780	(98)
Space heating												4705.3749	(98)
Space heating per m2											(98) / (4) =	49.1577	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5064.9891	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	910.0825	723.5036	608.5216	347.8018	151.1877	0.0000	0.0000	0.0000	0.0000	369.9856	664.5142	929.7780	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	979.6367	778.7982	655.0286	374.3830	162.7424	0.0000	0.0000	0.0000	0.0000	398.2622	715.3005	1000.8374	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3755	89.3312	89.2265	88.9697	88.3751	86.7000	86.7000	86.7000	86.7000	88.9858	89.2789	89.3976	(217)
Fuel for water heating, kWh/month													
	192.5295	168.8421	175.3167	154.5277	150.1990	133.5081	125.0945	141.5841	142.6920	160.3663	172.8706	186.8174	(219)
Water heating fuel used												1904.3479	(219)
Annual totals kWh/year													
Space heating fuel - main system												5064.9891	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	408.2938	(232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =	-588.2895	-588.2895	(233)
Total delivered energy for all uses		6864.3413	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5064.9891	0.2160	1094.0377	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1904.3479	0.2160	411.3392	(264)
Space and water heating			1505.3768	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1450.8840	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.1600	ZC1
Total Floor Area	TFA	95.7200	
Assumed number of occupants	N	2.6962	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4284	ZC2
CO2 emissions from cooking, equation (L16)		1.9192	ZC3
Total CO2 emissions		32.5077	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.5077	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8674	(36)
Total fabric heat loss (33) + (36) =	69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962 (42)
Average daily hot water use (litres/day)	98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4758	47.0560	43.6002	45.0536	47.0560	47.4758	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
								Total per year (kWh/year) = Sum(64)m =				2122.5163	(64)
Heat gains from water heating, kWh/month													
	66.0221	58.1080	60.8279	53.7934	51.9915	45.6133	43.4304	48.6760	49.2219	56.2709	59.8465	64.3409	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	88.7394	86.4702	81.7580	74.7131	69.8810	63.3519	58.3741	65.4248	68.3637	75.6330	83.1201	86.4797	(72)
Total internal gains													
	427.5190	425.2510	410.1872	385.2117	359.6745	335.2136	319.8823	326.9318	340.2223	365.4222	393.6144	414.9057	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	97.0845	186.5830	301.3089	433.6023	528.4702	540.2146	514.5869	443.5879	348.2228	219.6189	120.3981	80.2871	(83)
Total gains	524.6035	611.8339	711.4961	818.8140	888.1448	875.4282	834.4692	770.5197	688.4451	585.0411	514.0125	495.1928	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9986	0.9969	0.9909	0.9674	0.8967	0.7478	0.5812	0.6439	0.8817	0.9839	0.9972	0.9990	(86)
MIT	19.6123	19.7670	20.0434	20.4117	20.7319	20.9253	20.9827	20.9721	20.8208	20.3942	19.9358	19.5862	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9982	0.9958	0.9874	0.9542	0.8545	0.6543	0.4499	0.5115	0.8165	0.9753	0.9961	0.9986	(89)
MIT 2	18.0502	18.2778	18.6815	19.2159	19.6481	19.8740	19.9185	19.9148	19.7713	19.1997	18.5320	18.0179	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.2877	18.5042	18.8885	19.3977	19.8129	20.0338	20.0802	20.0755	19.9308	19.3813	18.7454	18.2563	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2877	18.5042	18.8885	19.3977	19.8129	20.0338	20.0802	20.0755	19.9308	19.3813	18.7454	18.2563	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9936	0.9828	0.9459	0.8496	0.6648	0.4698	0.5311	0.8172	0.9691	0.9941	0.9978	(94)
Useful gains	523.0653	607.9451	699.2531	774.5406	754.5997	581.9869	392.0374	409.2573	562.5653	566.9729	510.9764	494.0877	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1639.5728	1591.1301	1445.8353	1212.7665	935.4612	620.9655	397.7147	419.3268	668.6442	1012.5326	1347.9851	1633.6208	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	830.6816	660.7003	555.4572	315.5227	134.5610	0.0000	0.0000	0.0000	0.0000	331.4965	602.6463	847.8126	(98)
Space heating												4278.8781	(98)
Space heating per m2											(98) / (4) =	44.7020	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4581.2399	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	830.6816	660.7003	555.4572	315.5227	134.5610	0.0000	0.0000	0.0000	0.0000	331.4965	602.6463	847.8126	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	889.3807	707.3879	594.7079	337.8188	144.0696	0.0000	0.0000	0.0000	0.0000	354.9213	645.2316	907.7222	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1524	87.9676	87.5329	86.5374	84.4980	80.3000	80.3000	80.3000	80.3000	86.5435	87.7315	88.2294	(217)
Fuel for water heating, kWh/month													
	239.5928	211.6475	223.4418	200.5658	198.8696	184.3102	176.5832	196.8489	199.0229	210.1599	219.1067	233.6527	(219)
Water heating fuel used												2493.8020	(219)
Annual totals kWh/year													
Space heating fuel - main system												4581.2399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Total delivered energy for all uses												7558.3358	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4581.2399	0.2160	989.5478	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.8020	0.2160	538.6612	(264)
Space and water heating			1528.2091	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Total CO2, kg/m2/year			1779.0386	(272)
Emissions per m2 for space and water heating			15.9654	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2138	(272b)
Emissions per m2 for pumps and fans			0.4067	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9654 * 1.00) + 2.2138 + 0.4067, rounded to 2 d.p.			18.5900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3180	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2703	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3446	0.3379	0.3311	0.2973	0.2906	0.2568	0.2568	0.2500	0.2703	0.2906	0.3041	0.3176	(22b)
Effective ac	0.5594	0.5571	0.5548	0.5442	0.5422	0.5330	0.5330	0.5313	0.5365	0.5422	0.5462	0.5504	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.5870	45.3991	45.2150	44.3498	44.1880	43.4345	43.4345	43.2950	43.7247	44.1880	44.5154	44.8578	(38)
Heat transfer coeff	125.6230	125.4351	125.2509	124.3858	124.2239	123.4704	123.4704	123.3309	123.7607	124.2239	124.5514	124.8937	(39)
Average = Sum(39)m / 12 =												124.3850	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3124	1.3104	1.3085	1.2995	1.2978	1.2899	1.2899	1.2885	1.2929	1.2978	1.3012	1.3048	(40)
HLP (average)												1.2995	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	492.5030	593.3379	711.0901	840.2578	925.3150	917.0626	874.2390	797.1722	699.9833	575.1757	487.2705	461.5082	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9141	52.9933	53.0713	53.4404	53.5100	53.8365	53.8365	53.8975	53.7103	53.5100	53.3693	53.2230	
alpha	4.5276	4.5329	4.5381	4.5627	4.5673	4.5891	4.5891	4.5932	4.5807	4.5673	4.5580	4.5482	
util living area													
	0.9989	0.9973	0.9913	0.9678	0.8982	0.7551	0.5929	0.6611	0.8918	0.9861	0.9978	0.9992	(86)
MIT	19.4696	19.6389	19.9403	20.3392	20.6903	20.9065	20.9762	20.9614	20.7803	20.3075	19.8111	19.4378	(87)
Th 2	19.8311	19.8327	19.8342	19.8412	19.8426	19.8487	19.8487	19.8499	19.8464	19.8426	19.8399	19.8371	(88)
util rest of house													
	0.9985	0.9963	0.9880	0.9545	0.8549	0.6575	0.4518	0.5194	0.8273	0.9783	0.9968	0.9989	(89)
MIT 2	18.4405	18.6106	18.9115	19.3074	19.6319	19.8056	19.8429	19.8389	19.7200	19.2832	18.7885	18.4134	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5969	18.7669	19.0679	19.4642	19.7928	19.9729	20.0151	20.0096	19.8812	19.4389	18.9440	18.5691	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5969	18.7669	19.0679	19.4642	19.7928	19.9729	20.0151	20.0096	19.8812	19.4389	18.9440	18.5691	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9950	0.9849	0.9489	0.8526	0.6693	0.4734	0.5408	0.8297	0.9745	0.9957	0.9985	(94)
Useful gains	491.4810	590.3460	700.3724	797.3026	788.9598	613.7464	413.8451	431.0993	580.7634	560.4841	485.1724	460.7957	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1796.0211	1739.3945	1574.1356	1314.0418	1005.3193	663.3971	421.6664	445.1714	715.4863	1098.0043	1475.1838	1794.6102	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	970.5779	772.1606	650.0799	372.0522	160.9715	0.0000	0.0000	0.0000	0.0000	399.9150	712.8082	992.3580	(98)
Space heating												5030.9233	(98)
Space heating per m2											(98) / (4) =	52.5587	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1160.6222	913.6813	937.3149	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8261	0.8942	0.8592	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	958.7335	817.0188	805.3284	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1174.8660	1122.6453	1034.4829	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	155.6154	227.3861	170.4910	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												553.4925 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.9038	56.8465	42.6227	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												138.3731 (107)
Space cooling per m2												1.4456 (108)
Energy for space heating												52.5587 (99)
Energy for space cooling												1.4456 (108)
Total												54.0044 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8674	(36)
Total fabric heat loss					(33) + (36) =		69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	97.0845	186.5830	301.3089	433.6023	528.4702	540.2146	514.5869	443.5879	348.2228	219.6189	120.3981	80.2871	(83)
Total gains	478.6338	566.6832	668.0460	778.3146	849.8192	839.8891	800.7266	733.8025	650.2372	543.8015	470.0708	450.0387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9991	0.9978	0.9930	0.9730	0.9095	0.7679	0.6021	0.6692	0.8997	0.9880	0.9981	0.9993	(86)
MIT	19.5680	19.7239	20.0031	20.3780	20.7091	20.9158	20.9799	20.9671	20.7994	20.3570	19.8937	19.5426	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9988	0.9970	0.9903	0.9618	0.8706	0.6757	0.4679	0.5347	0.8402	0.9814	0.9973	0.9991	(89)
MIT 2	18.5930	18.7503	19.0298	19.4057	19.7147	19.8850	19.9197	19.9168	19.8037	19.3912	18.9280	18.5742	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.7413	18.8983	19.1777	19.5535	19.8658	20.0417	20.0809	20.0765	19.9550	19.5380	19.0748	18.7214	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7413	18.8983	19.1777	19.5535	19.8658	20.0417	20.0809	20.0765	19.9550	19.5380	19.0748	18.7214	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9959	0.9878	0.9569	0.8684	0.6869	0.4884	0.5550	0.8425	0.9781	0.9964	0.9987	(94)
Useful gains	477.8147	564.3755	659.8854	744.8074	737.9879	576.9187	391.0786	407.2892	547.8211	531.9040	468.3902	449.4686	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1692.7390	1637.2304	1479.5890	1230.7672	941.5698	621.8660	397.7855	419.4382	671.4171	1030.6034	1386.1218	1687.6784	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	903.9037	720.9585	609.8595	349.8911	151.4650	0.0000	0.0000	0.0000	0.0000	371.0324	660.7668	921.2281	(98)
Space heating												4689.1051	(98)
Space heating per m2											(98) / (4) =	48.9877	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1074.2106	845.6551	867.0633	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8339	0.9022	0.8695	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	895.7429	762.9904	753.9369	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1084.6631	1036.7217	960.4144	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	136.0226	203.6561	153.6193	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												493.2980 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.0057	50.9140	38.4048	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												123.3245 (107)
Space cooling per m2												1.2884 (108)
Energy for space heating												48.9877 (99)
Energy for space cooling												1.2884 (108)
Total												50.2761 (109)
Target Fabric Energy Efficiency (TFEE)												57.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3199	0.2971	0.3047	0.2895	0.2895	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818	(22b)
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9189	44.3444	44.5311	44.1623	44.1623	43.9850	43.8123	43.6445	43.4813	43.9850	43.6445	43.9850	(38)
Heat transfer coeff	124.9549	124.3803	124.5671	124.1982	124.1982	124.0209	123.8483	123.6804	123.5173	124.0209	123.6804	124.0209	(39)
Average = Sum(39)m / 12 =												124.0907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3054	1.2994	1.3014	1.2975	1.2975	1.2957	1.2939	1.2921	1.2904	1.2957	1.2921	1.2957	(40)
HLP (average)												1.2964	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
RHI water heating demand												1684	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1970	53.4427	53.3626	53.5211	53.5211	53.5976	53.6723	53.7451	53.8161	53.5976	53.7451	53.5976	
alpha	4.5465	4.5628	4.5575	4.5681	4.5681	4.5732	4.5782	4.5830	4.5877	4.5732	4.5830	4.5732	
util living area													
	0.9926	0.9876	0.9689	0.9106	0.7875	0.5768	0.4271	0.4523	0.7322	0.9354	0.9847	0.9940	(86)
MIT	19.7980	19.9298	20.2263	20.5867	20.8491	20.9720	20.9943	20.9928	20.9192	20.5950	20.1496	19.7818	(87)
Th 2	19.8366	19.8413	19.8398	19.8428	19.8428	19.8442	19.8456	19.8470	19.8484	19.8442	19.8470	19.8442	(88)
util rest of house													
	0.9901	0.9834	0.9580	0.8796	0.7188	0.4710	0.3036	0.3224	0.6315	0.9048	0.9783	0.9919	(89)
MIT 2	18.2766	18.4705	18.8940	19.3912	19.7133	19.8297	19.8442	19.8452	19.7956	19.4165	18.7946	18.2586	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9774	0.9487	0.8709	0.7217	0.4862	0.3224	0.3423	0.6429	0.8964	0.9716	0.9882	(94)
Useful gains	746.8708	823.7517	914.2389	952.3128	822.7112	571.1113	360.1162	359.3181	609.0991	734.8142	721.3480	705.6605	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1700.3699	1665.7373	1506.8328	1251.0390	917.3229	583.3128	361.5172	361.1023	650.4923	1016.4333	1372.9206	1673.0544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.4033	565.8143	440.8899	215.0828	70.3911	0.0000	0.0000	0.0000	0.0000	209.5246	469.1322	719.7410	(98)
Space heating												3399.9793	(98)
RHI space heating demand												3400	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3885	0.3809	0.3733	0.3352	0.3276	0.2895	0.2895	0.2818	0.3047	0.3276	0.3428	0.3580	(22b)
Effective ac	0.5755	0.5725	0.5697	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5588	0.5641	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8980	46.6592	46.4251	45.3256	45.1199	44.1623	44.1623	43.9850	44.5311	45.1199	45.5360	45.9711	(38)
Heat transfer coeff	126.9339	126.6951	126.4610	125.3615	125.1558	124.1982	124.1982	124.0209	124.5671	125.1558	125.5720	126.0070	(39)
Average = Sum(39)m / 12 =												125.3606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3261	1.3236	1.3212	1.3097	1.3075	1.2975	1.2975	1.2957	1.3014	1.3075	1.3119	1.3164	(40)
HLP (average)												1.3097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	727.1056	824.5153	931.5997	1045.5269	1115.6621	1094.9729	1045.8957	973.7429	886.3384	776.8521	705.0715	690.8405	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3676	52.4663	52.5634	53.0244	53.1116	53.5211	53.5211	53.5976	53.3626	53.1116	52.9356	52.7528	
alpha	4.4912	4.4978	4.5042	4.5350	4.5408	4.5681	4.5681	4.5732	4.5575	4.5408	4.5290	4.5169	
util living area													
	0.9946	0.9898	0.9761	0.9341	0.8364	0.6706	0.5093	0.5637	0.8072	0.9590	0.9901	0.9957	(86)
MIT	19.6723	19.8362	20.1205	20.4849	20.7799	20.9421	20.9868	20.9794	20.8625	20.4691	20.0018	19.6391	(87)
Th 2	19.8204	19.8224	19.8243	19.8333	19.8349	19.8428	19.8428	19.8442	19.8398	19.8349	19.8315	19.8280	(88)
util rest of house													
	0.9928	0.9864	0.9678	0.9105	0.7801	0.5709	0.3820	0.4329	0.7226	0.9393	0.9861	0.9943	(89)
MIT 2	18.0825	18.3217	18.7325	19.2487	19.6285	19.8064	19.8383	19.8364	19.7356	19.2397	18.5705	18.0394	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3241	18.5519	18.9435	19.4366	19.8035	19.9790	20.0129	20.0101	19.9069	19.4266	18.7880	18.2826	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3241	18.5519	18.9435	19.4366	19.8035	19.9790	20.0129	20.0101	19.9069	19.4266	18.7880	18.2826	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9810	0.9593	0.9005	0.7784	0.5835	0.4014	0.4526	0.7283	0.9301	0.9809	0.9913	(94)
Useful gains	719.3367	808.8393	893.6377	941.5093	868.4343	638.9461	419.7780	440.7146	645.4942	722.5203	691.5986	684.8559	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1780.1380	1729.6283	1573.6186	1320.8837	1014.2063	668.0644	423.8761	447.7327	723.3452	1104.6964	1467.6900	1774.5032	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	789.2361	618.7702	505.9058	273.1496	108.4543	0.0000	0.0000	0.0000	0.0000	284.3390	558.7858	810.6976	(98)
Space heating												3949.3384	(98)
Space heating per m2											(98) / (4) =	41.2593	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4251.1716	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	789.2361	618.7702	505.9058	273.1496	108.4543	0.0000	0.0000	0.0000	0.0000	284.3390	558.7858	810.6976	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	849.5545	666.0605	544.5702	294.0254	116.7431	0.0000	0.0000	0.0000	0.0000	306.0700	601.4917	872.6562	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3100	89.2544	89.1231	88.8026	88.1103	86.7000	86.7000	86.7000	86.7000	88.8047	89.1876	89.3368	(217)
Fuel for water heating, kWh/month													
	192.6707	168.9875	175.5202	154.8184	150.6504	133.5081	125.0945	141.5841	142.6920	160.6933	173.0476	186.9445	(219)
Water heating fuel used												1906.2114	(219)
Annual totals kWh/year													
Space heating fuel - main system												4251.1716	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6052.3872	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4251.1716	3.4800	147.9408	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1906.2114	3.4800	66.3362	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			320.4280	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9564	(257)
SAP value		86.6587	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4251.1716	0.2160	918.2531	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1906.2114	0.2160	411.7417	(264)
Space and water heating			1329.9947	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1275.5019	(272)
CO2 emissions per m2			13.3300	(273)
EI value			87.8541	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3199	0.2971	0.3047	0.2895	0.2895	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818	(22b)
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9189	44.3444	44.5311	44.1623	44.1623	43.9850	43.8123	43.6445	43.4813	43.9850	43.6445	43.9850	(38)
Heat transfer coeff	124.9549	124.3803	124.5671	124.1982	124.1982	124.0209	123.8483	123.6804	123.5173	124.0209	123.6804	124.0209	(39)
Average = Sum(39)m / 12 =												124.0907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3054	1.2994	1.3014	1.2975	1.2975	1.2957	1.2939	1.2921	1.2904	1.2957	1.2921	1.2957	(40)
HLP (average)												1.2964	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1970	53.4427	53.3626	53.5211	53.5211	53.5976	53.6723	53.7451	53.8161	53.5976	53.7451	53.5976	
alpha	4.5465	4.5628	4.5575	4.5681	4.5681	4.5732	4.5782	4.5830	4.5877	4.5732	4.5830	4.5732	
util living area													
	0.9926	0.9876	0.9689	0.9106	0.7875	0.5768	0.4271	0.4523	0.7322	0.9354	0.9847	0.9940	(86)
MIT	19.7980	19.9298	20.2263	20.5867	20.8491	20.9720	20.9943	20.9928	20.9192	20.5950	20.1496	19.7818	(87)
Th 2	19.8366	19.8413	19.8398	19.8428	19.8428	19.8442	19.8456	19.8470	19.8484	19.8442	19.8470	19.8442	(88)
util rest of house													
	0.9901	0.9834	0.9580	0.8796	0.7188	0.4710	0.3036	0.3224	0.6315	0.9048	0.9783	0.9919	(89)
MIT 2	18.2766	18.4705	18.8940	19.3912	19.7133	19.8297	19.8442	19.8452	19.7956	19.4165	18.7946	18.2586	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9774	0.9487	0.8709	0.7217	0.4862	0.3224	0.3423	0.6429	0.8964	0.9716	0.9882	(94)
Useful gains	746.8708	823.7517	914.2389	952.3128	822.7112	571.1113	360.1162	359.3181	609.0991	734.8142	721.3480	705.6605	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1700.3699	1665.7373	1506.8328	1251.0390	917.3229	583.3128	361.5172	361.1023	650.4923	1016.4333	1372.9206	1673.0544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	709.4033	565.8143	440.8899	215.0828	70.3911	0.0000	0.0000	0.0000	0.0000	209.5246	469.1322	719.7410	(98)
Space heating												3399.9793	(98)
Space heating per m2											(98) / (4) =	35.5201	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3659.8271	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	709.4033	565.8143	440.8899	215.0828	70.3911	0.0000	0.0000	0.0000	0.0000	209.5246	469.1322	719.7410	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	763.6204	609.0574	474.5854	231.5208	75.7708	0.0000	0.0000	0.0000	0.0000	225.5378	504.9863	774.7481	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2569	89.2070	89.0394	88.6245	87.7828	86.7000	86.7000	86.7000	86.7000	88.5755	89.0861	89.2794	(217)
Fuel for water heating, kWh/month													
	192.7852	169.0772	175.6852	155.1297	151.2124	133.5081	125.0945	141.5841	142.6920	161.1092	173.2448	187.0647	(219)
Water heating fuel used												1908.1871	(219)
Annual totals kWh/year													
Space heating fuel - main system												3659.8271	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												5383.2087	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3659.8271	7.3800	270.0952	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1908.1871	7.3800	140.8242	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			464.9542	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3659.8271	0.2160	790.5226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1908.1871	0.2160	412.1684	(264)
Space and water heating			1202.6911	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			1106.7770	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3659.8271	1.2200	4464.9890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1908.1871	1.2200	2327.9883	(264)
Space and water heating			6792.9773	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			6225.6244	(272)
Primary energy kWh/m2/year			65.0400	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-192 kg (17.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.01 kg/m²	B 88	B 90
Total Savings	£60	2.01 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£153	-£14
Mains gas	£518	£443	£75
Space heating	£399	£399	£0
Water heating	£141	£81	£60
Lighting	£117	£117	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£466	£405	£61
Total cost of uses	£466	£406	£60
Delivered energy	56 kWh/m²	46 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	10 kg/m²	2 kg/m²
Primary energy	65 kWh/m²	54 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3885	0.3809	0.3733	0.3352	0.3276	0.2895	0.2895	0.2818	0.3047	0.3276	0.3428	0.3580	(22b)
Effective ac	0.5755	0.5725	0.5697	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5588	0.5641	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.8980	46.6592	46.4251	45.3256	45.1199	44.1623	44.1623	43.9850	44.5311	45.1199	45.5360	45.9711	(38)
Heat transfer coeff	126.9339	126.6951	126.4610	125.3615	125.1558	124.1982	124.1982	124.0209	124.5671	125.1558	125.5720	126.0070	(39)
Average = Sum(39)m / 12 =												125.3606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3261	1.3236	1.3212	1.3097	1.3075	1.2975	1.2975	1.2957	1.3014	1.3075	1.3119	1.3164	(40)
HLP (average)												1.3097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1734	(H8)
Utilisation factor												0.5735	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-865.2518	(H17)
Solar input	-25.0906	-41.8690	-71.3076	-95.5663	-118.0641	-116.0758	-114.5418	-100.0758	-78.3794	-53.5239	-29.7610	-20.9965	(63)
								Solar input (sum of months) = Sum(63)m =				-865.2518	(63)
Output from w/h													
	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
									Total per year (kWh/year) = Sum(64)m =			825.4368	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	727.1056	824.5153	931.5997	1045.5269	1115.6621	1094.9729	1045.8957	973.7429	886.3384	776.8521	705.0715	690.8405	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3676	52.4663	52.5634	53.0244	53.1116	53.5211	53.5211	53.5976	53.3626	53.1116	52.9356	52.7528	
alpha	4.4912	4.4978	4.5042	4.5350	4.5408	4.5681	4.5681	4.5732	4.5575	4.5408	4.5290	4.5169	
util living area													
	0.9946	0.9898	0.9761	0.9341	0.8364	0.6706	0.5093	0.5637	0.8072	0.9590	0.9901	0.9957	(86)
MIT	19.6723	19.8362	20.1205	20.4849	20.7799	20.9421	20.9868	20.9794	20.8625	20.4691	20.0018	19.6391	(87)
Th 2	19.8204	19.8224	19.8243	19.8333	19.8349	19.8428	19.8428	19.8442	19.8398	19.8349	19.8315	19.8280	(88)
util rest of house													
	0.9928	0.9864	0.9678	0.9105	0.7801	0.5709	0.3820	0.4329	0.7226	0.9393	0.9861	0.9943	(89)
MIT 2	18.0825	18.3217	18.7325	19.2487	19.6285	19.8064	19.8383	19.8364	19.7356	19.2397	18.5705	18.0394	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.3241	18.5519	18.9435	19.4366	19.8035	19.9790	20.0129	20.0101	19.9069	19.4266	18.7880	18.2826	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3241	18.5519	18.9435	19.4366	19.8035	19.9790	20.0129	20.0101	19.9069	19.4266	18.7880	18.2826	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9810	0.9593	0.9005	0.7784	0.5835	0.4014	0.4526	0.7283	0.9301	0.9809	0.9913	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	719.3367	808.8393	893.6377	941.5093	868.4343	638.9461	419.7780	440.7146	645.4942	722.5203	691.5986	684.8559	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1780.1380	1729.6283	1573.6186	1320.8837	1014.2063	668.0644	423.8761	447.7327	723.3452	1104.6964	1467.6900	1774.5032	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	789.2361	618.7702	505.9058	273.1496	108.4543	0.0000	0.0000	0.0000	0.0000	284.3390	558.7858	810.6976	(98)
Space heating												3949.3384	(98)
Space heating per m2											(98) / (4) =	41.2593	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4251.1716	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	789.2361	618.7702	505.9058	273.1496	108.4543	0.0000	0.0000	0.0000	0.0000	284.3390	558.7858	810.6976	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	849.5545	666.0605	544.5702	294.0254	116.7431	0.0000	0.0000	0.0000	0.0000	306.0700	601.4917	872.6562	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3821	89.4059	89.4246	89.4607	89.5063	86.7000	86.7000	86.7000	86.7000	89.1147	89.2992	89.3964	(217)
Fuel for water heating, kWh/month	164.4441	121.8708	95.1878	46.8547	16.3948	0.0000	0.0000	26.1564	52.2890	100.0725	139.5041	163.3328	(219)
Water heating fuel used												926.1072	(219)
Annual totals kWh/year													
Space heating fuel - main system												4251.1716	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5122.2830	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4251.1716	3.4800	147.9408	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	926.1072	3.4800	32.2285	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			292.9154	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8742	(257)
SAP value		87.8042	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4251.1716	0.2160	918.2531	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	926.1072	0.2160	200.0391	(264)
Space and water heating			1118.2922	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	408.2938	0.5190	211.9045 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1089.7494 (272)
CO2 emissions per m2			11.3800 (273)
EI value			89.6229
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		3.9300	
Infiltration rate		0.3585	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3047	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3199	0.2971	0.3047	0.2895	0.2895	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818	(22b)
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.9189	44.3444	44.5311	44.1623	44.1623	43.9850	43.8123	43.6445	43.4813	43.9850	43.6445	43.9850	(38)
Heat transfer coeff	124.9549	124.3803	124.5671	124.1982	124.1982	124.0209	123.8483	123.6804	123.5173	124.0209	123.6804	124.0209	(39)
Average = Sum(39)m / 12 =												124.0907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3054	1.2994	1.3014	1.2975	1.2975	1.2957	1.2939	1.2921	1.2904	1.2957	1.2921	1.2957	(40)
HLP (average)												1.2964	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3132	(H8)
Utilisation factor												0.5330	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-899.9616	(H17)
Solar input	-29.3589	-41.7465	-71.7522	-96.8104	-113.7096	-121.4598	-118.9055	-106.4240	-83.3227	-57.6064	-34.7239	-24.1416	(63)
								Solar input (sum of months) = Sum(63)m =				-899.9616	(63)
Output from w/h													
	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
								Total per year (kWh/year) = Sum(64)m =				800.4747	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1970	53.4427	53.3626	53.5211	53.5211	53.5976	53.6723	53.7451	53.8161	53.5976	53.7451	53.5976	
alpha	4.5465	4.5628	4.5575	4.5681	4.5681	4.5732	4.5782	4.5830	4.5877	4.5732	4.5830	4.5732	
util living area													
	0.9926	0.9876	0.9689	0.9106	0.7875	0.5768	0.4271	0.4523	0.7322	0.9354	0.9847	0.9940	(86)
MIT	19.7980	19.9298	20.2263	20.5867	20.8491	20.9720	20.9943	20.9928	20.9192	20.5950	20.1496	19.7818	(87)
Th 2	19.8366	19.8413	19.8398	19.8428	19.8428	19.8442	19.8456	19.8470	19.8484	19.8442	19.8470	19.8442	(88)
util rest of house													
	0.9901	0.9834	0.9580	0.8796	0.7188	0.4710	0.3036	0.3224	0.6315	0.9048	0.9783	0.9919	(89)
MIT 2	18.2766	18.4705	18.8940	19.3912	19.7133	19.8297	19.8442	19.8452	19.7956	19.4165	18.7946	18.2586	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5079	18.6923	19.0966	19.5729	19.8860	20.0033	20.0190	20.0196	19.9664	19.5957	19.0005	18.4901	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9774	0.9487	0.8709	0.7217	0.4862	0.3224	0.3423	0.6429	0.8964	0.9716	0.9882	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	746.8708	823.7517	914.2389	952.3128	822.7112	571.1113	360.1162	359.3181	609.0991	734.8142	721.3480	705.6605	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1700.3699	1665.7373	1506.8328	1251.0390	917.3229	583.3128	361.5172	361.1023	650.4923	1016.4333	1372.9206	1673.0544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	709.4033	565.8143	440.8899	215.0828	70.3911	0.0000	0.0000	0.0000	0.0000	209.5246	469.1322	719.7410	(98)
Space heating												3399.9793	(98)
Space heating per m2											(98) / (4) =	35.5201	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3659.8271	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	709.4033	565.8143	440.8899	215.0828	70.3911	0.0000	0.0000	0.0000	0.0000	209.5246	469.1322	719.7410	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	763.6204	609.0574	474.5854	231.5208	75.7708	0.0000	0.0000	0.0000	0.0000	225.5378	504.9863	774.7481	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3477	89.3669	89.3686	89.3754	89.1994	86.7000	86.7000	86.7000	86.7000	88.9517	89.2309	89.3538	(217)
Fuel for water heating, kWh/month	159.7302	122.0611	94.7501	45.5074	21.3330	0.0000	0.0000	18.8343	46.5874	95.6663	134.0490	159.8909	(219)
Water heating fuel used												898.4098	(219)
Annual totals kWh/year													
Space heating fuel - main system												3659.8271	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4423.4313	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3659.8271	7.3800	270.0952	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	898.4098	7.3800	66.3026	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			404.7626	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3659.8271	0.2160	790.5226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.4098	0.2160	194.0565	(264)
Space and water heating			984.5792	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			914.6151	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3659.8271	1.2200	4464.9890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.4098	1.2200	1096.0599	(264)
Space and water heating			5561.0489	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			5147.1960	(272)
Primary energy kWh/m2/year			53.7735	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	651.97	(P1)
Transmission heat loss coefficient	80.04	(37)
Summer heat loss coefficient	732.00	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.7100	87.1704	0.7200	0.7000	0.7650	21.4764
East	9.0500	125.2818	0.7200	0.7000	0.7650	393.4332
South	0.7100	118.5567	0.7200	0.7000	0.7650	29.2091
West	5.0500	125.2818	0.7200	0.7000	0.7650	219.5401
total:						663.6588

	Jun	Jul	Aug	
Solar gains	714	664	585	(P3)
Internal gains	475	455	464	
Total summer gains	1188	1118	1049	(P5)
Summer gain/loss ratio	1.62	1.53	1.43	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.08	18.98	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 409 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	1 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	87 B	**DER**	15.16	**TER**	18.59
Environmental	88 B	**% DER<TER**	18.43		
CO_2 Emissions (t/year)	1.07	**DFEE**	54.00	**TFEE**	57.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.60		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.16	$kgCO_2/m^2$	Pass
	-3.43 (-18.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.82	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.00	$kWh/m^2/yr$	
	-3.8 (-6.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.93 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	9.05 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.93 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 410 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	87 B	**DER**	15.24	**TER**	18.59
Environmental	88 B	**% DER<TER**	18.00		
CO_2 Emissions (t/year)	1.07	**DFEE**	54.36	**TFEE**	57.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 96 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.24 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.39 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.71 m², No overhang
Windows facing East: 9.05 m², No overhang
Windows facing South: 0.71 m², No overhang
Windows facing West: 5.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3815	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4134	0.4053	0.3972	0.3567	0.3486	0.3080	0.3080	0.2999	0.3243	0.3486	0.3648	0.3810	(22b)
Effective ac	0.5855	0.5821	0.5789	0.5636	0.5608	0.5474	0.5474	0.5450	0.5526	0.5608	0.5665	0.5726	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.7125	47.4420	47.1769	45.9319	45.6989	44.6145	44.6145	44.4137	45.0322	45.6989	46.1702	46.6628	(38)
Heat transfer coeff	127.7484	127.4780	127.2129	125.9678	125.7349	124.6504	124.6504	124.4496	125.0681	125.7349	126.2061	126.6988	(39)
Average = Sum(39)m / 12 =												125.9667	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3346	1.3318	1.3290	1.3160	1.3136	1.3022	1.3022	1.3001	1.3066	1.3136	1.3185	1.3236	(40)
HLP (average)												1.3160	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	414.3696	412.0990	397.0299	372.6834	347.8122	324.0158	308.6796	315.0648	327.6871	352.2580	380.4587	401.7538	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	525.3234	625.3367	741.3830	868.2289	951.7781	941.4040	896.7789	822.0224	725.6560	603.2511	518.0565	493.5105	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.0337	52.1441	52.2527	52.7692	52.8670	53.3269	53.3269	53.4130	53.1488	52.8670	52.6696	52.4648	
alpha	4.4689	4.4763	4.4835	4.5179	4.5245	4.5551	4.5551	4.5609	4.5433	4.5245	4.5113	4.4977	
util living area													
	0.9986	0.9966	0.9899	0.9646	0.8921	0.7463	0.5845	0.6496	0.8827	0.9835	0.9971	0.9989	(86)
MIT	19.4728	19.6427	19.9446	20.3460	20.6949	20.9091	20.9768	20.9632	20.7878	20.3194	19.8218	19.4445	(87)
Th 2	19.8138	19.8160	19.8182	19.8283	19.8302	19.8391	19.8391	19.8407	19.8357	19.8302	19.8264	19.8224	(88)
util rest of house													
	0.9981	0.9954	0.9860	0.9500	0.8470	0.6475	0.4436	0.5078	0.8149	0.9744	0.9959	0.9985	(89)
MIT 2	17.7874	18.0369	18.4777	19.0587	19.5286	19.7782	19.8308	19.8257	19.6596	19.0310	18.3063	17.7516	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.0436	18.2810	18.7007	19.2544	19.7059	19.9501	20.0050	19.9986	19.8311	19.2268	18.5367	18.0089	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0436	18.2810	18.7007	19.2544	19.7059	19.9501	20.0050	19.9986	19.8311	19.2268	18.5367	18.0089	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9929	0.9806	0.9405	0.8411	0.6580	0.4649	0.5287	0.8145	0.9675	0.9937	0.9976	(94)
Useful gains	523.6455	620.8824	727.0289	816.6021	800.5851	619.4637	416.9111	434.6154	591.0586	583.6542	514.7810	492.3145	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1755.7202	1705.7830	1552.0832	1304.3167	1006.6190	666.8958	424.4343	447.8418	716.7723	1084.6945	1443.3796	1749.5772	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	916.6636	729.0531	613.8404	351.1545	153.2892	0.0000	0.0000	0.0000	0.0000	372.7740	668.5910	935.4034	(98)
Space heating												4740.7692	(98)
Space heating per m2										(98) / (4) =		49.5275	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5103.0885	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	916.6636	729.0531	613.8404	351.1545	153.2892	0.0000	0.0000	0.0000	0.0000	372.7740	668.5910	935.4034	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	986.7208	784.7720	660.7539	377.9919	165.0045	0.0000	0.0000	0.0000	0.0000	401.2637	719.6889	1006.8928	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3786	89.3348	89.2312	88.9760	88.3861	86.7000	86.7000	86.7000	86.7000	88.9907	89.2820	89.4001	(217)
Fuel for water heating, kWh/month													
	192.5227	168.8354	175.3076	154.5168	150.1803	133.5081	125.0945	141.5841	142.6920	160.3574	172.8646	186.8120	(219)
Water heating fuel used												1904.2756	(219)
Annual totals kWh/year													
Space heating fuel - main system												5103.0885	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6902.3684	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5103.0885	0.2160	1102.2671	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1904.2756	0.2160	411.3235	(264)
Space and water heating			1513.5906	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1459.0979	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.2400	ZC1
Total Floor Area	TFA	95.7200	
Assumed number of occupants	N	2.6962	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.4284	ZC2
CO2 emissions from cooking, equation (L16)		1.9192	ZC3
Total CO2 emissions		32.5877	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.5877	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8674	(36)
Total fabric heat loss (33) + (36) =	69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962 (42)
Average daily hot water use (litres/day)	98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4758	47.0560	43.6002	45.0536	47.0560	47.4758	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
								Total per year (kWh/year) = Sum(64)m =				2122.5163	(64)
Heat gains from water heating, kWh/month													
	66.0221	58.1080	60.8279	53.7934	51.9915	45.6133	43.4304	48.6760	49.2219	56.2709	59.8465	64.3409	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	88.7394	86.4702	81.7580	74.7131	69.8810	63.3519	58.3741	65.4248	68.3637	75.6330	83.1201	86.4797	(72)
Total internal gains													
	427.5190	425.2510	410.1872	385.2117	359.6745	335.2136	319.8823	326.9318	340.2223	365.4222	393.6144	414.9057	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	97.0845	186.5830	301.3089	433.6023	528.4702	540.2146	514.5869	443.5879	348.2228	219.6189	120.3981	80.2871	(83)
Total gains	524.6035	611.8339	711.4961	818.8140	888.1448	875.4282	834.4692	770.5197	688.4451	585.0411	514.0125	495.1928	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9986	0.9969	0.9909	0.9674	0.8967	0.7478	0.5812	0.6439	0.8817	0.9839	0.9972	0.9990	(86)
MIT	19.6123	19.7670	20.0434	20.4117	20.7319	20.9253	20.9827	20.9721	20.8208	20.3942	19.9358	19.5862	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9982	0.9958	0.9874	0.9542	0.8545	0.6543	0.4499	0.5115	0.8165	0.9753	0.9961	0.9986	(89)
MIT 2	18.0502	18.2778	18.6815	19.2159	19.6481	19.8740	19.9185	19.9148	19.7713	19.1997	18.5320	18.0179	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.2877	18.5042	18.8885	19.3977	19.8129	20.0338	20.0802	20.0755	19.9308	19.3813	18.7454	18.2563	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2877	18.5042	18.8885	19.3977	19.8129	20.0338	20.0802	20.0755	19.9308	19.3813	18.7454	18.2563	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9936	0.9828	0.9459	0.8496	0.6648	0.4698	0.5311	0.8172	0.9691	0.9941	0.9978	(94)
Useful gains	523.0653	607.9451	699.2531	774.5406	754.5997	581.9869	392.0374	409.2573	562.5653	566.9729	510.9764	494.0877	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1639.5728	1591.1301	1445.8353	1212.7665	935.4612	620.9655	397.7147	419.3268	668.6442	1012.5326	1347.9851	1633.6208	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	830.6816	660.7003	555.4572	315.5227	134.5610	0.0000	0.0000	0.0000	0.0000	331.4965	602.6463	847.8126	(98)
Space heating												4278.8781	(98)
Space heating per m2											(98) / (4) =	44.7020	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4581.2399	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	830.6816	660.7003	555.4572	315.5227	134.5610	0.0000	0.0000	0.0000	0.0000	331.4965	602.6463	847.8126	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	889.3807	707.3879	594.7079	337.8188	144.0696	0.0000	0.0000	0.0000	0.0000	354.9213	645.2316	907.7222	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	211.2067	186.1812	195.5850	173.5644	168.0409	148.0011	141.7963	158.0697	159.8154	181.8798	192.2255	206.1504	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1524	87.9676	87.5329	86.5374	84.4980	80.3000	80.3000	80.3000	80.3000	86.5435	87.7315	88.2294	(217)
Fuel for water heating, kWh/month													
	239.5928	211.6475	223.4418	200.5658	198.8696	184.3102	176.5832	196.8489	199.0229	210.1599	219.1067	233.6527	(219)
Water heating fuel used												2493.8020	(219)
Annual totals kWh/year													
Space heating fuel - main system												4581.2399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Total delivered energy for all uses												7558.3358	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4581.2399	0.2160	989.5478	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2493.8020	0.2160	538.6612	(264)
Space and water heating			1528.2091	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Total CO2, kg/m2/year			1779.0386	(272)
Emissions per m2 for space and water heating			15.9654	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2138	(272b)
Emissions per m2 for pumps and fans			0.4067	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9654 * 1.00) + 2.2138 + 0.4067, rounded to 2 d.p.			18.5900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3410	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2898	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3695	0.3623	0.3550	0.3188	0.3116	0.2753	0.2753	0.2681	0.2898	0.3116	0.3261	0.3406	(22b)
Effective ac	0.5683	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5532	0.5580	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3124	46.0963	45.8845	44.8897	44.7036	43.8372	43.8372	43.6767	44.1709	44.7036	45.0801	45.4738	(38)
Heat transfer coeff	126.3483	126.1323	125.9205	124.9257	124.7396	123.8731	123.8731	123.7127	124.2069	124.7396	125.1161	125.5097	(39)
Average = Sum(39)m / 12 =												124.9248	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3200	1.3177	1.3155	1.3051	1.3032	1.2941	1.2941	1.2924	1.2976	1.3032	1.3071	1.3112	(40)
HLP (average)												1.3051	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	492.5030	593.3379	711.0901	840.2578	925.3150	917.0626	874.2390	797.1722	699.9833	575.1757	487.2705	461.5082	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.6103	52.7004	52.7890	53.2094	53.2888	53.6615	53.6615	53.7311	53.5173	53.2888	53.1284	52.9618	
alpha	4.5074	4.5134	4.5193	4.5473	4.5526	4.5774	4.5774	4.5821	4.5678	4.5526	4.5419	4.5308	
util living area													
	0.9989	0.9973	0.9913	0.9680	0.8989	0.7563	0.5944	0.6624	0.8925	0.9861	0.9978	0.9992	(86)
MIT	19.4601	19.6300	19.9324	20.3338	20.6866	20.9052	20.9757	20.9608	20.7780	20.3031	19.8049	19.4297	(87)
Th 2	19.8252	19.8270	19.8287	19.8368	19.8383	19.8454	19.8454	19.8468	19.8427	19.8383	19.8353	19.8321	(88)
util rest of house													
	0.9985	0.9963	0.9880	0.9547	0.8557	0.6586	0.4527	0.5203	0.8280	0.9784	0.9968	0.9989	(89)
MIT 2	18.4264	18.5972	18.8993	19.2986	19.6251	19.8016	19.8394	19.8356	19.7150	19.2755	18.7787	18.4014	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.5835	18.7542	19.0564	19.4560	19.7865	19.9694	20.0122	20.0067	19.8766	19.4317	18.9347	18.5577	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5835	18.7542	19.0564	19.4560	19.7865	19.9694	20.0122	20.0067	19.8766	19.4317	18.9347	18.5577	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9949	0.9850	0.9491	0.8534	0.6703	0.4743	0.5418	0.8304	0.9745	0.9957	0.9984	(94)
Useful gains	491.4745	590.3385	700.3884	797.4798	789.6460	614.7178	414.6951	431.8752	581.2511	560.5166	485.1668	460.7911	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1804.7021	1747.4633	1581.1017	1318.7098	1008.7043	665.1213	422.6741	446.1899	717.4903	1101.6641	1480.7102	1802.0312	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	977.0413	777.5879	655.2507	375.2856	162.9794	0.0000	0.0000	0.0000	0.0000	402.6137	716.7913	997.8826	(98)
Space heating												5065.4324	(98)
Space heating per m2											(98) / (4) =	52.9193	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1164.4075	916.6612	940.2165	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8244	0.8929	0.8577	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	959.8860	818.4537	806.4355	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1174.8660	1122.6453	1034.4829	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	154.7856	226.3186	169.6673	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												550.7715 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.6964	56.5797	42.4168	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												137.6929 (107)
Space cooling per m2												1.4385 (108)
Energy for space heating												52.9193 (99)
Energy for space cooling												1.4385 (108)
Total												54.3578 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1215	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3715	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3158	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4026	0.3947	0.3868	0.3473	0.3394	0.3000	0.3000	0.2921	0.3158	0.3394	0.3552	0.3710	(22b)
Effective ac	0.5810	0.5779	0.5748	0.5603	0.5576	0.5450	0.5450	0.5427	0.5499	0.5576	0.5631	0.5688	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.5200	1.3258	20.5758			(27)
Ground floor			47.8600	0.1300	6.2218			(28a)
External Wall	147.8200	17.6400	130.1800	0.1800	23.4324			(29a)
Main Roof	47.8600		47.8600	0.1300	6.2218			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.9958			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8674	(36)
Total fabric heat loss					(33) + (36) =		69.8632	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.3524	47.0959	46.8445	45.6638	45.4429	44.4146	44.4146	44.2241	44.8107	45.4429	45.8898	46.3570	(38)
Heat transfer coeff	117.2155	116.9591	116.7077	115.5270	115.3061	114.2777	114.2777	114.0873	114.6738	115.3061	115.7530	116.2202	(39)
Average = Sum(39)m / 12 =												115.5259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2246	1.2219	1.2193	1.2069	1.2046	1.1939	1.1939	1.1919	1.1980	1.2046	1.2093	1.2142	(40)
HLP (average)												1.2069	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.0527	29.7827	30.7331	26.7938	25.7093	22.1852	20.5578	23.5904	23.8722	27.8207	30.3685	32.9782	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	134.8108	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1193	20.5343	16.6997	12.6427	9.4506	7.9786	8.6211	11.2061	15.0408	19.0977	22.2898	23.7618	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.2171	251.8032	245.2863	231.4127	213.8997	197.4399	186.4438	183.8577	190.3746	204.2483	221.7612	238.2210	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	36.4811	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	45.7697	44.3195	41.3079	37.2136	34.5555	30.8127	27.6315	31.7075	33.1558	37.3934	42.1784	44.3255	(72)
Total internal gains													
	381.5493	380.1002	366.7371	344.7123	321.3490	299.6745	286.1397	290.2146	302.0144	324.1826	349.6727	369.7516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.6300	0.7000	0.7700	2.3073	(74)
East	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(76)
South	0.7100	46.7521	0.6300	0.7000	0.7700	10.1445	(78)
West	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117	(80)

Solar gains	97.0845	186.5830	301.3089	433.6023	528.4702	540.2146	514.5869	443.5879	348.2228	219.6189	120.3981	80.2871	(83)
Total gains	478.6338	566.6832	668.0460	778.3146	849.8192	839.8891	800.7266	733.8025	650.2372	543.8015	470.0708	450.0387	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7094	56.8337	56.9562	57.5383	57.6485	58.1673	58.1673	58.2644	57.9663	57.6485	57.4259	57.1951	
alpha	4.7806	4.7889	4.7971	4.8359	4.8432	4.8778	4.8778	4.8843	4.8644	4.8432	4.8284	4.8130	
util living area													
	0.9991	0.9978	0.9930	0.9730	0.9095	0.7679	0.6021	0.6692	0.8997	0.9880	0.9981	0.9993	(86)
MIT	19.5680	19.7239	20.0031	20.3780	20.7091	20.9158	20.9799	20.9671	20.7994	20.3570	19.8937	19.5426	(87)
Th 2	19.9004	19.9025	19.9046	19.9145	19.9163	19.9249	19.9249	19.9265	19.9216	19.9163	19.9126	19.9087	(88)
util rest of house													
	0.9988	0.9970	0.9903	0.9618	0.8706	0.6757	0.4679	0.5347	0.8402	0.9814	0.9973	0.9991	(89)
MIT 2	18.5930	18.7503	19.0298	19.4057	19.7147	19.8850	19.9197	19.9168	19.8037	19.3912	18.9280	18.5742	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.7413	18.8983	19.1777	19.5535	19.8658	20.0417	20.0809	20.0765	19.9550	19.5380	19.0748	18.7214	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7413	18.8983	19.1777	19.5535	19.8658	20.0417	20.0809	20.0765	19.9550	19.5380	19.0748	18.7214	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9959	0.9878	0.9569	0.8684	0.6869	0.4884	0.5550	0.8425	0.9781	0.9964	0.9987	(94)
Useful gains	477.8147	564.3755	659.8854	744.8074	737.9879	576.9187	391.0786	407.2892	547.8211	531.9040	468.3902	449.4686	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1692.7390	1637.2304	1479.5890	1230.7672	941.5698	621.8660	397.7855	419.4382	671.4171	1030.6034	1386.1218	1687.6784	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	903.9037	720.9585	609.8595	349.8911	151.4650	0.0000	0.0000	0.0000	0.0000	371.0324	660.7668	921.2281	(98)
Space heating												4689.1051	(98)
Space heating per m2											(98) / (4) =	48.9877	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1074.2106	845.6551	867.0633	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8339	0.9022	0.8695	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	895.7429	762.9904	753.9369	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1084.6631	1036.7217	960.4144	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	136.0226	203.6561	153.6193	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												493.2980 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.0057	50.9140	38.4048	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												123.3245 (107)
Space cooling per m2												1.2884 (108)
Energy for space heating												48.9877 (99)
Energy for space cooling												1.2884 (108)
Total												50.2761 (109)
Target Fabric Energy Efficiency (TFEE)												57.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3815	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3405	0.3161	0.3243	0.3080	0.3080	0.2999	0.2918	0.2837	0.2756	0.2999	0.2837	0.2999	(22b)
Effective ac	0.5580	0.5500	0.5526	0.5474	0.5474	0.5450	0.5426	0.5402	0.5380	0.5450	0.5402	0.5450	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4713	44.8207	45.0322	44.6145	44.6145	44.4137	44.2182	44.0281	43.8433	44.4137	44.0281	44.4137	(38)
Heat transfer coeff	125.5073	124.8566	125.0681	124.6504	124.6504	124.4496	124.2541	124.0640	123.8793	124.4496	124.0640	124.4496	(39)
Average = Sum(39)m / 12 =												124.5286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3112	1.3044	1.3066	1.3022	1.3022	1.3001	1.2981	1.2961	1.2942	1.3001	1.2961	1.3001	(40)
HLP (average)												1.3010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
RHI water heating demand												1684	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9629	53.2389	53.1488	53.3269	53.3269	53.4130	53.4970	53.5790	53.6589	53.4130	53.5790	53.4130	
alpha	4.5309	4.5493	4.5433	4.5551	4.5551	4.5609	4.5665	4.5719	4.5773	4.5609	4.5719	4.5609	
util living area													
	0.9926	0.9876	0.9690	0.9111	0.7887	0.5784	0.4284	0.4536	0.7333	0.9358	0.9847	0.9940	(86)
MIT	19.7908	19.9236	20.2205	20.5827	20.8469	20.9714	20.9942	20.9927	20.9181	20.5916	20.1454	19.7762	(87)
Th 2	19.8321	19.8374	19.8357	19.8391	19.8391	19.8407	19.8423	19.8439	19.8454	19.8407	19.8439	19.8407	(88)
util rest of house													
	0.9901	0.9834	0.9582	0.8802	0.7200	0.4720	0.3042	0.3230	0.6325	0.9053	0.9784	0.9919	(89)
MIT 2	18.2630	18.4588	18.8828	19.3829	19.7076	19.8259	19.8409	19.8420	19.7919	19.4094	18.7864	18.2480	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9775	0.9489	0.8714	0.7228	0.4873	0.3232	0.3430	0.6439	0.8967	0.9717	0.9882	(94)
Useful gains	746.8755	823.7812	914.4062	952.9066	823.9621	572.4463	360.9090	360.0589	610.0094	735.1240	721.3818	705.6603	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1706.2982	1670.7674	1511.5930	1254.6447	920.0204	584.9149	362.3453	361.8843	651.9889	1019.1332	1376.2371	1677.6205	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.8105	569.1747	444.3070	217.2515	71.4673	0.0000	0.0000	0.0000	0.0000	211.3028	471.4958	723.1384	(98)
Space heating												3421.9480	(98)
RHI space heating demand												3422	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3815	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4134	0.4053	0.3972	0.3567	0.3486	0.3080	0.3080	0.2999	0.3243	0.3486	0.3648	0.3810	(22b)
Effective ac	0.5855	0.5821	0.5789	0.5636	0.5608	0.5474	0.5474	0.5450	0.5526	0.5608	0.5665	0.5726	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.7125	47.4420	47.1769	45.9319	45.6989	44.6145	44.6145	44.4137	45.0322	45.6989	46.1702	46.6628	(38)
Heat transfer coeff	127.7484	127.4780	127.2129	125.9678	125.7349	124.6504	124.6504	124.4496	125.0681	125.7349	126.2061	126.6988	(39)
Average = Sum(39)m / 12 =												125.9667	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3346	1.3318	1.3290	1.3160	1.3136	1.3022	1.3022	1.3001	1.3066	1.3136	1.3185	1.3236	(40)
HLP (average)												1.3160	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	727.1056	824.5153	931.5997	1045.5269	1115.6621	1094.9729	1045.8957	973.7429	886.3384	776.8521	705.0715	690.8405	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.0337	52.1441	52.2527	52.7692	52.8670	53.3269	53.3269	53.4130	53.1488	52.8670	52.6696	52.4648	
alpha	4.4689	4.4763	4.4835	4.5179	4.5245	4.5551	4.5551	4.5609	4.5433	4.5245	4.5113	4.4977	
util living area													
	0.9946	0.9898	0.9763	0.9346	0.8377	0.6721	0.5108	0.5652	0.8085	0.9592	0.9901	0.9957	(86)
MIT	19.6614	19.8259	20.1115	20.4790	20.7763	20.9410	20.9865	20.9789	20.8604	20.4641	19.9946	19.6298	(87)
Th 2	19.8138	19.8160	19.8182	19.8283	19.8302	19.8391	19.8391	19.8407	19.8357	19.8302	19.8264	19.8224	(88)
util rest of house													
	0.9928	0.9864	0.9680	0.9111	0.7815	0.5722	0.3829	0.4339	0.7239	0.9397	0.9862	0.9943	(89)
MIT 2	18.0621	18.3024	18.7153	19.2369	19.6203	19.8020	19.8345	19.8327	19.7298	19.2293	18.5565	18.0220	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.3052	18.5340	18.9275	19.4257	19.7960	19.9751	20.0096	20.0070	19.9017	19.4170	18.7751	18.2664	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3052	18.5340	18.9275	19.4257	19.7960	19.9751	20.0096	20.0070	19.9017	19.4170	18.7751	18.2664	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9810	0.9594	0.9010	0.7796	0.5848	0.4023	0.4536	0.7294	0.9304	0.9809	0.9913	(94)
Useful gains	719.3305	808.8639	893.7939	942.0496	869.7321	640.3173	420.8092	441.7098	646.4956	722.7477	691.6155	684.8476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1789.1379	1738.0341	1580.9444	1325.8992	1017.9547	670.0101	425.0106	448.8838	725.6020	1108.6088	1473.4648	1782.1939	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	795.9367	624.4023	511.2399	276.3717	110.2776	0.0000	0.0000	0.0000	0.0000	287.0807	562.9315	816.4256	(98)
Space heating												3984.6661	(98)
Space heating per m2											(98) / (4) =	41.6284	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4289.1993	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	795.9367	624.4023	511.2399	276.3717	110.2776	0.0000	0.0000	0.0000	0.0000	287.0807	562.9315	816.4256	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	856.7672	672.1231	550.3121	297.4938	118.7057	0.0000	0.0000	0.0000	0.0000	309.0212	605.9543	878.8220	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3140	89.2590	89.1293	88.8111	88.1234	86.7000	86.7000	86.7000	86.7000	88.8116	89.1917	89.3400	(217)
Fuel for water heating, kWh/month													
	192.6620	168.9787	175.5080	154.8037	150.6279	133.5081	125.0945	141.5841	142.6920	160.6808	173.0397	186.9377	(219)
Water heating fuel used												1906.1173	(219)
Annual totals kWh/year													
Space heating fuel - main system												4289.1993	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6090.3208	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4289.1993	3.4800	149.2641	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1906.1173	3.4800	66.3329	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			321.7481	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9603	(257)
SAP value		86.6037	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4289.1993	0.2160	926.4670	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1906.1173	0.2160	411.7213	(264)
Space and water heating			1338.1884	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1283.6956	(272)
CO2 emissions per m2			13.4100	(273)
EI value			87.7761	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600 (1b)	x	2.5400 (2b)	=	121.5644	(1b) - (3b)
First floor	47.8600 (1c)	x	2.6200 (2c)	=	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620 (8)
Pressure test		Yes
Measured/design AP50		4.3900
Infiltration rate		0.3815 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3405	0.3161	0.3243	0.3080	0.3080	0.2999	0.2918	0.2837	0.2756	0.2999	0.2837	0.2999	(22b)
Effective ac	0.5580	0.5500	0.5526	0.5474	0.5474	0.5450	0.5426	0.5402	0.5380	0.5450	0.5402	0.5450	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4713	44.8207	45.0322	44.6145	44.6145	44.4137	44.2182	44.0281	43.8433	44.4137	44.0281	44.4137	(38)
Heat transfer coeff	125.5073	124.8566	125.0681	124.6504	124.6504	124.4496	124.2541	124.0640	123.8793	124.4496	124.0640	124.4496	(39)
Average = Sum(39)m / 12 =												124.5286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3112	1.3044	1.3066	1.3022	1.3022	1.3001	1.2981	1.2961	1.2942	1.3001	1.2961	1.3001	(40)
HLP (average)												1.3010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6962 (42)
Average daily hot water use (litres/day)		98.2351 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
								Total per year (kWh/year) = Sum(64)m =				1684.2794	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9629	53.2389	53.1488	53.3269	53.3269	53.4130	53.4970	53.5790	53.6589	53.4130	53.5790	53.4130	
alpha	4.5309	4.5493	4.5433	4.5551	4.5551	4.5609	4.5665	4.5719	4.5773	4.5609	4.5719	4.5609	
util living area													
	0.9926	0.9876	0.9690	0.9111	0.7887	0.5784	0.4284	0.4536	0.7333	0.9358	0.9847	0.9940	(86)
MIT	19.7908	19.9236	20.2205	20.5827	20.8469	20.9714	20.9942	20.9927	20.9181	20.5916	20.1454	19.7762	(87)
Th 2	19.8321	19.8374	19.8357	19.8391	19.8391	19.8407	19.8423	19.8439	19.8454	19.8407	19.8439	19.8407	(88)
util rest of house													
	0.9901	0.9834	0.9582	0.8802	0.7200	0.4720	0.3042	0.3230	0.6325	0.9053	0.9784	0.9919	(89)
MIT 2	18.2630	18.4588	18.8828	19.3829	19.7076	19.8259	19.8409	19.8420	19.7919	19.4094	18.7864	18.2480	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9775	0.9489	0.8714	0.7228	0.4873	0.3232	0.3430	0.6439	0.8967	0.9717	0.9882	(94)
Useful gains	746.8755	823.7812	914.4062	952.9066	823.9621	572.4463	360.9090	360.0589	610.0094	735.1240	721.3818	705.6603	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1706.2982	1670.7674	1511.5930	1254.6447	920.0204	584.9149	362.3453	361.8843	651.9889	1019.1332	1376.2371	1677.6205	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.8105	569.1747	444.3070	217.2515	71.4673	0.0000	0.0000	0.0000	0.0000	211.3028	471.4958	723.1384	(98)
Space heating												3421.9480	(98)
Space heating per m2											(98) / (4) =	35.7496	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3683.4747	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.8105	569.1747	444.3070	217.2515	71.4673	0.0000	0.0000	0.0000	0.0000	211.3028	471.4958	723.1384	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	768.3644	612.6746	478.2637	233.8552	76.9293	0.0000	0.0000	0.0000	0.0000	227.4519	507.5305	778.4052	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2601	89.2102	89.0442	88.6322	87.7937	86.7000	86.7000	86.7000	86.7000	88.5820	89.0891	89.2817	(217)
Fuel for water heating, kWh/month													
	192.7784	169.0711	175.6757	155.1162	151.1937	133.5081	125.0945	141.5841	142.6920	161.0972	173.2389	187.0597	(219)
Water heating fuel used												1908.1096	(219)
Annual totals kWh/year													
Space heating fuel - main system												3683.4747	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												5406.7788	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3683.4747	7.3800	271.8404	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1908.1096	7.3800	140.8185	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			466.6937	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3683.4747	0.2160	795.6305	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1908.1096	0.2160	412.1517	(264)
Space and water heating			1207.7822	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			1111.8682	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3683.4747	1.2200	4493.8391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1908.1096	1.2200	2327.8937	(264)
Space and water heating			6821.7329	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			6254.3800	(272)
Primary energy kWh/m2/year			65.3404	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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Current energy efficiency rating:                                    B 87
Current environmental impact rating:                                 B 88

_____________________________________________________________________________

(For testing purposes):
A                                                                      Not considered
B                                                                      Not considered
C                                                                      Not considered
D                                                                      Not considered
E  Low energy lighting                                                 Already installed
F                                                                      Not considered
G                                                                      Not considered
H                                                                      Not considered
I                                                                      Not considered
J                                                                      Not considered
K                                                                      Not considered
M                                                                      Not considered
N  Solar water heating                                                 Recommended
O                                                                      Not considered
P                                                                      Not considered
R                                                                      Not considered
S                                                                      Not considered
T                                                                      Not considered
U  Solar photovoltaic panels                                           Already installed
A2                                                                     Not considered
A3                                                                     Not considered
T2                                                                     Not considered
W                                                                      Not considered
X                                                                      Not considered
Y                                                                      Not considered
J2                                                                     Not considered
Q2                                                                     Not considered
Z1                                                                     Not considered
Z2                                                                     Not considered
Z3                                                                     Not considered
Z4                                                                     Not considered
Z5                                                                     Not considered
V2 Wind turbine                                                        Not applicable
L2                                                                     Not considered
Q3                                                                     Not considered
O3                                                                     Not considered

Recommended measures:                    SAP change    Cost change     CO2 change
N  Solar water heating                    + 1.1         -£  60          -192 kg (17.3%)
_____________________________________________________________________________

                                                                       Energy  Environmental
                                         Typical annual savings        efficiency  impact
Recommended measures
Solar water heating                      £60              2.01 kg/m²   B 88     B 90
                           Total Savings £60              2.01 kg/m²

Potential energy efficiency rating:                                    B 88
Potential environmental impact rating:                                       B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):
                                  Current        Potential      Saving
  Electricity                      £139          £153         -£14
  Mains gas                        £520          £445         £75

  Space heating                    £400          £400         £0
  Water heating                    £141          £81          £60
  Lighting                         £117          £117         £0
  Generated (PV)                  -£191         -£191         £0

  Total cost of fuels              £468           £407           £61
  Total cost of uses               £467           £407           £60
  Delivered energy                 56 kWh/m²      46 kWh/m²      10 kWh/m²
  Carbon dioxide emissions         1.1 tonnes     0.9 tonnes     0.2 tonnes
  CO2 emissions per m²             12 kg/m²       10 kg/m²       2 kg/m²
  Primary energy                   65 kWh/m²      54 kWh/m²      11 kWh/m²
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3815	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4134	0.4053	0.3972	0.3567	0.3486	0.3080	0.3080	0.2999	0.3243	0.3486	0.3648	0.3810	(22b)
Effective ac	0.5855	0.5821	0.5789	0.5636	0.5608	0.5474	0.5474	0.5450	0.5526	0.5608	0.5665	0.5726	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.7125	47.4420	47.1769	45.9319	45.6989	44.6145	44.6145	44.4137	45.0322	45.6989	46.1702	46.6628	(38)
Heat transfer coeff	127.7484	127.4780	127.2129	125.9678	125.7349	124.6504	124.6504	124.4496	125.0681	125.7349	126.2061	126.6988	(39)
Average = Sum(39)m / 12 =												125.9667	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3346	1.3318	1.3290	1.3160	1.3136	1.3022	1.3022	1.3001	1.3066	1.3136	1.3185	1.3236	(40)
HLP (average)												1.3160	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6962	(42)
Average daily hot water use (litres/day)												98.2351	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1734	(H8)
Utilisation factor												0.5735	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-865.2518	(H17)
Solar input	-25.0906	-41.8690	-71.3076	-95.5663	-118.0641	-116.0758	-114.5418	-100.0758	-78.3794	-53.5239	-29.7610	-20.9965	(63)
								Solar input (sum of months) = Sum(63)m =				-865.2518	(63)
Output from w/h													
	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
									Total per year (kWh/year) = Sum(64)m =			825.4368	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	10.6334	0.7200	0.7000	0.7700	2.6369	(74)
East	9.0500	19.6403	0.7200	0.7000	0.7700	62.0811	(76)
South	0.7100	46.7521	0.7200	0.7000	0.7700	11.5937	(78)
West	5.0500	19.6403	0.7200	0.7000	0.7700	34.6420	(80)

Solar gains	110.9537	213.2377	344.3531	495.5455	603.9660	617.3881	588.0993	506.9576	397.9690	250.9931	137.5978	91.7567	(83)
Total gains	727.1056	824.5153	931.5997	1045.5269	1115.6621	1094.9729	1045.8957	973.7429	886.3384	776.8521	705.0715	690.8405	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.0337	52.1441	52.2527	52.7692	52.8670	53.3269	53.3269	53.4130	53.1488	52.8670	52.6696	52.4648	
alpha	4.4689	4.4763	4.4835	4.5179	4.5245	4.5551	4.5551	4.5609	4.5433	4.5245	4.5113	4.4977	
util living area													
	0.9946	0.9898	0.9763	0.9346	0.8377	0.6721	0.5108	0.5652	0.8085	0.9592	0.9901	0.9957	(86)
MIT	19.6614	19.8259	20.1115	20.4790	20.7763	20.9410	20.9865	20.9789	20.8604	20.4641	19.9946	19.6298	(87)
Th 2	19.8138	19.8160	19.8182	19.8283	19.8302	19.8391	19.8391	19.8407	19.8357	19.8302	19.8264	19.8224	(88)
util rest of house													
	0.9928	0.9864	0.9680	0.9111	0.7815	0.5722	0.3829	0.4339	0.7239	0.9397	0.9862	0.9943	(89)
MIT 2	18.0621	18.3024	18.7153	19.2369	19.6203	19.8020	19.8345	19.8327	19.7298	19.2293	18.5565	18.0220	(90)
Living area fraction										fLA = Living area / (4) =		0.1520	(91)
MIT	18.3052	18.5340	18.9275	19.4257	19.7960	19.9751	20.0096	20.0070	19.9017	19.4170	18.7751	18.2664	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3052	18.5340	18.9275	19.4257	19.7960	19.9751	20.0096	20.0070	19.9017	19.4170	18.7751	18.2664	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9810	0.9594	0.9010	0.7796	0.5848	0.4023	0.4536	0.7294	0.9304	0.9809	0.9913	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	719.3305	808.8639	893.7939	942.0496	869.7321	640.3173	420.8092	441.7098	646.4956	722.7477	691.6155	684.8476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1789.1379	1738.0341	1580.9444	1325.8992	1017.9547	670.0101	425.0106	448.8838	725.6020	1108.6088	1473.4648	1782.1939	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	795.9367	624.4023	511.2399	276.3717	110.2776	0.0000	0.0000	0.0000	0.0000	287.0807	562.9315	816.4256	(98)
Space heating												3984.6661	(98)
Space heating per m2											(98) / (4) =	41.6284	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4289.1993	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.9367	624.4023	511.2399	276.3717	110.2776	0.0000	0.0000	0.0000	0.0000	287.0807	562.9315	816.4256	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	856.7672	672.1231	550.3121	297.4938	118.7057	0.0000	0.0000	0.0000	0.0000	309.0212	605.9543	878.8220	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	146.9836	108.9598	85.1214	41.9166	14.6744	0.0000	0.0000	22.6776	45.3346	89.1793	124.5759	146.0137	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3857	89.4097	89.4289	89.4651	89.5120	86.7000	86.7000	86.7000	86.7000	89.1204	89.3028	89.3994	(217)
Fuel for water heating, kWh/month	164.4374	121.8657	95.1833	46.8524	16.3938	0.0000	0.0000	26.1564	52.2890	100.0662	139.4984	163.3273	(219)
Water heating fuel used												926.0700	(219)
Annual totals kWh/year													
Space heating fuel - main system												4289.1993	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5160.2735	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4289.1993	3.4800	149.2641	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	926.0700	3.4800	32.2272	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	408.2938	13.1900	53.8540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			294.2374	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8782	(257)
SAP value		87.7492	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4289.1993	0.2160	926.4670	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	926.0700	0.2160	200.0311	(264)
Space and water heating			1126.4982	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	408.2938	0.5190	211.9045 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1097.9554 (272)
CO2 emissions per m2			11.4700 (273)
EI value			89.5448
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.8600	(1b)	x 2.5400	(2b) =	121.5644	(1b) - (3b)
First floor	47.8600	(1c)	x 2.6200	(2c) =	125.3932	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.9576	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1620	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3815	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3405	0.3161	0.3243	0.3080	0.3080	0.2999	0.2918	0.2837	0.2756	0.2999	0.2837	0.2999	(22b)
Effective ac	0.5580	0.5500	0.5526	0.5474	0.5474	0.5450	0.5426	0.5402	0.5380	0.5450	0.5402	0.5450	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			15.5200	1.2357	19.1787			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			47.8600	0.2000	9.5720			(28a)
External Wall	147.8200	17.6400	130.1800	0.2700	35.1486			(29a)
Main Roof	47.8600		47.8600	0.1600	7.6576			(30)
Total net area of external elements Aum(A, m2)			243.5400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.7369			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2990	(36)
Total fabric heat loss					(33) + (36) =		80.0359	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4713	44.8207	45.0322	44.6145	44.6145	44.4137	44.2182	44.0281	43.8433	44.4137	44.0281	44.4137	(38)
Heat transfer coeff	125.5073	124.8566	125.0681	124.6504	124.6504	124.4496	124.2541	124.0640	123.8793	124.4496	124.0640	124.4496	(39)
Average = Sum(39)m / 12 =												124.5286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3112	1.3044	1.3066	1.3022	1.3022	1.3001	1.2981	1.2961	1.2942	1.3001	1.2961	1.3001	(40)
HLP (average)												1.3010	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6962	(42)
Average daily hot water use (litres/day)	98.2351	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.0586	104.1292	100.1998	96.2704	92.3410	88.4116	88.4116	92.3410	96.2704	100.1998	104.1292	108.0586	(44)
Energy conte	160.2478	140.1538	144.6261	126.0886	120.9850	104.4008	96.7427	111.0137	112.3395	130.9209	142.9104	155.1915	(45)
Energy content (annual)										Total = Sum(45)m =		1545.6209	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0372	21.0231	21.6939	18.9133	18.1477	15.6601	14.5114	16.6521	16.8509	19.6381	21.4366	23.2787	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8263	10.6750	11.8029	11.3943	11.7535	11.3507	11.7142	11.7397	11.3744	11.7823	11.4266	11.8187	(61)
Total heat required for water heating calculated for each month													
	172.0741	150.8287	156.4290	137.4828	132.7385	115.7515	108.4570	122.7534	123.7140	142.7032	154.3370	167.0102	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3132	(H8)
Utilisation factor												0.5330	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.2351	(H14)
Volume ratio Veff/V												0.7635	(H15)
Solar storage volume factor												0.9460	(H16)
Solar input												-899.9616	(H17)
Solar input	-29.3589	-41.7465	-71.7522	-96.8104	-113.7096	-121.4598	-118.9055	-106.4240	-83.3227	-57.6064	-34.7239	-24.1416	(63)
								Solar input (sum of months) = Sum(63)m =				-899.9616	(63)
Output from w/h													
	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
								Total per year (kWh/year) = Sum(64)m =				800.4747	(64)
Heat gains from water heating, kWh/month													
	56.2390	49.2699	51.0389	44.7730	43.1659	37.5509	35.0955	39.8470	40.1965	46.4768	50.3744	54.5558	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	161.7729	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.7982	51.3359	41.7491	31.6068	23.6264	19.9464	21.5528	28.0152	37.6019	47.7443	55.7246	59.4046	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	371.9658	375.8257	366.0990	345.3921	319.2533	294.6865	278.2744	274.4145	284.1412	304.8481	330.9869	355.5537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	53.8735	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	-107.8486	(71)
Water heating gains (Table 5)													
	75.5900	73.3183	68.6007	62.1847	58.0187	52.1541	47.1714	53.5578	55.8285	62.4688	69.9644	73.3277	(72)
Total internal gains													
	616.1519	611.2776	587.2466	549.9814	511.6962	477.5848	457.7964	466.7853	488.3694	525.8590	567.4737	599.0839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.7100	13.4839	0.7200	0.7000	0.7700	3.3438	(74)
East	9.0500	25.1925	0.7200	0.7000	0.7700	79.6314	(76)
South	0.7100	56.7559	0.7200	0.7000	0.7700	14.0745	(78)
West	5.0500	25.1925	0.7200	0.7000	0.7700	44.4352	(80)

Solar gains	141.4849	231.4975	376.3981	543.5334	628.2783	697.0713	659.0215	583.0785	458.9870	293.9146	174.9242	114.9871	(83)
Total gains	757.6367	842.7750	963.6447	1093.5148	1139.9744	1174.6561	1116.8179	1049.8638	947.3564	819.7736	742.3980	714.0710	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9629	53.2389	53.1488	53.3269	53.3269	53.4130	53.4970	53.5790	53.6589	53.4130	53.5790	53.4130	
alpha	4.5309	4.5493	4.5433	4.5551	4.5551	4.5609	4.5665	4.5719	4.5773	4.5609	4.5719	4.5609	
util living area													
	0.9926	0.9876	0.9690	0.9111	0.7887	0.5784	0.4284	0.4536	0.7333	0.9358	0.9847	0.9940	(86)
MIT	19.7908	19.9236	20.2205	20.5827	20.8469	20.9714	20.9942	20.9927	20.9181	20.5916	20.1454	19.7762	(87)
Th 2	19.8321	19.8374	19.8357	19.8391	19.8391	19.8407	19.8423	19.8439	19.8454	19.8407	19.8439	19.8407	(88)
util rest of house													
	0.9901	0.9834	0.9582	0.8802	0.7200	0.4720	0.3042	0.3230	0.6325	0.9053	0.9784	0.9919	(89)
MIT 2	18.2630	18.4588	18.8828	19.3829	19.7076	19.8259	19.8409	19.8420	19.7919	19.4094	18.7864	18.2480	(90)
Living area fraction									fLA = Living area / (4) =			0.1520	(91)
MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4952	18.6815	19.0862	19.5653	19.8808	20.0000	20.0162	20.0169	19.9631	19.5891	18.9930	18.4803	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9775	0.9489	0.8714	0.7228	0.4873	0.3232	0.3430	0.6439	0.8967	0.9717	0.9882	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	746.8755	823.7812	914.4062	952.9066	823.9621	572.4463	360.9090	360.0589	610.0094	735.1240	721.3818	705.6603	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1706.2982	1670.7674	1511.5930	1254.6447	920.0204	584.9149	362.3453	361.8843	651.9889	1019.1332	1376.2371	1677.6205	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	713.8105	569.1747	444.3070	217.2515	71.4673	0.0000	0.0000	0.0000	0.0000	211.3028	471.4958	723.1384	(98)
Space heating												3421.9480	(98)
Space heating per m2											(98) / (4) =	35.7496	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3683.4747	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	713.8105	569.1747	444.3070	217.2515	71.4673	0.0000	0.0000	0.0000	0.0000	211.3028	471.4958	723.1384	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	768.3644	612.6746	478.2637	233.8552	76.9293	0.0000	0.0000	0.0000	0.0000	227.4519	507.5305	778.4052	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	142.7152	109.0822	84.6768	40.6725	19.0289	0.0000	0.0000	16.3294	40.3913	85.0968	119.6131	142.8686	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3505	89.3695	89.3720	89.3798	89.2077	86.7000	86.7000	86.7000	86.7000	88.9574	89.2335	89.3559	(217)
Fuel for water heating, kWh/month	159.7251	122.0575	94.7465	45.5052	21.3310	0.0000	0.0000	18.8343	46.5874	95.6602	134.0450	159.8871	(219)
Water heating fuel used												898.3794	(219)
Annual totals kWh/year													
Space heating fuel - main system												3683.4747	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												408.2938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4447.0486	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3683.4747	7.3800	271.8404	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	898.3794	7.3800	66.3004	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	408.2938	28.6600	117.0170	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			406.5056	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3683.4747	0.2160	795.6305	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.3794	0.2160	194.0500	(264)
Space and water heating			989.6805	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	408.2938	0.5190	211.9045	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			919.7164	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3683.4747	1.2200	4493.8391	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	898.3794	1.2200	1096.0229	(264)
Space and water heating			5589.8620	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	408.2938	3.0700	1253.4620	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			5176.0091	(272)
Primary energy kWh/m2/year			54.0745	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	651.97	(P1)
Transmission heat loss coefficient	80.04	(37)
Summer heat loss coefficient	732.00	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.7100	87.1704	0.7200	0.7000	0.7650	21.4764
East	9.0500	125.2818	0.7200	0.7000	0.7650	393.4332
South	0.7100	118.5567	0.7200	0.7000	0.7650	29.2091
West	5.0500	125.2818	0.7200	0.7000	0.7650	219.5401
total:						663.6588

	Jun	Jul	Aug	
Solar gains	714	664	585	(P3)
Internal gains	475	455	464	
Total summer gains	1188	1118	1049	(P5)
Summer gain/loss ratio	1.62	1.53	1.43	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.27	19.08	18.98	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 410 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	87 B	**DER**	15.24	**TER**	18.59
Environmental	88 B	**% DER<TER**	18.00		
CO_2 Emissions (t/year)	1.07	**DFEE**	54.36	**TFEE**	57.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.24	$kgCO_2/m^2$	Pass
	-3.35 (-18.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.82	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	54.36	$kWh/m^2/yr$	
	-3.4 (-5.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	0.71 m², No overhang
Windows facing East	9.05 m², No overhang
Windows facing South	0.71 m², No overhang
Windows facing West	5.05 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 411 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 411	**Prop Type Ref**	
Property	5 Pheasant Road, Boorley Green, Southampton, SO32 2DY		

SAP Rating	88 B	**DER**	14.07	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.02		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.39	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 60 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.45 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.47 m², No overhang
Windows facing East: 1.30 m², No overhang
Windows facing South: 5.22 m², No overhang
Windows facing West: 1.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3626	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3082	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3930	0.3853	0.3775	0.3390	0.3313	0.2928	0.2928	0.2851	0.3082	0.3313	0.3467	0.3621	(22b)
Effective ac	0.5772	0.5742	0.5713	0.5575	0.5549	0.5429	0.5429	0.5406	0.5475	0.5549	0.5601	0.5656	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1933	27.0520	26.9136	26.2633	26.1416	25.5752	25.5752	25.4703	25.7934	26.1416	26.3877	26.6451	(38)
Heat transfer coeff	81.3749	81.2336	81.0952	80.4449	80.3232	79.7568	79.7568	79.6520	79.9750	80.3232	80.5694	80.8267	(39)
Average = Sum(39)m / 12 =												80.4443	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3504	1.3481	1.3458	1.3350	1.3329	1.3235	1.3235	1.3218	1.3272	1.3329	1.3370	1.3413	(40)
HLP (average)												1.3350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	308.2961	306.4753	295.4466	277.7386	259.9415	242.6260	231.2680	236.4967	245.4949	263.3889	283.9481	299.1929	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	429.2746	515.2394	588.8383	655.2357	696.2293	681.8683	652.1880	612.4972	567.7807	496.1499	429.3283	402.4252	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4252	51.5147	51.6026	52.0197	52.0985	52.4685	52.4685	52.5376	52.3254	52.0985	51.9394	51.7740	
alpha	4.4283	4.4343	4.4402	4.4680	4.4732	4.4979	4.4979	4.5025	4.4884	4.4732	4.4626	4.4516	
util living area													
	0.9958	0.9902	0.9763	0.9370	0.8448	0.6844	0.5223	0.5729	0.8060	0.9581	0.9914	0.9969	(86)
MIT	19.5994	19.8001	20.0956	20.4581	20.7605	20.9338	20.9844	20.9766	20.8577	20.4570	19.9536	19.5591	(87)
Th 2	19.8016	19.8034	19.8052	19.8135	19.8151	19.8224	19.8224	19.8238	19.8196	19.8151	19.8119	19.8086	(88)
util rest of house													
	0.9944	0.9869	0.9679	0.9140	0.7894	0.5831	0.3904	0.4387	0.7202	0.9380	0.9879	0.9958	(89)
MIT 2	17.9636	18.2563	18.6832	19.1973	19.5893	19.7806	19.8172	19.8149	19.7123	19.2080	18.4873	17.9097	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.6452	18.8996	19.2718	19.7227	20.0773	20.2611	20.3036	20.2990	20.1896	19.7285	19.0983	18.5970	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6452	18.8996	19.2718	19.7227	20.0773	20.2611	20.3036	20.2990	20.1896	19.7285	19.0983	18.5970	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9834	0.9631	0.9119	0.8031	0.6231	0.4458	0.4950	0.7501	0.9361	0.9850	0.9942	(94)
Useful gains	426.0268	506.7053	567.1313	597.5034	559.1359	424.8666	290.7403	303.1937	425.8909	464.4558	422.8736	400.0869	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1167.3423	1137.2397	1035.7278	870.6289	672.8921	451.5137	295.3838	310.5624	487.0168	733.2293	966.6968	1163.6632	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	551.5387	423.7192	348.6358	196.6503	84.6346	0.0000	0.0000	0.0000	0.0000	199.9675	391.5527	568.1007	(98)
Space heating												2764.7995	(98)
Space heating per m2											(98) / (4) =	45.8812	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2976.1028	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	551.5387	423.7192	348.6358	196.6503	84.6346	0.0000	0.0000	0.0000	0.0000	199.9675	391.5527	568.1007	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	593.6907	456.1024	375.2807	211.6796	91.1029	0.0000	0.0000	0.0000	0.0000	215.2502	421.4776	611.5186	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2160	89.1422	88.9997	88.6864	88.0490	86.7000	86.7000	86.7000	86.7000	88.6710	89.0812	89.2472	(217)
Fuel for water heating, kWh/month													
	162.0920	142.2497	147.9020	130.6473	127.2011	112.8685	105.9690	119.6348	120.4782	135.6209	145.7548	157.3322	(219)
Water heating fuel used												1607.7504	(219)
Annual totals kWh/year													
Space heating fuel - main system												2976.1028	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4309.4612	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2976.1028	0.2160	642.8382	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1607.7504	0.2160	347.2741	(264)
Space and water heating			990.1123	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			847.7029	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.0700	ZC1
Total Floor Area	TFA	60.2600	
Assumed number of occupants	N	1.9890	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0715	ZC2
CO2 emissions from cooking, equation (L16)		2.7669	ZC3
Total CO2 emissions		33.9085	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.9085	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	45.6500	39.7329	42.3300	39.3581	39.0100	36.1452	37.3500	39.0100	39.3581	42.3300	42.5710	45.6500	(61)
Total heat required for water heating calculated for each month													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
								Total per year (kWh/year) = Sum(64)m =				1769.8350	(64)
Heat gains from water heating, kWh/month													
	55.5843	48.5662	50.4482	44.5954	43.1016	37.8141	36.0043	40.3531	40.8056	46.6704	50.0355	54.1905	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	74.7101	72.2711	67.8068	61.9381	57.9323	52.5195	48.3929	54.2380	56.6744	62.7291	69.4938	72.8367	(72)
Total internal gains													
	319.6824	317.3078	305.7271	287.4681	269.1179	251.2502	239.8956	245.6763	255.2290	273.6741	294.7833	310.5810	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	425.5386	499.9764	562.4448	617.7780	650.8697	635.5873	608.2007	574.6767	537.2292	477.3400	421.9910	400.9093	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9960	0.9910	0.9785	0.9425	0.8546	0.6936	0.5282	0.5766	0.8103	0.9599	0.9917	0.9969	(86)
MIT	19.6903	19.8732	20.1471	20.4886	20.7750	20.9402	20.9867	20.9802	20.8718	20.4978	20.0271	19.6555	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9946	0.9879	0.9710	0.9216	0.8025	0.5964	0.4015	0.4481	0.7282	0.9408	0.9883	0.9959	(89)
MIT 2	18.1361	18.4033	18.7999	19.2872	19.6610	19.8462	19.8802	19.8787	19.7834	19.3107	18.6359	18.0912	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9848	0.9667	0.9196	0.8154	0.6349	0.4547	0.5020	0.7571	0.9393	0.9857	0.9944	(94)
Useful gains	422.4614	492.3986	543.7382	568.1216	530.6913	403.5094	276.5414	288.4971	406.7427	448.3875	415.9368	398.6646	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1113.0485	1082.4655	984.2000	824.9901	637.2052	427.5177	280.5025	294.7483	461.6698	696.2112	919.7639	1108.3779	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating												2577.3801	(98)
Space heating per m2											(98) / (4) =	42.7710	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2759.5076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	550.1036	424.5449	350.8604	198.0143	84.8462	0.0000	0.0000	0.0000	0.0000	197.4099	388.3891	565.3391	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5604	87.3009	86.7856	85.6842	83.6904	80.3000	80.3000	80.3000	80.3000	85.5573	87.0343	87.6635	(217)
Fuel for water heating, kWh/month													
	203.8564	178.6033	186.9285	167.9272	166.4566	152.7955	146.3898	163.1903	164.9925	176.3323	185.0369	198.8350	(219)
Water heating fuel used												2091.3443	(219)
Annual totals kWh/year													
Space heating fuel - main system												2759.5076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Total delivered energy for all uses												5200.2131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2759.5076	0.2160	596.0536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2091.3443	0.2160	451.7304	(264)
Space and water heating			1047.7840	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Total CO2, kg/m2/year			1229.1025	(272)
Emissions per m2 for space and water heating			17.3877	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3630	(272b)
Emissions per m2 for pumps and fans			0.6460	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3877 * 1.00) + 2.3630 + 0.6460, rounded to 2 d.p.			20.4000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3626	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3082	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3930	0.3853	0.3775	0.3390	0.3313	0.2928	0.2928	0.2851	0.3082	0.3313	0.3467	0.3621	(22b)
Effective ac	0.5772	0.5742	0.5713	0.5575	0.5549	0.5429	0.5429	0.5406	0.5475	0.5549	0.5601	0.5656	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1933	27.0520	26.9136	26.2633	26.1416	25.5752	25.5752	25.4703	25.7934	26.1416	26.3877	26.6451	(38)
Heat transfer coeff	81.3749	81.2336	81.0952	80.4449	80.3232	79.7568	79.7568	79.6520	79.9750	80.3232	80.5694	80.8267	(39)
Average = Sum(39)m / 12 =												80.4443	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3504	1.3481	1.3458	1.3350	1.3329	1.3235	1.3235	1.3218	1.3272	1.3329	1.3370	1.3413	(40)
HLP (average)												1.3350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	400.8945	487.5422	562.5567	630.8777	673.1204	660.5172	632.3296	590.7247	545.3271	471.7056	402.6362	374.7230	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4252	51.5147	51.6026	52.0197	52.0985	52.4685	52.4685	52.5376	52.3254	52.0985	51.9394	51.7740	
alpha	4.4283	4.4343	4.4402	4.4680	4.4732	4.4979	4.4979	4.5025	4.4884	4.4732	4.4626	4.4516	
util living area													
	0.9968	0.9921	0.9799	0.9441	0.8571	0.7001	0.5368	0.5907	0.8226	0.9647	0.9933	0.9977	(86)
MIT	19.5575	19.7602	20.0600	20.4304	20.7435	20.9274	20.9826	20.9736	20.8441	20.4264	19.9149	19.5180	(87)
Th 2	19.8016	19.8034	19.8052	19.8135	19.8151	19.8224	19.8224	19.8238	19.8196	19.8151	19.8119	19.8086	(88)
util rest of house													
	0.9957	0.9893	0.9727	0.9231	0.8039	0.5988	0.4022	0.4539	0.7396	0.9472	0.9905	0.9968	(89)
MIT 2	18.5051	18.7078	19.0049	19.3679	19.6482	19.7907	19.8184	19.8169	19.7379	19.3726	18.8694	18.4712	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9436	19.1464	19.4445	19.8106	20.1046	20.2644	20.3035	20.2989	20.1989	19.8117	19.3050	18.9074	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9436	19.1464	19.4445	19.8106	20.1046	20.2644	20.3035	20.2989	20.1989	19.8117	19.3050	18.9074	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9874	0.9699	0.9230	0.8185	0.6393	0.4589	0.5115	0.7695	0.9471	0.9889	0.9960	(94)
Useful gains	398.7516	481.3806	545.6249	582.3196	550.9362	422.2538	290.1710	302.1647	419.6037	446.7582	398.1807	373.2160	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1191.6218	1157.2828	1049.7396	877.7055	675.0837	451.7728	295.3810	310.5528	487.7562	739.9137	983.3527	1188.7484	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	589.8954	454.2063	375.0613	212.6778	92.3658	0.0000	0.0000	0.0000	0.0000	218.1077	421.3239	606.7561	(98)
Space heating												2970.3944	(98)
Space heating per m2											(98) / (4) =	49.2930	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	749.7143	590.2006	605.3548	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8640	0.9213	0.8993	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	647.7216	543.7648	544.4203	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.3257	811.9197	764.4492	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	142.9950	199.5072	163.7015	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												506.2037 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.7488	49.8768	40.9254	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												126.5509 (107)
Space cooling per m2												2.1001 (108)
Energy for space heating												49.2930 (99)
Energy for space cooling												2.1001 (108)
Total												51.3931 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	385.7722	461.4467	525.8828	583.6905	618.5844	605.6119	579.7146	543.7246	505.0413	442.6105	384.4636	361.8190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9973	0.9935	0.9834	0.9525	0.8727	0.7178	0.5512	0.6044	0.8359	0.9693	0.9943	0.9980	(86)
MIT	19.6307	19.8167	20.0964	20.4483	20.7499	20.9309	20.9842	20.9759	20.8516	20.4533	19.9718	19.5966	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9964	0.9912	0.9774	0.9344	0.8241	0.6208	0.4205	0.4721	0.7581	0.9541	0.9920	0.9973	(89)
MIT 2	18.6239	18.8105	19.0886	19.4369	19.7101	19.8537	19.8810	19.8798	19.8018	19.4491	18.9736	18.5964	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9896	0.9750	0.9341	0.8371	0.6595	0.4756	0.5278	0.7860	0.9539	0.9906	0.9966	(94)
Useful gains	384.0342	456.6256	512.7279	545.2031	517.7941	399.4181	275.6838	286.9784	396.9810	422.2205	380.8568	360.5938	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1133.0054	1098.8740	995.4685	830.3348	638.5804	427.5523	280.4571	294.6670	461.8437	700.9114	932.9704	1128.9672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.2346	431.5909	359.1590	205.2948	89.8650	0.0000	0.0000	0.0000	0.0000	207.3461	397.5218	571.6698	(98)
Space heating												2819.6819	(98)
Space heating per m2											(98) / (4) =	46.7919	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	704.7684	554.8177	568.8901	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8653	0.9238	0.9028	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.8029	512.5501	513.5980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	782.1507	750.4217	709.5141	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.0904	176.9765	145.7615	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  446.8284 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0226   44.2441   36.4404    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  111.7071 (107)
Space cooling per m2                                                                                             1.8538 (108)
Energy for space heating                                                                                        46.7919 (99)
Energy for space cooling                                                                                         1.8538 (108)
Total                                                                                                           48.6457 (109)
Target Fabric Energy Efficiency (TFEE)                                                                          55.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3626	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3082	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3236	0.3005	0.3082	0.2928	0.2928	0.2851	0.2774	0.2697	0.2620	0.2851	0.2697	0.2851	(22b)
Effective ac	0.5524	0.5451	0.5475	0.5429	0.5429	0.5406	0.5385	0.5364	0.5343	0.5406	0.5364	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0227	25.6829	25.7934	25.5752	25.5752	25.4703	25.3683	25.2690	25.1725	25.4703	25.2690	25.4703	(38)
Heat transfer coeff	80.2044	79.8645	79.9750	79.7568	79.7568	79.6520	79.5499	79.4506	79.3541	79.6520	79.4506	79.6520	(39)
Average = Sum(39)m / 12 =												79.6932	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3310	1.3253	1.3272	1.3235	1.3235	1.3218	1.3201	1.3185	1.3169	1.3218	1.3185	1.3218	(40)
HLP (average)												1.3225	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
RHI water heating demand												1419	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.1758	52.3978	52.3254	52.4685	52.4685	52.5376	52.6050	52.6708	52.7348	52.5376	52.6708	52.5376	
alpha	4.4784	4.4932	4.4884	4.4979	4.4979	4.5025	4.5070	4.5114	4.5157	4.5025	4.5114	4.5025	
util living area													
	0.9822	0.9714	0.9400	0.8640	0.7281	0.5205	0.3808	0.3969	0.6439	0.8766	0.9636	0.9855	(86)
MIT	19.9439	20.0873	20.3657	20.6748	20.8869	20.9802	20.9961	20.9954	20.9496	20.7090	20.2960	19.9166	(87)
Th 2	19.8167	19.8210	19.8196	19.8224	19.8224	19.8238	19.8251	19.8264	19.8276	19.8238	19.8264	19.8238	(88)
util rest of house													
	0.9765	0.9625	0.9214	0.8235	0.6545	0.4201	0.2678	0.2795	0.5425	0.8294	0.9501	0.9807	(89)
MIT 2	18.4720	18.6793	19.0687	19.4812	19.7297	19.8139	19.8242	19.8253	19.7972	19.5368	18.9839	18.4384	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0854	19.2660	19.6092	19.9786	20.2119	20.2999	20.3125	20.3129	20.2774	20.0252	19.5307	19.0544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0854	19.2660	19.6092	19.9786	20.2119	20.2999	20.3125	20.3129	20.2774	20.0252	19.5307	19.0544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9174	0.8295	0.6804	0.4617	0.3151	0.3287	0.5833	0.8386	0.9458	0.9765	(94)
Useful gains	585.1408	640.0578	682.7360	673.9281	563.5164	391.0840	254.5775	254.1097	422.6913	547.2986	564.6249	552.5102	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1137.7286	1115.3901	1008.4193	835.7372	615.0751	398.2514	255.5553	255.2652	442.5912	687.0148	924.0625	1119.4605	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	411.1254	319.4233	242.3084	116.5026	38.3597	0.0000	0.0000	0.0000	0.0000	103.9489	258.7950	421.8111	(98)
Space heating												1912.2744	(98)
RHI space heating demand												1912	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3626	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3082	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3930	0.3853	0.3775	0.3390	0.3313	0.2928	0.2928	0.2851	0.3082	0.3313	0.3467	0.3621	(22b)
Effective ac	0.5772	0.5742	0.5713	0.5575	0.5549	0.5429	0.5429	0.5406	0.5475	0.5549	0.5601	0.5656	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.1933	27.0520	26.9136	26.2633	26.1416	25.5752	25.5752	25.4703	25.7934	26.1416	26.3877	26.6451	(38)
Heat transfer coeff	81.3749	81.2336	81.0952	80.4449	80.3232	79.7568	79.7568	79.6520	79.9750	80.3232	80.5694	80.8267	(39)
Average = Sum(39)m / 12 =												80.4443	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3504	1.3481	1.3458	1.3350	1.3329	1.3235	1.3235	1.3218	1.3272	1.3329	1.3370	1.3413	(40)
HLP (average)												1.3350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	573.9511	658.1976	725.6954	783.2436	815.0111	793.5191	760.7137	722.7411	684.1258	621.3441	563.7487	543.9766	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4252	51.5147	51.6026	52.0197	52.0985	52.4685	52.4685	52.5376	52.3254	52.0985	51.9394	51.7740	
alpha	4.4283	4.4343	4.4402	4.4680	4.4732	4.4979	4.4979	4.5025	4.4884	4.4732	4.4626	4.4516	
util living area													
	0.9872	0.9758	0.9516	0.8936	0.7800	0.6087	0.4535	0.4949	0.7208	0.9150	0.9762	0.9897	(86)
MIT	19.8086	19.9988	20.2697	20.5877	20.8321	20.9585	20.9911	20.9869	20.9113	20.5976	20.1416	19.7658	(87)
Th 2	19.8016	19.8034	19.8052	19.8135	19.8151	19.8224	19.8224	19.8238	19.8196	19.8151	19.8119	19.8086	(88)
util rest of house													
	0.9831	0.9682	0.9364	0.8605	0.7162	0.5108	0.3362	0.3744	0.6278	0.8809	0.9674	0.9864	(89)
MIT 2	18.2662	18.5402	18.9247	19.3631	19.6647	19.7976	19.8196	19.8191	19.7578	19.3891	18.7550	18.2094	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9089	19.1480	19.4852	19.8734	20.1512	20.2813	20.3077	20.3057	20.2385	19.8927	19.3328	18.8579	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9089	19.1480	19.4852	19.8734	20.1512	20.2813	20.3077	20.3057	20.2385	19.8927	19.3328	18.8579	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9630	0.9314	0.8624	0.7358	0.5504	0.3853	0.4249	0.6631	0.8836	0.9629	0.9828	(94)
Useful gains	561.9127	633.8271	675.9401	675.4536	599.6580	436.7374	293.1236	307.0758	453.6265	548.9893	542.8125	534.6422	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1188.7949	1157.4127	1053.0335	882.7526	678.8254	453.1264	295.7167	311.0970	490.9237	746.4183	985.5871	1184.7523	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	466.4004	351.8495	280.5575	149.2552	58.9006	0.0000	0.0000	0.0000	0.0000	146.8871	318.7977	483.6819	(98)
Space heating												2256.3300	(98)
Space heating per m2											(98) / (4) =	37.4432	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2428.7728	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	466.4004	351.8495	280.5575	149.2552	58.9006	0.0000	0.0000	0.0000	0.0000	146.8871	318.7977	483.6819	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	502.0456	378.7400	301.9995	160.6622	63.4021	0.0000	0.0000	0.0000	0.0000	158.1132	343.1622	520.6479	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1215	89.0295	88.8527	88.4729	87.7768	86.7000	86.7000	86.7000	86.7000	88.4307	88.9499	89.1596	(217)
Fuel for water heating, kWh/month													
	162.2639	142.4297	148.1466	130.9626	127.5954	112.8685	105.9690	119.6348	120.4782	135.9893	145.9701	157.4867	(219)
Water heating fuel used												1609.7948	(219)
Annual totals kWh/year													
Space heating fuel - main system												2428.7728	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3764.1757	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2428.7728	3.4800	84.5213	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1609.7948	3.4800	56.0209	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	274.3612	13.1900	36.1882	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			224.3499	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8952	(257)
SAP value		87.5122	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2428.7728	0.2160	524.6149	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1609.7948	0.2160	347.7157	(264)
Space and water heating			872.3306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			729.9212	(272)
CO2 emissions per m2			12.1100	(273)
EI value			90.7078	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8805 = 3.952, stars = 4
Water heating environmental impact	0.216 / 0.8805 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.4500	
Infiltration rate		0.3626	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3082	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3236	0.3005	0.3082	0.2928	0.2928	0.2851	0.2774	0.2697	0.2620	0.2851	0.2697	0.2851	(22b)
Effective ac	0.5524	0.5451	0.5475	0.5429	0.5429	0.5406	0.5385	0.5364	0.5343	0.5406	0.5364	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0227	25.6829	25.7934	25.5752	25.5752	25.4703	25.3683	25.2690	25.1725	25.4703	25.2690	25.4703	(38)
Heat transfer coeff	80.2044	79.8645	79.9750	79.7568	79.7568	79.6520	79.5499	79.4506	79.3541	79.6520	79.4506	79.6520	(39)
Average = Sum(39)m / 12 =												79.6932	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3310	1.3253	1.3272	1.3235	1.3235	1.3218	1.3201	1.3185	1.3169	1.3218	1.3185	1.3218	(40)
HLP (average)												1.3225	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.1758	52.3978	52.3254	52.4685	52.4685	52.5376	52.6050	52.6708	52.7348	52.5376	52.6708	52.5376	
alpha	4.4784	4.4932	4.4884	4.4979	4.4979	4.5025	4.5070	4.5114	4.5157	4.5025	4.5114	4.5025	
util living area													
	0.9822	0.9714	0.9400	0.8640	0.7281	0.5205	0.3808	0.3969	0.6439	0.8766	0.9636	0.9855	(86)
MIT	19.9439	20.0873	20.3657	20.6748	20.8869	20.9802	20.9961	20.9954	20.9496	20.7090	20.2960	19.9166	(87)
Th 2	19.8167	19.8210	19.8196	19.8224	19.8224	19.8238	19.8251	19.8264	19.8276	19.8238	19.8264	19.8238	(88)
util rest of house													
	0.9765	0.9625	0.9214	0.8235	0.6545	0.4201	0.2678	0.2795	0.5425	0.8294	0.9501	0.9807	(89)
MIT 2	18.4720	18.6793	19.0687	19.4812	19.7297	19.8139	19.8242	19.8253	19.7972	19.5368	18.9839	18.4384	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0854	19.2660	19.6092	19.9786	20.2119	20.2999	20.3125	20.3129	20.2774	20.0252	19.5307	19.0544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0854	19.2660	19.6092	19.9786	20.2119	20.2999	20.3125	20.3129	20.2774	20.0252	19.5307	19.0544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9174	0.8295	0.6804	0.4617	0.3151	0.3287	0.5833	0.8386	0.9458	0.9765	(94)
Useful gains	585.1408	640.0578	682.7360	673.9281	563.5164	391.0840	254.5775	254.1097	422.6913	547.2986	564.6249	552.5102	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1137.7286	1115.3901	1008.4193	835.7372	615.0751	398.2514	255.5553	255.2652	442.5912	687.0148	924.0625	1119.4605	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	411.1254	319.4233	242.3084	116.5026	38.3597	0.0000	0.0000	0.0000	0.0000	103.9489	258.7950	421.8111	(98)
Space heating												1912.2744	(98)
Space heating per m2											(98) / (4) =	31.7337	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2058.4224	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	411.1254	319.4233	242.3084	116.5026	38.3597	0.0000	0.0000	0.0000	0.0000	103.9489	258.7950	421.8111	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	442.5461	343.8356	260.8272	125.4064	41.2914	0.0000	0.0000	0.0000	0.0000	111.8933	278.5738	454.0485	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0448	88.9669	88.7470	88.2754	87.4945	86.7000	86.7000	86.7000	86.7000	88.1548	88.8049	89.0789	(217)
Fuel for water heating, kWh/month													
	162.4036	142.5300	148.3231	131.2556	128.0071	112.8685	105.9690	119.6348	120.4782	136.4149	146.2083	157.6295	(219)
Water heating fuel used												1611.7226	(219)
Annual totals kWh/year													
Space heating fuel - main system												2058.4224	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3326.5680	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2058.4224	7.3800	151.9116	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1611.7226	7.3800	118.9451	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	274.3612	28.6600	78.6319	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			279.3875	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2058.4224	0.2160	444.6192	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.7226	0.2160	348.1321	(264)
Space and water heating			792.7513	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			614.4348	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2058.4224	1.2200	2511.2753	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.7226	1.2200	1966.3016	(264)
Space and water heating			4477.5769	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	274.3612	3.0700	842.2889	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3422.7954	(272)
Primary energy kWh/m2/year			56.8005	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£100	£100	£0
Mains gas	£378	£378	£0
Space heating	£280	£280	£0
Water heating	£119	£119	£0
Lighting	£79	£79	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£279	£279	£0
Total cost of uses	£279	£279	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	376.89 (P1)
Transmission heat loss coefficient	54.18 (37)
Summer heat loss coefficient	431.07 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.4700	87.1704	0.7200	0.7000	0.7650	135.2108
East	1.3000	125.2818	0.7200	0.7000	0.7650	56.5153
South	5.2200	118.5567	0.7200	0.7000	0.7650	214.7489
West	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
total:						471.2501

	Jun	Jul	Aug	
Solar gains	504	471	428	(P3)
Internal gains	351	337	344	
Total summer gains	856	808	772	(P5)
Summer gain/loss ratio	1.98	1.87	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.63	19.42	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 411 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 411	**Prop Type Ref**	
Property	5 Pheasant Road, Boorley Green, Southampton, SO32 2DY		

SAP Rating	88 B	**DER**	14.07	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.02		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.39	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.40	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.07	$kgCO_2/m^2$	Pass
	-6.33 (-31.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.39	$kWh/m^2/yr$	
	-4.5 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	4.47 m², No overhang		
Windows facing East	1.30 m², No overhang		
Windows facing South	5.22 m², No overhang		
Windows facing West	1.49 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.45 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 412 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 412	**Prop Type Ref**	
Property	5 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.14	**TER**	20.84
Environmental	92 A	**% DER<TER**	36.95		
CO_2 Emissions (t/year)	0.47	**DFEE**	48.31	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.23 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.07 m², No overhang
Windows facing East: 1.49 m², No overhang
Windows facing South: 3.80 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3803	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3232	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4121	0.4040	0.3960	0.3556	0.3475	0.3071	0.3071	0.2990	0.3232	0.3475	0.3636	0.3798	(22b)
Effective ac	0.5849	0.5816	0.5784	0.5632	0.5604	0.5471	0.5471	0.5447	0.5522	0.5604	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8739	22.7450	22.6186	22.0249	21.9138	21.3967	21.3967	21.3009	21.5959	21.9138	22.1385	22.3734	(38)
Heat transfer coeff	65.7715	65.6426	65.5161	64.9224	64.8114	64.2943	64.2943	64.1985	64.4934	64.8114	65.0361	65.2710	(39)
Average = Sum(39)m / 12 =												64.9219	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2821	1.2796	1.2771	1.2655	1.2634	1.2533	1.2533	1.2514	1.2572	1.2634	1.2678	1.2723	(40)
HLP (average)												1.2655	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	274.8889	273.1952	263.3948	247.7199	232.0754	216.7746	206.6900	211.5326	219.4569	235.3038	253.5002	266.8876	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	367.1472	433.2278	490.5501	543.7793	577.6475	566.1574	540.8941	507.7218	470.2461	414.3310	364.5163	345.5171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1648	54.2712	54.3759	54.8732	54.9672	55.4093	55.4093	55.4920	55.2382	54.9672	54.7773	54.5801	
alpha	4.6110	4.6181	4.6251	4.6582	4.6645	4.6940	4.6940	4.6995	4.6825	4.6645	4.6518	4.6387	
util living area													
	0.9957	0.9903	0.9767	0.9366	0.8405	0.6738	0.5108	0.5617	0.8006	0.9575	0.9912	0.9968	(86)
MIT	19.6900	19.8772	20.1575	20.5047	20.7897	20.9461	20.9881	20.9818	20.8769	20.5026	20.0274	19.6530	(87)
Th 2	19.8549	19.8569	19.8588	19.8679	19.8696	19.8776	19.8776	19.8791	19.8745	19.8696	19.8662	19.8626	(88)
util rest of house													
	0.9943	0.9871	0.9686	0.9140	0.7858	0.5764	0.3867	0.4347	0.7167	0.9375	0.9877	0.9957	(89)
MIT 2	18.1320	18.4052	18.8103	19.3032	19.6711	19.8434	19.8735	19.8721	19.7814	19.3118	18.6318	18.0835	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.8441	19.0781	19.4261	19.8524	20.1825	20.3474	20.3830	20.3793	20.2822	19.8561	19.2697	18.8009	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8441	19.0781	19.4261	19.8524	20.1825	20.3474	20.3830	20.3793	20.2822	19.8561	19.2697	18.8009	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9841	0.9647	0.9136	0.8025	0.6191	0.4438	0.4931	0.7500	0.9372	0.9852	0.9942	(94)
Useful gains	364.3997	426.3567	473.2294	496.8068	463.5580	350.5309	240.0504	250.3325	352.6831	388.3301	359.1116	343.5200	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	956.5905	930.6837	846.8700	711.0565	549.7601	369.5270	243.2270	255.4669	398.7106	599.9028	791.4712	953.0179	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	440.5900	338.9077	277.9886	154.2598	64.1343	0.0000	0.0000	0.0000	0.0000	157.4101	311.2989	453.4664	(98)
Space heating												2198.0558	(98)
Space heating per m2											(98) / (4) =	42.8471	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2366.0450	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	440.5900	338.9077	277.9886	154.2598	64.1343	0.0000	0.0000	0.0000	0.0000	157.4101	311.2989	453.4664	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	474.2626	364.8092	299.2342	166.0493	69.0359	0.0000	0.0000	0.0000	0.0000	169.4403	335.0903	488.1232	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1307	89.0514	88.8964	88.5547	87.8908	86.7000	86.7000	86.7000	86.7000	88.5415	88.9818	89.1641	(217)
Fuel for water heating, kWh/month													
	150.8922	132.4557	137.8007	121.8515	118.7395	105.2670	98.9250	111.5511	112.2971	126.4823	135.7753	146.4863	(219)
Water heating fuel used												1498.5237	(219)
Annual totals kWh/year													
Space heating fuel - main system												2366.0450	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3555.1024	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2366.0450	0.2160	511.0657	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1498.5237	0.2160	323.6811	(264)
Space and water heating			834.7468	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			674.1338	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.1400	ZC1
Total Floor Area	TFA	51.3000	
Assumed number of occupants	N	1.7284	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3973	ZC2
CO2 emissions from cooking, equation (L16)		3.1283	ZC3
Total CO2 emissions		33.6656	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.6656	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	42.1812	36.7137	39.1135	36.3674	36.0458	33.3986	34.5119	36.0458	36.3674	39.1135	39.3361	42.1812	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (64)
								Total per year (kWh/year) = Sum(64)m =				1635.3511 (64)
Heat gains from water heating, kWh/month												
	51.3606	44.8758	46.6148	41.2068	39.8265	34.9407	33.2685	37.2868	37.7049	43.1241	46.2335	50.0728 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	69.0331	66.7794	62.6544	57.2316	53.5302	48.5287	44.7157	50.1166	52.3679	57.9625	64.2132	67.3021	(72)
Total internal gains													
	285.1184	282.9126	272.6018	256.4172	240.2613	224.4500	214.3683	219.7213	228.1583	244.5148	263.2200	277.1187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	365.8443	422.9412	471.3626	515.4692	542.6370	530.1600	506.7969	478.8869	447.5989	401.1636	360.3591	345.9195	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9958	0.9910	0.9790	0.9432	0.8539	0.6892	0.5231	0.5715	0.8088	0.9596	0.9914	0.9967	(86)
MIT	19.7466	19.9180	20.1805	20.5130	20.7901	20.9468	20.9887	20.9829	20.8819	20.5242	20.0736	19.7157	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9944	0.9880	0.9717	0.9226	0.8025	0.5942	0.4008	0.4472	0.7280	0.9407	0.9880	0.9957	(89)
MIT 2	18.2391	18.4898	18.8702	19.3460	19.7073	19.8839	19.9143	19.9133	19.8239	19.3718	18.7257	18.2007	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9853	0.9681	0.9220	0.8178	0.6358	0.4571	0.5043	0.7600	0.9405	0.9856	0.9942	(94)
Useful gains	363.1533	416.7065	456.3210	475.2761	443.7621	337.0971	231.6373	241.5204	340.1922	377.2926	355.1631	343.9302	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	928.3313	901.6352	819.0285	685.4691	529.6690	355.8228	234.6796	246.3539	384.3176	579.2762	765.9678	923.5361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating												2108.7545	(98)
Space heating per m2											(98) / (4) =	41.1063	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2257.7671	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	450.2060	348.8994	288.9233	162.0331	68.4312	0.0000	0.0000	0.0000	0.0000	160.8948	316.6803	461.6989	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3062	87.0435	86.5140	85.3779	83.3912	80.3000	80.3000	80.3000	80.3000	85.2405	86.7480	87.4103	(217)
Fuel for water heating, kWh/month													
	188.9145	165.5197	173.2665	155.7237	154.3598	141.1851	135.2661	150.7900	152.4553	163.5389	171.5409	184.2584	(219)
Water heating fuel used												1936.8188	(219)
Annual totals kWh/year													
Space heating fuel - main system												2257.7671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Total delivered energy for all uses												4508.8727	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2257.7671	0.2160	487.6777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1936.8188	0.2160	418.3529	(264)
Space and water heating			906.0306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Total CO2, kg/m2/year			1069.1454	(272)
Emissions per m2 for space and water heating			17.6614	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4209	(272b)
Emissions per m2 for pumps and fans			0.7588	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6614 * 1.00) + 2.4209 + 0.7588, rounded to 2 d.p.			20.8400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3803	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3232	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4121	0.4040	0.3960	0.3556	0.3475	0.3071	0.3071	0.2990	0.3232	0.3475	0.3636	0.3798	(22b)
Effective ac	0.5849	0.5816	0.5784	0.5632	0.5604	0.5471	0.5471	0.5447	0.5522	0.5604	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8739	22.7450	22.6186	22.0249	21.9138	21.3967	21.3967	21.3009	21.5959	21.9138	22.1385	22.3734	(38)
Heat transfer coeff	65.7715	65.6426	65.5161	64.9224	64.8114	64.2943	64.2943	64.1985	64.4934	64.8114	65.0361	65.2710	(39)
Average = Sum(39)m / 12 =												64.9219	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2821	1.2796	1.2771	1.2655	1.2634	1.2533	1.2533	1.2514	1.2572	1.2634	1.2678	1.2723	(40)
HLP (average)												1.2655	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	340.4040	407.1154	465.7453	520.7514	555.7735	545.9073	522.0229	487.0824	448.9776	391.2236	339.3323	319.4003	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1648	54.2712	54.3759	54.8732	54.9672	55.4093	55.4093	55.4920	55.2382	54.9672	54.7773	54.5801	
alpha	4.6110	4.6181	4.6251	4.6582	4.6645	4.6940	4.6940	4.6940	4.6995	4.6825	4.6645	4.6518	4.6387	
util living area													
	0.9969	0.9925	0.9808	0.9450	0.8551	0.6922	0.5275	0.5822	0.8203	0.9652	0.9934	0.9977	(86)
MIT	19.6431	19.8325	20.1175	20.4738	20.7713	20.9396	20.9865	20.9789	20.8623	20.4683	19.9840	19.6069	(87)
Th 2	19.8549	19.8569	19.8588	19.8679	19.8696	19.8776	19.8776	19.8791	19.8745	19.8696	19.8662	19.8626	(88)
util rest of house													
	0.9958	0.9899	0.9740	0.9246	0.8029	0.5945	0.4003	0.4521	0.7394	0.9483	0.9907	0.9969	(89)
MIT 2	18.6319	18.8217	19.1044	19.4545	19.7203	19.8511	19.8744	19.8734	19.8019	19.4575	18.9807	18.6020	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.0941	19.2837	19.5675	19.9204	20.2008	20.3487	20.3827	20.3788	20.2866	19.9195	19.4393	19.0614	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0941	19.2837	19.5675	19.9204	20.2008	20.3487	20.3827	20.3788	20.2866	19.9195	19.4393	19.0614	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9882	0.9718	0.9257	0.8199	0.6377	0.4589	0.5121	0.7722	0.9492	0.9894	0.9961	(94)
Useful gains	338.6542	402.3137	452.6038	482.0722	455.6511	348.1421	239.5585	249.4291	346.6889	371.3495	335.7320	318.1592	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	973.0324	944.1834	856.1351	715.4745	550.9461	369.6060	243.2078	255.4299	398.9969	604.0122	802.4984	970.0164	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	471.9774	364.1364	300.2273	168.0496	70.8995	0.0000	0.0000	0.0000	0.0000	173.1011	336.0718	484.9818	(98)
Space heating												2369.4448	(98)
Space heating per m2											(98) / (4) =	46.1880	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	604.3660	475.7775	487.9086	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8806	0.9336	0.9134	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	532.2263	444.1781	445.6398	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.4180	674.2629	634.4069	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	123.2581	171.1831	140.4427	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												434.8839	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   30.8145   42.7958   35.1107    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          108.7210 (107)
Space cooling per m2                                                                                                     2.1193 (108)
Energy for space heating                                                                                                46.1880 (99)
Energy for space cooling                                                                                                 2.1193 (108)
Total                                                                                                                   48.3073 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   48.3 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	328.8717	387.1113	437.3509	483.7440	512.5770	502.2344	480.2474	450.0588	417.6289	368.8452	325.4553	309.5716	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9973	0.9937	0.9843	0.9543	0.8745	0.7167	0.5490	0.6028	0.8379	0.9702	0.9944	0.9980	(86)
MIT	19.6812	19.8559	20.1246	20.4686	20.7627	20.9370	20.9861	20.9785	20.8600	20.4752	20.0128	19.6509	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9964	0.9916	0.9786	0.9370	0.8270	0.6218	0.4222	0.4742	0.7619	0.9556	0.9921	0.9973	(89)
MIT 2	18.6980	18.8736	19.1413	19.4834	19.7502	19.8898	19.9149	19.9142	19.8388	19.4970	19.0396	18.6753	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9902	0.9767	0.9375	0.8417	0.6636	0.4807	0.5335	0.7923	0.9561	0.9909	0.9966	(94)
Useful gains	327.4139	383.3033	427.1509	453.4944	431.4587	333.2823	230.8535	240.1229	330.9076	352.6689	322.4907	308.5312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.2408	913.0286	826.7081	688.8592	530.3395	355.7443	234.6264	246.2593	384.1998	582.1139	774.8944	937.8715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	457.4312	355.9754	297.2706	169.4627	73.5673	0.0000	0.0000	0.0000	0.0000	170.7070	325.7306	468.2292	(98)
Space heating												2318.3740	(98)
Space heating per m2											(98) / (4) =	45.1925	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	579.6997	456.3593	467.8108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8741	0.9304	0.9103	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	506.7211	424.5918	425.8391	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	652.3719	625.4344	591.1325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.8686	149.4268	122.9784	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												377.2738	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.2171   37.3567   30.7446    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              94.3184 (107)
Space cooling per m2                                                                                                        1.8386 (108)
Energy for space heating                                                                                                   45.1925 (99)
Energy for space cooling                                                                                                    1.8386 (108)
Total                                                                                                                      47.0310 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                      54.1 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3803	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3232	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3394	0.3152	0.3232	0.3071	0.3071	0.2990	0.2909	0.2828	0.2747	0.2990	0.2828	0.2990	(22b)
Effective ac	0.5576	0.5497	0.5522	0.5471	0.5471	0.5447	0.5423	0.5400	0.5377	0.5447	0.5400	0.5447	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.8053	21.4950	21.5959	21.3967	21.3967	21.3009	21.2077	21.1171	21.0290	21.3009	21.1171	21.3009	(38)
Heat transfer coeff	64.7028	64.3926	64.4934	64.2943	64.2943	64.1985	64.1053	64.0146	63.9265	64.1985	64.0146	64.1985	(39)
Average = Sum(39)m / 12 =												64.2362	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2613	1.2552	1.2572	1.2533	1.2533	1.2514	1.2496	1.2478	1.2461	1.2514	1.2478	1.2514	(40)
HLP (average)												1.2522	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397 (64)
RHI water heating demand												1322 (64)
Heat gains from water heating, kWh/month												
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0594	55.3247	55.2382	55.4093	55.4093	55.4920	55.5726	55.6513	55.7280	55.4920	55.6513	55.4920	
alpha	4.6706	4.6883	4.6825	4.6940	4.6940	4.6995	4.7048	4.7101	4.7152	4.6995	4.7101	4.6995	
util living area	0.9807	0.9696	0.9370	0.8568	0.7143	0.5052	0.3682	0.3840	0.6293	0.8685	0.9604	0.9840	(86)
MIT	20.0388	20.1721	20.4318	20.7189	20.9084	20.9854	20.9973	20.9969	20.9606	20.7495	20.3700	20.0147	(87)
Th 2	19.8713	19.8761	19.8745	19.8776	19.8776	19.8791	19.8805	19.8819	19.8833	19.8791	19.8819	19.8791	(88)
util rest of house	0.9746	0.9604	0.9180	0.8162	0.6427	0.4112	0.2637	0.2754	0.5325	0.8209	0.9462	0.9789	(89)
MIT 2	18.6472	18.8402	19.2020	19.5831	19.8027	19.8718	19.8799	19.8811	19.8594	19.6328	19.1287	18.6188	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2833	19.4490	19.7642	20.1023	20.3082	20.3808	20.3907	20.3911	20.3628	20.1433	19.6961	19.2569	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2833	19.4490	19.7642	20.1023	20.3082	20.3808	20.3907	20.3911	20.3628	20.1433	19.6961	19.2569	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9706	0.9561	0.9158	0.8252	0.6716	0.4540	0.3116	0.3252	0.5756	0.8334	0.9434	0.9752	(94)
Useful gains	500.8255	542.4096	573.2445	561.4107	465.8985	321.5205	210.3397	209.9534	348.3896	457.6915	479.6623	474.7330	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	930.6392	911.0930	823.2044	681.6681	502.0203	326.1805	210.9498	210.6811	362.0041	561.3045	755.1260	915.2701	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	319.7814	247.7552	185.9702	86.5854	26.8746	0.0000	0.0000	0.0000	0.0000	77.0881	198.3338	327.7596	(98)
Space heating												1470.1484	(98)
RHI space heating demand												1470	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3803	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3232	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4121	0.4040	0.3960	0.3556	0.3475	0.3071	0.3071	0.2990	0.3232	0.3475	0.3636	0.3798	(22b)
Effective ac	0.5849	0.5816	0.5784	0.5632	0.5604	0.5471	0.5471	0.5447	0.5522	0.5604	0.5661	0.5721	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8739	22.7450	22.6186	22.0249	21.9138	21.3967	21.3967	21.3009	21.5959	21.9138	22.1385	22.3734	(38)
Heat transfer coeff	65.7715	65.6426	65.5161	64.9224	64.8114	64.2943	64.2943	64.1985	64.4934	64.8114	65.0361	65.2710	(39)
Average = Sum(39)m / 12 =												64.9219	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2821	1.2796	1.2771	1.2655	1.2634	1.2533	1.2533	1.2514	1.2572	1.2634	1.2678	1.2723	(40)
HLP (average)												1.2655	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	494.3932	558.9712	610.9826	656.5158	682.3650	664.6815	636.7099	605.0403	572.8755	524.6564	482.8607	470.0549	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1648	54.2712	54.3759	54.8732	54.9672	55.4093	55.4093	55.4920	55.2382	54.9672	54.7773	54.5801	
alpha	4.6110	4.6181	4.6251	4.6582	4.6645	4.6940	4.6940	4.6995	4.6825	4.6645	4.6518	4.6387	
util living area													
	0.9860	0.9744	0.9494	0.8883	0.7689	0.5925	0.4388	0.4794	0.7071	0.9091	0.9741	0.9887	(86)
MIT	19.9079	20.0840	20.3382	20.6372	20.8599	20.9683	20.9937	20.9905	20.9283	20.6466	20.2227	19.8685	(87)
Th 2	19.8549	19.8569	19.8588	19.8679	19.8696	19.8776	19.8776	19.8791	19.8745	19.8696	19.8662	19.8626	(88)
util rest of house													
	0.9816	0.9666	0.9340	0.8550	0.7061	0.4996	0.3297	0.3670	0.6169	0.8743	0.9647	0.9851	(89)
MIT 2	18.4468	18.7004	19.0606	19.4720	19.7444	19.8586	19.8755	19.8756	19.8246	19.4964	18.9095	18.3957	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1147	19.3328	19.6446	20.0046	20.2543	20.3658	20.3866	20.3853	20.3291	20.0222	19.5098	19.0689	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1147	19.3328	19.6446	20.0046	20.2543	20.3658	20.3866	20.3853	20.3291	20.0222	19.5098	19.0689	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9779	0.9622	0.9305	0.8595	0.7289	0.5412	0.3798	0.4186	0.6554	0.8797	0.9610	0.9818	(94)
Useful gains	483.4870	537.8384	568.5369	564.2643	497.3505	359.7360	241.8031	253.2424	375.4576	461.5493	464.0488	461.5167	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	974.3840	947.4090	861.1836	720.9393	554.4171	370.7097	243.4596	255.8474	401.7356	610.6624	807.0857	970.5109	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	365.2273	275.2314	217.7291	112.8060	42.4576	0.0000	0.0000	0.0000	0.0000	110.9401	246.9865	378.6917	(98)
Space heating												1750.0698	(98)
Space heating per m2											(98) / (4) =	34.1144	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1883.8211	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	365.2273	275.2314	217.7291	112.8060	42.4576	0.0000	0.0000	0.0000	0.0000	110.9401	246.9865	378.6917	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	393.1403	296.2663	234.3693	121.4274	45.7024	0.0000	0.0000	0.0000	0.0000	119.4189	265.8628	407.6337	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0158	88.9155	88.7210	88.3065	87.6017	86.7000	86.7000	86.7000	86.7000	88.2635	88.8231	89.0570	(217)
Fuel for water heating, kWh/month													
	151.0870	132.6581	138.0732	122.1940	119.1313	105.2670	98.9250	111.5511	112.2971	126.8807	136.0178	146.6624	(219)
Water heating fuel used												1500.7446	(219)
Annual totals kWh/year													
Space heating fuel - main system												1883.8211	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3075.0994	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1883.8211	3.4800	65.5570	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1500.7446	3.4800	52.2259	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	239.2868	13.1900	31.5619	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			196.9643	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8590	(257)
SAP value		88.0165	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1883.8211	0.2160	406.9054	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1500.7446	0.2160	324.1608	(264)
Space and water heating			731.0662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			570.4532	(272)
CO2 emissions per m2			11.1200	(273)
EI value			92.0622	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8796 = 3.956, stars = 4
Water heating environmental impact	0.216 / 0.8796 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3803	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3232	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3394	0.3152	0.3232	0.3071	0.3071	0.2990	0.2909	0.2828	0.2747	0.2990	0.2828	0.2990	(22b)
Effective ac	0.5576	0.5497	0.5522	0.5471	0.5471	0.5447	0.5423	0.5400	0.5377	0.5447	0.5400	0.5447	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.8053	21.4950	21.5959	21.3967	21.3967	21.3009	21.2077	21.1171	21.0290	21.3009	21.1171	21.3009	(38)
Heat transfer coeff	64.7028	64.3926	64.4934	64.2943	64.2943	64.1985	64.1053	64.0146	63.9265	64.1985	64.0146	64.1985	(39)
Average = Sum(39)m / 12 =												64.2362	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2613	1.2552	1.2572	1.2533	1.2533	1.2514	1.2496	1.2478	1.2461	1.2514	1.2478	1.2514	(40)
HLP (average)												1.2522	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0594	55.3247	55.2382	55.4093	55.4093	55.4920	55.5726	55.6513	55.7280	55.4920	55.6513	55.4920	
alpha	4.6706	4.6883	4.6825	4.6940	4.6940	4.6995	4.7048	4.7101	4.7152	4.6995	4.7101	4.6995	
util living area													
	0.9807	0.9696	0.9370	0.8568	0.7143	0.5052	0.3682	0.3840	0.6293	0.8685	0.9604	0.9840	(86)
MIT	20.0388	20.1721	20.4318	20.7189	20.9084	20.9854	20.9973	20.9969	20.9606	20.7495	20.3700	20.0147	(87)
Th 2	19.8713	19.8761	19.8745	19.8776	19.8776	19.8791	19.8805	19.8819	19.8833	19.8791	19.8819	19.8791	(88)
util rest of house													
	0.9746	0.9604	0.9180	0.8162	0.6427	0.4112	0.2637	0.2754	0.5325	0.8209	0.9462	0.9789	(89)
MIT 2	18.6472	18.8402	19.2020	19.5831	19.8027	19.8718	19.8799	19.8811	19.8594	19.6328	19.1287	18.6188	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2833	19.4490	19.7642	20.1023	20.3082	20.3808	20.3907	20.3911	20.3628	20.1433	19.6961	19.2569	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2833	19.4490	19.7642	20.1023	20.3082	20.3808	20.3907	20.3911	20.3628	20.1433	19.6961	19.2569	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9706	0.9561	0.9158	0.8252	0.6716	0.4540	0.3116	0.3252	0.5756	0.8334	0.9434	0.9752	(94)
Useful gains	500.8255	542.4096	573.2445	561.4107	465.8985	321.5205	210.3397	209.9534	348.3896	457.6915	479.6623	474.7330	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	930.6392	911.0930	823.2044	681.6681	502.0203	326.1805	210.9498	210.6811	362.0041	561.3045	755.1260	915.2701	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	319.7814	247.7552	185.9702	86.5854	26.8746	0.0000	0.0000	0.0000	0.0000	77.0881	198.3338	327.7596	(98)
Space heating												1470.1484	(98)
Space heating per m2											(98) / (4) =	28.6579	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1582.5063	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	319.7814	247.7552	185.9702	86.5854	26.8746	0.0000	0.0000	0.0000	0.0000	77.0881	198.3338	327.7596	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	344.2212	266.6902	200.1832	93.2028	28.9285	0.0000	0.0000	0.0000	0.0000	82.9797	213.4917	352.8091	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9283	88.8424	88.6013	88.0960	87.3366	86.7000	86.7000	86.7000	86.7000	87.9768	88.6612	88.9643	(217)
Fuel for water heating, kWh/month													
	151.2356	132.7673	138.2596	122.4860	119.4929	105.2670	98.9250	111.5511	112.2971	127.2942	136.2662	146.8152	(219)
Water heating fuel used												1502.6572	(219)
Annual totals kWh/year													
Space heating fuel - main system												1582.5063	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												2706.5121	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1582.5063	7.3800	116.7890	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.6572	7.3800	110.8961	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	239.2868	28.6600	68.5796	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			226.1636	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1582.5063	0.2160	341.8214	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6572	0.2160	324.5740	(264)
Space and water heating			666.3953	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			469.8752	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1582.5063	1.2200	1930.6577	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6572	1.2200	1833.2418	(264)
Space and water heating			3763.8995	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	239.2868	3.0700	734.6105	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			2601.4396	(272)
Primary energy kWh/m2/year			50.7103	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£90	£90	£0
Mains gas	£335	£335	£0
Space heating	£245	£245	£0
Water heating	£111	£111	£0
Lighting	£69	£69	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£226	£226	£0
Total cost of uses	£226	£226	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	234.64 (P1)
Transmission heat loss coefficient	42.90 (37)
Summer heat loss coefficient	277.53 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0700	87.1704	0.7200	0.7000	0.7650	123.1114
East	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
South	3.8000	118.5567	0.7200	0.7000	0.7650	156.3306
West	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
total:						375.0832

	Jun	Jul	Aug	
Solar gains	402	375	338	(P3)
Internal gains	312	300	306	
Total summer gains	714	675	644	(P5)
Summer gain/loss ratio	2.57	2.43	2.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.22	19.98	19.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 412 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 412	**Prop Type Ref**	
Property	5 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.14	**TER**	20.84
Environmental	92 A	**% DER<TER**	36.95		
CO_2 Emissions (t/year)	0.47	**DFEE**	48.31	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.84	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.14	$kgCO_2/m^2$	Pass
	-7.70 (-36.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.09	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.31	$kWh/m^2/yr$	
	-5.8 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.07 m², No overhang
Windows facing East	1.49 m², No overhang
Windows facing South	3.80 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 413 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.13	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.09		
CO_2 Emissions (t/year)	0.74	**DFEE**	46.11	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.13 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3680	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2893	0.3128	0.3363	0.3519	0.3675	(22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5419	0.5489	0.5565	0.5619	0.5675	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7072	39.4957	39.2883	38.3142	38.1319	37.2835	37.2835	37.1264	37.6103	38.1319	38.5006	38.8861	(38)
Heat transfer coeff	100.0341	99.8225	99.6151	98.6410	98.4587	97.6103	97.6103	97.4532	97.9371	98.4587	98.8274	99.2129	(39)
Average = Sum(39)m / 12 =												98.6401	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2454	1.2428	1.2402	1.2281	1.2258	1.2153	1.2153	1.2133	1.2193	1.2258	1.2304	1.2352	(40)
HLP (average)												1.2281	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3568	644.5901	728.6659	793.4887	826.3666	801.9157	769.5317	734.0468	696.4399	618.8715	536.4872	501.1512	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7588	55.8770	55.9933	56.5462	56.6509	57.1433	57.1433	57.2355	56.9526	56.6509	56.4396	56.2203	
alpha	4.7173	4.7251	4.7329	4.7697	4.7767	4.8096	4.8096	4.8157	4.7968	4.7767	4.7626	4.7480	
util living area													
	0.9968	0.9920	0.9802	0.9472	0.8664	0.7114	0.5427	0.5873	0.8148	0.9622	0.9930	0.9977	(86)
MIT	19.6934	19.8873	20.1600	20.4904	20.7697	20.9373	20.9863	20.9801	20.8749	20.5058	20.0309	19.6566	(87)
Th 2	19.8838	19.8859	19.8880	19.8976	19.8994	19.9078	19.9078	19.9094	19.9046	19.8994	19.8957	19.8919	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9277	0.8171	0.6157	0.4158	0.4595	0.7344	0.9443	0.9902	0.9969	(89)
MIT 2	18.1570	18.4405	18.8357	19.3088	19.6763	19.8666	19.9029	19.9015	19.8081	19.3399	18.6580	18.1090	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5428	18.8038	19.1683	19.6055	19.9509	20.1355	20.1750	20.1723	20.0760	19.6327	19.0028	18.4976	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5428	18.8038	19.1683	19.6055	19.9509	20.1355	20.1750	20.1723	20.0760	19.6327	19.0028	18.4976	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9213	0.8198	0.6372	0.4479	0.4917	0.7487	0.9386	0.9869	0.9954	(94)
Useful gains	532.0432	635.2645	704.7529	731.0141	677.4169	510.9691	344.6586	360.9376	521.3981	580.8944	529.4737	498.8267	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.7682	1387.9133	1261.9530	1056.0015	812.3694	540.3184	348.9531	367.6253	585.2746	889.3478	1176.3197	1418.5067	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	664.1874	505.7800	414.5569	233.9909	100.4046	0.0000	0.0000	0.0000	0.0000	229.4893	465.7291	684.2419	(98)
Space heating												3298.3802	(98)
Space heating per m2											(98) / (4) =	41.0655	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3550.4631	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	664.1874	505.7800	414.5569	233.9909	100.4046	0.0000	0.0000	0.0000	0.0000	229.4893	465.7291	684.2419	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	714.9488	544.4348	446.2399	251.8740	108.0782	0.0000	0.0000	0.0000	0.0000	247.0283	501.3231	736.5360	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2501	89.1741	89.0335	88.7273	88.0901	86.7000	86.7000	86.7000	86.7000	88.6849	89.1131	89.2803	(217)
Fuel for water heating, kWh/month													
	182.9179	160.4857	166.7441	147.1182	143.1168	126.8734	118.9465	134.5283	135.5512	152.7743	164.3621	177.4956	(219)
Water heating fuel used												1810.9140	(219)
Annual totals kWh/year													
Space heating fuel - main system												3550.4631	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5161.6015	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3550.4631	0.2160	766.9000	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.9140	0.2160	391.1574	(264)
Space and water heating			1158.0575	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1054.3739	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.1300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3680	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2893	0.3128	0.3363	0.3519	0.3675	(22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5419	0.5489	0.5565	0.5619	0.5675	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7072	39.4957	39.2883	38.3142	38.1319	37.2835	37.2835	37.1264	37.6103	38.1319	38.5006	38.8861	(38)
Heat transfer coeff	100.0341	99.8225	99.6151	98.6410	98.4587	97.6103	97.6103	97.4532	97.9371	98.4587	98.8274	99.2129	(39)
Average = Sum(39)m / 12 =												98.6401	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2454	1.2428	1.2402	1.2281	1.2258	1.2153	1.2153	1.2133	1.2193	1.2258	1.2304	1.2352	(40)
HLP (average)												1.2281	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7588	55.8770	55.9933	56.5462	56.6509	57.1433	57.1433	57.2355	56.9526	56.6509	56.4396	56.2203	
alpha	4.7173	4.7251	4.7329	4.7697	4.7767	4.8096	4.8096	4.8157	4.7968	4.7767	4.7626	4.7480	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8772	0.7262	0.5566	0.6040	0.8299	0.9679	0.9945	0.9982	(86)
MIT	19.6578	19.8534	20.1296	20.4664	20.7543	20.9314	20.9847	20.9776	20.8635	20.4798	19.9980	19.6217	(87)
Th 2	19.8838	19.8859	19.8880	19.8976	19.8994	19.9078	19.9078	19.9094	19.9046	19.8994	19.8957	19.8919	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9353	0.8301	0.6308	0.4274	0.4741	0.7520	0.9521	0.9922	0.9976	(89)
MIT 2	18.6695	18.8656	19.1401	19.4736	19.7352	19.8766	19.9040	19.9032	19.8315	19.4934	19.0182	18.6399	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9177	19.1136	19.3886	19.7229	19.9911	20.1415	20.1754	20.1730	20.0906	19.7411	19.2643	18.8864	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9177	19.1136	19.3886	19.7229	19.9911	20.1415	20.1754	20.1730	20.0906	19.7411	19.2643	18.8864	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8346	0.6529	0.4602	0.5070	0.7671	0.9492	0.9905	0.9968	(94)
Useful gains	501.7860	607.2638	681.0955	714.3926	668.5352	508.3343	344.1777	360.0788	515.3578	561.9071	502.1800	469.0392	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1462.2636	1418.8396	1283.8993	1067.5808	816.3311	540.9091	348.9984	367.6920	586.7068	900.0246	1202.1629	1457.0813	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.5953	545.3790	448.4860	254.2955	109.9601	0.0000	0.0000	0.0000	0.0000	251.5595	503.9877	735.1034	(98)
Space heating												3563.3664	(98)
Space heating per m2											(98) / (4) =	44.3646	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.5369	722.3163	740.6443	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8623	0.9232	0.9049	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.1685	666.8272	670.2149	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	151.9795	221.4672	187.3866	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											560.8334	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	37.9949	55.3668	46.8467	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											140.2083	(107)
Space cooling per m2											1.7456	(108)
Energy for space heating											44.3646	(99)
Energy for space cooling											1.7456	(108)
Total											46.1102	(109)
Dwelling Fabric Energy Efficiency (DFEE)											46.1	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3680	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3284	0.3050	0.3128	0.2972	0.2972	0.2893	0.2815	0.2737	0.2659	0.2893	0.2737	0.2893	(22b)
Effective ac	0.5539	0.5465	0.5489	0.5441	0.5441	0.5419	0.5396	0.5375	0.5353	0.5419	0.5375	0.5419	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9538	37.4448	37.6103	37.2835	37.2835	37.1264	36.9734	36.8247	36.6802	37.1264	36.8247	37.1264	(38)
Heat transfer coeff	98.2807	97.7716	97.9371	97.6103	97.6103	97.4532	97.3003	97.1515	97.0070	97.4532	97.1515	97.4532	(39)
Average = Sum(39)m / 12 =												97.5150	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2236	1.2173	1.2193	1.2153	1.2153	1.2133	1.2114	1.2096	1.2078	1.2133	1.2096	1.2133	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7536	57.0490	56.9526	57.1433	57.1433	57.2355	57.3254	57.4132	57.4987	57.2355	57.4132	57.2355	
alpha	4.7836	4.8033	4.7968	4.8096	4.8096	4.8157	4.8217	4.8275	4.8332	4.8157	4.8275	4.8157	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5414	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0286	20.1663	20.4208	20.7002	20.8950	20.9825	20.9969	20.9965	20.9590	20.7455	20.3626	20.0034	(87)
Th 2	19.9012	19.9062	19.9046	19.9078	19.9078	19.9094	19.9109	19.9124	19.9138	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6548	18.8551	19.2119	19.5881	19.8196	19.9003	19.9101	19.9115	19.8884	19.6555	19.1426	18.6249	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6936	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8088	801.2741	847.6508	825.5141	683.1224	467.7506	299.2011	298.7355	510.8439	680.1021	707.7397	691.0078	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.7396	1357.4987	1225.7268	1011.9658	740.8251	474.7998	299.9773	299.6096	529.3923	831.2023	1121.9992	1361.5268	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.7805	373.7829	281.2885	134.2452	42.9307	0.0000	0.0000	0.0000	0.0000	112.4185	298.2668	498.8662	(98)
Space heating												2227.5794	(98)
RHI space heating demand												2228	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4700	
Infiltration rate			0.3680	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2893	0.3128	0.3363	0.3519	0.3675	(22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5419	0.5489	0.5565	0.5619	0.5675	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7072	39.4957	39.2883	38.3142	38.1319	37.2835	37.2835	37.1264	37.6103	38.1319	38.5006	38.8861	(38)
Heat transfer coeff	100.0341	99.8225	99.6151	98.6410	98.4587	97.6103	97.6103	97.4532	97.9371	98.4587	98.8274	99.2129	(39)
Average = Sum(39)m / 12 =												98.6401	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2454	1.2428	1.2402	1.2281	1.2258	1.2153	1.2153	1.2133	1.2193	1.2258	1.2304	1.2352	(40)
HLP (average)												1.2281	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6041	822.5847	898.8150	952.3016	973.3902	939.8558	903.5279	870.2957	840.5344	774.3021	703.7071	677.4546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7588	55.8770	55.9933	56.5462	56.6509	57.1433	57.1433	57.2355	56.9526	56.6509	56.4396	56.2203	
alpha	4.7173	4.7251	4.7329	4.7697	4.7767	4.8096	4.8096	4.8157	4.7968	4.7767	4.7626	4.7480	
util living area													
	0.9894	0.9789	0.9572	0.9055	0.8007	0.6302	0.4683	0.5046	0.7269	0.9199	0.9794	0.9917	(86)
MIT	19.8938	20.0780	20.3281	20.6181	20.8428	20.9626	20.9926	20.9895	20.9252	20.6405	20.2112	19.8544	(87)
Th 2	19.8838	19.8859	19.8880	19.8976	19.8994	19.9078	19.9078	19.9094	19.9046	19.8994	19.8957	19.8919	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8758	0.7417	0.5367	0.3557	0.3903	0.6389	0.8883	0.9718	0.9890	(89)
MIT 2	18.4475	18.7137	19.0702	19.4742	19.7553	19.8846	19.9053	19.9054	19.8514	19.5146	18.9156	18.3964	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8107	19.0563	19.3861	19.7614	20.0284	20.1553	20.1784	20.1777	20.1210	19.7973	19.2410	18.7625	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8107	19.0563	19.3861	19.7614	20.0284	20.1553	20.1784	20.1777	20.1210	19.7973	19.2410	18.7625	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9362	0.8716	0.7493	0.5589	0.3841	0.4191	0.6577	0.8848	0.9659	0.9852	(94)
Useful gains	702.4699	794.6648	841.5014	829.9794	729.3902	525.2766	347.0587	364.7510	552.8168	685.0651	679.6786	667.4560	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.5650	1413.1186	1283.6455	1071.3811	820.0022	542.2575	349.2844	368.1452	589.6817	905.5562	1199.8619	1444.7922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.3268	415.6009	328.9552	173.8093	67.4153	0.0000	0.0000	0.0000	0.0000	164.0453	374.5319	578.3382	(98)
Space heating												2660.0229	(98)
Space heating per m2											(98) / (4) =	33.1178	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2863.3186	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	557.3268	415.6009	328.9552	173.8093	67.4153	0.0000	0.0000	0.0000	0.0000	164.0453	374.5319	578.3382	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	599.9212	447.3637	354.0960	187.0929	72.5676	0.0000	0.0000	0.0000	0.0000	176.5827	403.1560	622.5384	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1545	89.0580	88.8799	88.4990	87.7888	86.7000	86.7000	86.7000	86.7000	88.4238	88.9768	89.1920	(217)
Fuel for water heating, kWh/month													
	183.1140	160.6948	167.0323	147.4977	143.6080	126.8734	118.9465	134.5283	135.5512	153.2254	164.6139	177.6714	(219)
Water heating fuel used												1813.3570	(219)
Annual totals kWh/year													
Space heating fuel - main system												2863.3186	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4476.9000	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2863.3186	3.4800	99.6435	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1813.3570	3.4800	63.1048	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			256.3979	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8593	(257)
SAP value		88.0128	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2863.3186	0.2160	618.4768	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1813.3570	0.2160	391.6851	(264)
Space and water heating			1010.1619	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			906.4784	(272)
CO2 emissions per m2			11.2900	(273)
EI value			90.3074	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8806 = 3.952, stars = 4
Water heating environmental impact	0.216 / 0.8806 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4700	
Infiltration rate			0.3680	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3284	0.3050	0.3128	0.2972	0.2972	0.2893	0.2815	0.2737	0.2659	0.2893	0.2737	0.2893	(22b)
Effective ac	0.5539	0.5465	0.5489	0.5441	0.5441	0.5419	0.5396	0.5375	0.5353	0.5419	0.5375	0.5419	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9538	37.4448	37.6103	37.2835	37.2835	37.1264	36.9734	36.8247	36.6802	37.1264	36.8247	37.1264	(38)
Heat transfer coeff	98.2807	97.7716	97.9371	97.6103	97.6103	97.4532	97.3003	97.1515	97.0070	97.4532	97.1515	97.4532	(39)
Average = Sum(39)m / 12 =												97.5150	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2236	1.2173	1.2193	1.2153	1.2153	1.2133	1.2114	1.2096	1.2078	1.2133	1.2096	1.2133	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7536	57.0490	56.9526	57.1433	57.1433	57.2355	57.3254	57.4132	57.4987	57.2355	57.4132	57.2355	
alpha	4.7836	4.8033	4.7968	4.8096	4.8096	4.8157	4.8217	4.8275	4.8332	4.8157	4.8275	4.8157	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5414	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0286	20.1663	20.4208	20.7002	20.8950	20.9825	20.9969	20.9965	20.9590	20.7455	20.3626	20.0034	(87)
Th 2	19.9012	19.9062	19.9046	19.9078	19.9078	19.9094	19.9109	19.9124	19.9138	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6548	18.8551	19.2119	19.5881	19.8196	19.9003	19.9101	19.9115	19.8884	19.6555	19.1426	18.6249	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6936	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8088	801.2741	847.6508	825.5141	683.1224	467.7506	299.2011	298.7355	510.8439	680.1021	707.7397	691.0078	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.7396	1357.4987	1225.7268	1011.9658	740.8251	474.7998	299.9773	299.6096	529.3923	831.2023	1121.9992	1361.5268	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.7805	373.7829	281.2885	134.2452	42.9307	0.0000	0.0000	0.0000	0.0000	112.4185	298.2668	498.8662	(98)
Space heating												2227.5794	(98)
Space heating per m2											(98) / (4) =	27.7338	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2397.8249	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.7805	373.7829	281.2885	134.2452	42.9307	0.0000	0.0000	0.0000	0.0000	112.4185	298.2668	498.8662	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	522.9069	402.3497	302.7864	144.5051	46.2118	0.0000	0.0000	0.0000	0.0000	121.0102	321.0623	536.9926	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0731	88.9906	88.7682	88.2934	87.4911	86.7000	86.7000	86.7000	86.7000	88.1224	88.8203	89.1071	(217)
Fuel for water heating, kWh/month													
	183.2814	160.8166	167.2425	147.8412	144.0966	126.8734	118.9465	134.5283	135.5512	153.7494	164.9038	177.8406	(219)
Water heating fuel used												1815.6715	(219)
Annual totals kWh/year													
Space heating fuel - main system												2397.8249	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3938.6030	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2397.8249	7.3800	176.9595	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1815.6715	7.3800	133.9966	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			339.1716	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2397.8249	0.2160	517.9302	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.6715	0.2160	392.1850	(264)
Space and water heating			910.1152	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			767.4455	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2397.8249	1.2200	2925.3464	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.6715	1.2200	2215.1193	(264)
Space and water heating			5140.4657	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4296.5428	(272)
Primary energy kWh/m2/year			53.4928	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (24.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£418	£346	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£339	£282	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	41 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4700	
Infiltration rate			0.3680	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3988	0.3910	0.3832	0.3441	0.3363	0.2972	0.2972	0.2893	0.3128	0.3363	0.3519	0.3675	(22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5419	0.5489	0.5565	0.5619	0.5675	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7072	39.4957	39.2883	38.3142	38.1319	37.2835	37.2835	37.1264	37.6103	38.1319	38.5006	38.8861	(38)
Heat transfer coeff	100.0341	99.8225	99.6151	98.6410	98.4587	97.6103	97.6103	97.4532	97.9371	98.4587	98.8274	99.2129	(39)
Average = Sum(39)m / 12 =												98.6401	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2454	1.2428	1.2402	1.2281	1.2258	1.2153	1.2153	1.2133	1.2193	1.2258	1.2304	1.2352	(40)
HLP (average)												1.2281	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6041	822.5847	898.8150	952.3016	973.3902	939.8558	903.5279	870.2957	840.5344	774.3021	703.7071	677.4546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7588	55.8770	55.9933	56.5462	56.6509	57.1433	57.1433	57.2355	56.9526	56.6509	56.4396	56.2203	
alpha	4.7173	4.7251	4.7329	4.7697	4.7767	4.8096	4.8096	4.8157	4.7968	4.7767	4.7626	4.7480	
util living area													
	0.9894	0.9789	0.9572	0.9055	0.8007	0.6302	0.4683	0.5046	0.7269	0.9199	0.9794	0.9917	(86)
MIT	19.8938	20.0780	20.3281	20.6181	20.8428	20.9626	20.9926	20.9895	20.9252	20.6405	20.2112	19.8544	(87)
Th 2	19.8838	19.8859	19.8880	19.8976	19.8994	19.9078	19.9078	19.9094	19.9046	19.8994	19.8957	19.8919	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8758	0.7417	0.5367	0.3557	0.3903	0.6389	0.8883	0.9718	0.9890	(89)
MIT 2	18.4475	18.7137	19.0702	19.4742	19.7553	19.8846	19.9053	19.9054	19.8514	19.5146	18.9156	18.3964	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8107	19.0563	19.3861	19.7614	20.0284	20.1553	20.1784	20.1777	20.1210	19.7973	19.2410	18.7625	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8107	19.0563	19.3861	19.7614	20.0284	20.1553	20.1784	20.1777	20.1210	19.7973	19.2410	18.7625	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9362	0.8716	0.7493	0.5589	0.3841	0.4191	0.6577	0.8848	0.9659	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4699	794.6648	841.5014	829.9794	729.3902	525.2766	347.0587	364.7510	552.8168	685.0651	679.6786	667.4560	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1451.5650	1413.1186	1283.6455	1071.3811	820.0022	542.2575	349.2844	368.1452	589.6817	905.5562	1199.8619	1444.7922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	557.3268	415.6009	328.9552	173.8093	67.4153	0.0000	0.0000	0.0000	0.0000	164.0453	374.5319	578.3382	(98)

Space heating 2660.0229 (98)
Space heating per m2 (98) / (4) = 33.1178 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2863.3186 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	557.3268	415.6009	328.9552	173.8093	67.4153	0.0000	0.0000	0.0000	0.0000	164.0453	374.5319	578.3382	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	599.9212	447.3637	354.0960	187.0929	72.5676	0.0000	0.0000	0.0000	0.0000	176.5827	403.1560	622.5384	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)

Efficiency of water heater 86.7000 (216)

(217)m	89.2434	89.2496	89.2628	89.3179	89.4421	86.7000	86.7000	86.7000	86.7000	88.7966	89.1149	89.2654	(217)

Fuel for water heating, kWh/month

	155.4952	114.5698	88.3583	41.7316	12.1380	0.0000	0.0000	21.8859	47.3296	93.7595	131.7683	154.5714	(219)

Water heating fuel used 861.6076 (219)
Annual totals kWh/year
Space heating fuel - main system 2863.3186 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) = -630.4424 -630.4424 (233)
Total delivered energy for all uses 3575.1505 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2863.3186	3.4800	99.6435	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.6076	3.4800	29.9839	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.8720	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7704 (257)
SAP value 89.2530
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2863.3186	0.2160	618.4768	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.6076	0.2160	186.1072	(264)
Space and water heating			804.5841	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			726.8505 (272)
CO2 emissions per m2			9.0500 (273)
EI value			92.2281
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4700	
Infiltration rate			0.3680	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3128	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3284	0.3050	0.3128	0.2972	0.2972	0.2893	0.2815	0.2737	0.2659	0.2893	0.2737	0.2893	(22b)
Effective ac	0.5539	0.5465	0.5489	0.5441	0.5441	0.5419	0.5396	0.5375	0.5353	0.5419	0.5375	0.5419	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9538	37.4448	37.6103	37.2835	37.2835	37.1264	36.9734	36.8247	36.6802	37.1264	36.8247	37.1264	(38)
Heat transfer coeff	98.2807	97.7716	97.9371	97.6103	97.6103	97.4532	97.3003	97.1515	97.0070	97.4532	97.1515	97.4532	(39)
Average = Sum(39)m / 12 =												97.5150	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2236	1.2173	1.2193	1.2153	1.2153	1.2133	1.2114	1.2096	1.2078	1.2133	1.2096	1.2133	(40)
HLP (average)												1.2141	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7536	57.0490	56.9526	57.1433	57.1433	57.2355	57.3254	57.4132	57.4987	57.2355	57.4132	57.2355	
alpha	4.7836	4.8033	4.7968	4.8096	4.8096	4.8157	4.8217	4.8275	4.8332	4.8157	4.8275	4.8157	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5414	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0286	20.1663	20.4208	20.7002	20.8950	20.9825	20.9969	20.9965	20.9590	20.7455	20.3626	20.0034	(87)
Th 2	19.9012	19.9062	19.9046	19.9078	19.9078	19.9094	19.9109	19.9124	19.9138	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6548	18.8551	19.2119	19.5881	19.8196	19.9003	19.9101	19.9115	19.8884	19.6555	19.1426	18.6249	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9998	19.1844	19.5154	19.8674	20.0896	20.1721	20.1830	20.1839	20.1573	19.9292	19.4490	18.9711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6936	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8088	801.2741	847.6508	825.5141	683.1224	467.7506	299.2011	298.7355	510.8439	680.1021	707.7397	691.0078 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1385.7396	1357.4987	1225.7268	1011.9658	740.8251	474.7998	299.9773	299.6096	529.3923	831.2023	1121.9992	1361.5268 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	485.7805	373.7829	281.2885	134.2452	42.9307	0.0000	0.0000	0.0000	0.0000	112.4185	298.2668	498.8662 (98)

Space heating 2227.5794 (98)
Space heating per m2 (98) / (4) = 27.7338 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2397.8249 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.7805	373.7829	281.2885	134.2452	42.9307	0.0000	0.0000	0.0000	0.0000	112.4185	298.2668	498.8662	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	522.9069	402.3497	302.7864	144.5051	46.2118	0.0000	0.0000	0.0000	0.0000	121.0102	321.0623	536.9926	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1856	89.1918	89.1814	89.2002	89.0361	86.7000	86.7000	86.7000	86.7000	88.5474	88.9995	89.1990	(217)
Fuel for water heating, kWh/month	150.9851	114.8625	88.0980	40.6217	17.1969	0.0000	0.0000	14.9624	41.9393	89.6417	126.5681	151.2946	(219)

Water heating fuel used 836.1701 (219)
Annual totals kWh/year
Space heating fuel - main system 2397.8249 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602 -705.5602 (233)
Total delivered energy for all uses 3009.1016 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2397.8249	7.3800	176.9595	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	836.1701	7.3800	61.7094	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			281.2144	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2397.8249	0.2160	517.9302	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.1701	0.2160	180.6128	(264)
Space and water heating			698.5429	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			581.8232	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2397.8249	1.2200	2925.3464	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.1701	1.2200	1020.1276	(264)
Space and water heating			3945.4740	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3255.0511	(272)
Primary energy kWh/m2/year			40.5260	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 413 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.13	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.09		
CO_2 Emissions (t/year)	0.74	**DFEE**	46.11	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.13	$kgCO_2/m^2$	Pass
	-5.13 (-28.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.11	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	3.61 m², No overhang
Windows facing South	7.97 m², No overhang
Windows facing West	2.46 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 414 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.13	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.09		
CO_2 Emissions (t/year)	0.74	**DFEE**	46.10	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.13 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3675	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3983	0.3905	0.3826	0.3436	0.3358	0.2967	0.2967	0.2889	0.3124	0.3358	0.3514	0.3670	(22b)
Effective ac	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5674	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6925	39.4814	39.2746	38.3031	38.1214	37.2753	37.2753	37.1186	37.6012	38.1214	38.4891	38.8735	(38)
Heat transfer coeff	100.0193	99.8083	99.6014	98.6300	98.4482	97.6021	97.6021	97.4454	97.9280	98.4482	98.8159	99.2003	(39)
Average = Sum(39)m / 12 =												98.6291	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2453	1.2426	1.2401	1.2280	1.2257	1.2152	1.2152	1.2132	1.2192	1.2257	1.2303	1.2351	(40)
HLP (average)												1.2280	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3568	644.5901	728.6659	793.4887	826.3666	801.9157	769.5317	734.0468	696.4399	618.8715	536.4872	501.1512	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7670	55.8849	56.0010	56.5526	56.6570	57.1481	57.1481	57.2400	56.9579	56.6570	56.4462	56.2274	
alpha	4.7178	4.7257	4.7334	4.7702	4.7771	4.8099	4.8099	4.8160	4.7972	4.7771	4.7631	4.7485	
util living area													
	0.9968	0.9920	0.9802	0.9472	0.8664	0.7113	0.5426	0.5872	0.8148	0.9622	0.9930	0.9977	(86)
MIT	19.6936	19.8875	20.1602	20.4906	20.7698	20.9373	20.9863	20.9801	20.8750	20.5059	20.0311	19.6568	(87)
Th 2	19.8840	19.8860	19.8881	19.8977	19.8995	19.9079	19.9079	19.9094	19.9047	19.8995	19.8959	19.8921	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9277	0.8171	0.6157	0.4158	0.4595	0.7344	0.9443	0.9902	0.9969	(89)
MIT 2	18.1575	18.4409	18.8361	19.3090	19.6765	19.8667	19.9030	19.9015	19.8083	19.3401	18.6583	18.1094	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5432	18.8042	19.1686	19.6057	19.9510	20.1355	20.1750	20.1724	20.0761	19.6329	19.0030	18.4979	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5432	18.8042	19.1686	19.6057	19.9510	20.1355	20.1750	20.1724	20.0761	19.6329	19.0030	18.4979	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9213	0.8197	0.6372	0.4479	0.4917	0.7486	0.9386	0.9869	0.9954	(94)
Useful gains	532.0433	635.2642	704.7504	731.0059	677.3963	510.9447	344.6381	360.9180	521.3789	580.8901	529.4735	498.8268	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.5974	1387.7533	1261.8135	1055.9064	812.2985	540.2808	348.9300	367.6021	585.2307	889.2725	1176.2096	1418.3608	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	664.0603	505.6727	414.4550	233.9284	100.3672	0.0000	0.0000	0.0000	0.0000	229.4365	465.6500	684.1333	(98)
Space heating												3297.7033	(98)
Space heating per m2											(98) / (4) =	41.0571	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3549.7344	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	664.0603	505.6727	414.4550	233.9284	100.3672	0.0000	0.0000	0.0000	0.0000	229.4365	465.6500	684.1333	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	714.8119	544.3194	446.1302	251.8067	108.0379	0.0000	0.0000	0.0000	0.0000	246.9714	501.2379	736.4190	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2500	89.1740	89.0333	88.7271	88.0898	86.7000	86.7000	86.7000	86.7000	88.6847	89.1130	89.2803	(217)
Fuel for water heating, kWh/month													
	182.9181	160.4859	166.7444	147.1186	143.1172	126.8734	118.9465	134.5283	135.5512	152.7746	164.3623	177.4957	(219)
Water heating fuel used												1810.9162	(219)
Annual totals kWh/year													
Space heating fuel - main system												3549.7344	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5160.8750	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3549.7344	0.2160	766.7426	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.9162	0.2160	391.1579	(264)
Space and water heating			1157.9005	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1054.2170	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.1300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3675	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3983	0.3905	0.3826	0.3436	0.3358	0.2967	0.2967	0.2889	0.3124	0.3358	0.3514	0.3670	(22b)
Effective ac	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5674	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6925	39.4814	39.2746	38.3031	38.1214	37.2753	37.2753	37.1186	37.6012	38.1214	38.4891	38.8735	(38)
Heat transfer coeff	100.0193	99.8083	99.6014	98.6300	98.4482	97.6021	97.6021	97.4454	97.9280	98.4482	98.8159	99.2003	(39)
Average = Sum(39)m / 12 =												98.6291	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2453	1.2426	1.2401	1.2280	1.2257	1.2152	1.2152	1.2132	1.2192	1.2257	1.2303	1.2351	(40)
HLP (average)												1.2280	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7670	55.8849	56.0010	56.5526	56.6570	57.1481	57.1481	57.2400	56.9579	56.6570	56.4462	56.2274	
alpha	4.7178	4.7257	4.7334	4.7702	4.7771	4.8099	4.8099	4.8160	4.7972	4.7771	4.7631	4.7485	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8772	0.7262	0.5566	0.6039	0.8299	0.9679	0.9945	0.9982	(86)
MIT	19.6580	19.8536	20.1298	20.4665	20.7544	20.9315	20.9847	20.9776	20.8635	20.4799	19.9982	19.6219	(87)
Th 2	19.8840	19.8860	19.8881	19.8977	19.8995	19.9079	19.9079	19.9094	19.9047	19.8995	19.8959	19.8921	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9352	0.8301	0.6308	0.4274	0.4740	0.7520	0.9521	0.9922	0.9976	(89)
MIT 2	18.6698	18.8659	19.1404	19.4738	19.7353	19.8767	19.9041	19.9033	19.8316	19.4936	19.0185	18.6402	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9180	19.1139	19.3889	19.7231	19.9912	20.1416	20.1755	20.1731	20.0907	19.7413	19.2645	18.8867	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9180	19.1139	19.3889	19.7231	19.9912	20.1416	20.1755	20.1731	20.0907	19.7413	19.2645	18.8867	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8346	0.6529	0.4602	0.5070	0.7671	0.9492	0.9905	0.9968	(94)
Useful gains	501.7862	607.2636	681.0935	714.3853	668.5161	508.3106	344.1574	360.0595	515.3398	561.9036	502.1799	469.0393	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1462.0798	1418.6683	1283.7509	1067.4809	816.2580	540.8712	348.9753	367.6687	586.6621	899.9453	1202.0451	1456.9243	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.4585	545.2640	448.3771	254.2288	109.9200	0.0000	0.0000	0.0000	0.0000	251.5030	503.9029	734.9865	(98)
Space heating												3562.6408	(98)
Space heating per m2											(98) / (4) =	44.3556	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.4597	722.2555	740.5851	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8623	0.9232	0.9049	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.1389	666.7922	670.1847	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0008	221.4933	187.4091	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											560.9032	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0002	55.3733	46.8523	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											140.2258	(107)
Space cooling per m2											1.7458	(108)
Energy for space heating											44.3556	(99)
Energy for space cooling											1.7458	(108)
Total											46.1014	(109)
Dwelling Fabric Energy Efficiency (DFEE)											46.1	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3675	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3280	0.3046	0.3124	0.2967	0.2967	0.2889	0.2811	0.2733	0.2655	0.2889	0.2733	0.2889	(22b)
Effective ac	0.5538	0.5464	0.5488	0.5440	0.5440	0.5417	0.5395	0.5374	0.5352	0.5417	0.5374	0.5417	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9438	37.4361	37.6012	37.2753	37.2753	37.1186	36.9661	36.8177	36.6736	37.1186	36.8177	37.1186	(38)
Heat transfer coeff	98.2706	97.7630	97.9280	97.6021	97.6021	97.4454	97.2929	97.1446	97.0004	97.4454	97.1446	97.4454	(39)
Average = Sum(39)m / 12 =												97.5070	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2235	1.2172	1.2192	1.2152	1.2152	1.2132	1.2113	1.2095	1.2077	1.2132	1.2095	1.2132	(40)
HLP (average)												1.2140	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7594	57.0541	56.9579	57.1481	57.1481	57.2400	57.3298	57.4173	57.5026	57.2400	57.4173	57.2400	
alpha	4.7840	4.8036	4.7972	4.8099	4.8099	4.8160	4.8220	4.8278	4.8335	4.8160	4.8278	4.8160	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0288	20.1664	20.4209	20.7003	20.8950	20.9825	20.9969	20.9965	20.9590	20.7456	20.3627	20.0035	(87)
Th 2	19.9013	19.9063	19.9047	19.9079	19.9079	19.9094	19.9110	19.9124	19.9139	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8366	0.9550	0.9839	(89)
MIT 2	18.6551	18.8554	19.2121	19.5883	19.8197	19.9004	19.9102	19.9115	19.8885	19.6557	19.1428	18.6252	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6936	0.4686	0.3134	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8075	801.2714	847.6428	825.4963	683.0933	467.7228	299.1843	298.7197	510.8214	680.0883	707.7367	691.0071	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.6247	1357.4009	1225.6339	1011.8953	740.7723	474.7681	299.9599	299.5933	529.3623	831.1481	1121.9342	1361.4384	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.6960	373.7190	281.2254	134.2073	42.9132	0.0000	0.0000	0.0000	0.0000	112.3885	298.2221	498.8009	(98)
Space heating												2227.1725	(98)
RHI space heating demand												2227	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1445	(8)
Pressure test				Yes	
Measured/design AP50				4.4600	
Infiltration rate				0.3675	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3983	0.3905	0.3826	0.3436	0.3358	0.2967	0.2967	0.2889	0.3124	0.3358	0.3514	0.3670	(22b)
Effective ac	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5674	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6925	39.4814	39.2746	38.3031	38.1214	37.2753	37.2753	37.1186	37.6012	38.1214	38.4891	38.8735	(38)
Heat transfer coeff	100.0193	99.8083	99.6014	98.6300	98.4482	97.6021	97.6021	97.4454	97.9280	98.4482	98.8159	99.2003	(39)
Average = Sum(39)m / 12 =												98.6291	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2453	1.2426	1.2401	1.2280	1.2257	1.2152	1.2152	1.2132	1.2192	1.2257	1.2303	1.2351	(40)
HLP (average)												1.2280	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6041	822.5847	898.8150	952.3016	973.3902	939.8558	903.5279	870.2957	840.5344	774.3021	703.7071	677.4546	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7670	55.8849	56.0010	56.5526	56.6570	57.1481	57.1481	57.2400	56.9579	56.6570	56.4462	56.2274	
alpha	4.7178	4.7257	4.7334	4.7702	4.7771	4.8099	4.8099	4.8160	4.7972	4.7771	4.7631	4.7485	
util living area													
	0.9894	0.9789	0.9572	0.9054	0.8006	0.6302	0.4682	0.5046	0.7268	0.9199	0.9794	0.9917	(86)
MIT	19.8940	20.0782	20.3283	20.6182	20.8429	20.9626	20.9926	20.9895	20.9252	20.6406	20.2114	19.8546	(87)
Th 2	19.8840	19.8860	19.8881	19.8977	19.8995	19.9079	19.9079	19.9094	19.9047	19.8995	19.8959	19.8921	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8758	0.7417	0.5367	0.3557	0.3903	0.6389	0.8883	0.9718	0.9890	(89)
MIT 2	18.4480	18.7142	19.0705	19.4744	19.7555	19.8847	19.9054	19.9055	19.8515	19.5148	18.9160	18.3968	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8111	19.0567	19.3864	19.7616	20.0285	20.1554	20.1784	20.1777	20.1211	19.7975	19.2413	18.7629	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8111	19.0567	19.3864	19.7616	20.0285	20.1554	20.1784	20.1777	20.1211	19.7975	19.2413	18.7629	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9362	0.8715	0.7493	0.5589	0.3841	0.4191	0.6577	0.8847	0.9659	0.9852	(94)
Useful gains	702.4690	794.6616	841.4927	829.9615	729.3580	525.2470	347.0369	364.7296	552.7888	685.0530	679.6764	667.4556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.3910	1412.9553	1283.5027	1071.2831	819.9288	542.2192	349.2612	368.1218	589.6362	905.4782	1199.7493	1444.6437	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.1980	415.4934	328.8554	173.7516	67.3847	0.0000	0.0000	0.0000	0.0000	163.9963	374.4525	578.2279	(98)
Space heating												2659.3598	(98)
Space heating per m2											(98) / (4) =	33.1096	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2862.6047	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	557.1980	415.4934	328.8554	173.7516	67.3847	0.0000	0.0000	0.0000	0.0000	163.9963	374.4525	578.2279	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	599.7825	447.2480	353.9886	187.0307	72.5347	0.0000	0.0000	0.0000	0.0000	176.5299	403.0705	622.4197	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1544	89.0579	88.8797	88.4988	87.7884	86.7000	86.7000	86.7000	86.7000	88.4235	88.9766	89.1919	(217)
Fuel for water heating, kWh/month													
	183.1142	160.6951	167.0327	147.4981	143.6086	126.8734	118.9465	134.5283	135.5512	153.2258	164.6142	177.6716	(219)
Water heating fuel used												1813.3598	(219)
Annual totals kWh/year													
Space heating fuel - main system												2862.6047	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4476.1889	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2862.6047	3.4800	99.6186	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1813.3598	3.4800	63.1049	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			256.3732	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8592	(257)
SAP value		88.0140	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2862.6047	0.2160	618.3226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1813.3598	0.2160	391.6857	(264)
Space and water heating			1010.0083	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			906.3248	(272)
CO2 emissions per m2			11.2800	(273)
EI value			90.3090	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8806 = 3.952, stars = 4
Water heating environmental impact	0.216 / 0.8806 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.3675	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3280	0.3046	0.3124	0.2967	0.2967	0.2889	0.2811	0.2733	0.2655	0.2889	0.2733	0.2889	(22b)
Effective ac	0.5538	0.5464	0.5488	0.5440	0.5440	0.5417	0.5395	0.5374	0.5352	0.5417	0.5374	0.5417	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9438	37.4361	37.6012	37.2753	37.2753	37.1186	36.9661	36.8177	36.6736	37.1186	36.8177	37.1186	(38)
Heat transfer coeff	98.2706	97.7630	97.9280	97.6021	97.6021	97.4454	97.2929	97.1446	97.0004	97.4454	97.1446	97.4454	(39)
Average = Sum(39)m / 12 =												97.5070	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2235	1.2172	1.2192	1.2152	1.2152	1.2132	1.2113	1.2095	1.2077	1.2132	1.2095	1.2132	(40)
HLP (average)												1.2140	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7594	57.0541	56.9579	57.1481	57.1481	57.2400	57.3298	57.4173	57.5026	57.2400	57.4173	57.2400	
alpha	4.7840	4.8036	4.7972	4.8099	4.8099	4.8160	4.8220	4.8278	4.8335	4.8160	4.8278	4.8160	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0288	20.1664	20.4209	20.7003	20.8950	20.9825	20.9969	20.9965	20.9590	20.7456	20.3627	20.0035	(87)
Th 2	19.9013	19.9063	19.9047	19.9079	19.9079	19.9094	19.9110	19.9124	19.9139	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8366	0.9550	0.9839	(89)
MIT 2	18.6551	18.8554	19.2121	19.5883	19.8197	19.9004	19.9102	19.9115	19.8885	19.6557	19.1428	18.6252	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6936	0.4686	0.3134	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8075	801.2714	847.6428	825.4963	683.0933	467.7228	299.1843	298.7197	510.8214	680.0883	707.7367	691.0071	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.6247	1357.4009	1225.6339	1011.8953	740.7723	474.7681	299.9599	299.5933	529.3623	831.1481	1121.9342	1361.4384	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.6960	373.7190	281.2254	134.2073	42.9132	0.0000	0.0000	0.0000	0.0000	112.3885	298.2221	498.8009	(98)
Space heating												2227.1725	(98)
Space heating per m2											(98) / (4) =	27.7287	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2397.3870	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.6960	373.7190	281.2254	134.2073	42.9132	0.0000	0.0000	0.0000	0.0000	112.3885	298.2221	498.8009	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	522.8159	402.2810	302.7184	144.4643	46.1929	0.0000	0.0000	0.0000	0.0000	120.9779	321.0142	536.9224	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0730	88.9905	88.7680	88.2932	87.4909	86.7000	86.7000	86.7000	86.7000	88.1222	88.8202	89.1071	(217)
Fuel for water heating, kWh/month													
	183.2816	160.8168	167.2428	147.8415	144.0970	126.8734	118.9465	134.5283	135.5512	153.7498	164.9040	177.8408	(219)
Water heating fuel used												1815.6737	(219)
Annual totals kWh/year													
Space heating fuel - main system												2397.3870	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3938.1673	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2397.3870	7.3800	176.9272	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1815.6737	7.3800	133.9967	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			339.1394	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2397.3870	0.2160	517.8356	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.6737	0.2160	392.1855	(264)
Space and water heating			910.0211	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			767.3514	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2397.3870	1.2200	2924.8121	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.6737	1.2200	2215.1220	(264)
Space and water heating			5139.9341	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4296.0112	(272)
Primary energy kWh/m2/year			53.4862	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (24.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£418	£346	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£339	£282	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	41 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3675	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3983	0.3905	0.3826	0.3436	0.3358	0.2967	0.2967	0.2889	0.3124	0.3358	0.3514	0.3670	(22b)
Effective ac	0.5793	0.5762	0.5732	0.5590	0.5564	0.5440	0.5440	0.5417	0.5488	0.5564	0.5617	0.5674	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6925	39.4814	39.2746	38.3031	38.1214	37.2753	37.2753	37.1186	37.6012	38.1214	38.4891	38.8735	(38)
Heat transfer coeff	100.0193	99.8083	99.6014	98.6300	98.4482	97.6021	97.6021	97.4454	97.9280	98.4482	98.8159	99.2003	(39)
Average = Sum(39)m / 12 =												98.6291	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2453	1.2426	1.2401	1.2280	1.2257	1.2152	1.2152	1.2132	1.2192	1.2257	1.2303	1.2351	(40)
HLP (average)												1.2280	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6041	822.5847	898.8150	952.3016	973.3902	939.8558	903.5279	870.2957	840.5344	774.3021	703.7071	677.4546	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7670	55.8849	56.0010	56.5526	56.6570	57.1481	57.1481	57.2400	56.9579	56.6570	56.4462	56.2274	
alpha	4.7178	4.7257	4.7334	4.7702	4.7771	4.8099	4.8099	4.8160	4.7972	4.7771	4.7631	4.7485	
util living area													
	0.9894	0.9789	0.9572	0.9054	0.8006	0.6302	0.4682	0.5046	0.7268	0.9199	0.9794	0.9917	(86)
MIT	19.8940	20.0782	20.3283	20.6182	20.8429	20.9626	20.9926	20.9895	20.9252	20.6406	20.2114	19.8546	(87)
Th 2	19.8840	19.8860	19.8881	19.8977	19.8995	19.9079	19.9079	19.9094	19.9047	19.8995	19.8959	19.8921	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8758	0.7417	0.5367	0.3557	0.3903	0.6389	0.8883	0.9718	0.9890	(89)
MIT 2	18.4480	18.7142	19.0705	19.4744	19.7555	19.8847	19.9054	19.9055	19.8515	19.5148	18.9160	18.3968	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8111	19.0567	19.3864	19.7616	20.0285	20.1554	20.1784	20.1777	20.1211	19.7975	19.2413	18.7629	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8111	19.0567	19.3864	19.7616	20.0285	20.1554	20.1784	20.1777	20.1211	19.7975	19.2413	18.7629	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9362	0.8715	0.7493	0.5589	0.3841	0.4191	0.6577	0.8847	0.9659	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4690	794.6616	841.4927	829.9615	729.3580	525.2470	347.0369	364.7296	552.7888	685.0530	679.6764	667.4556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1451.3910	1412.9553	1283.5027	1071.2831	819.9288	542.2192	349.2612	368.1218	589.6362	905.4782	1199.7493	1444.6437	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	557.1980	415.4934	328.8554	173.7516	67.3847	0.0000	0.0000	0.0000	0.0000	163.9963	374.4525	578.2279	(98)
Space heating												2659.3598	(98)
Space heating per m2											(98) / (4) =	33.1096	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2862.6047	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	557.1980	415.4934	328.8554	173.7516	67.3847	0.0000	0.0000	0.0000	0.0000	163.9963	374.4525	578.2279	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	599.7825	447.2480	353.9886	187.0307	72.5347	0.0000	0.0000	0.0000	0.0000	176.5299	403.0705	622.4197	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2432	89.2494	89.2627	89.3177	89.4419	86.7000	86.7000	86.7000	86.7000	88.7964	89.1148	89.2653	(217)
Fuel for water heating, kWh/month	155.4954	114.5699	88.3584	41.7316	12.1380	0.0000	0.0000	21.8859	47.3296	93.7597	131.7685	154.5716	(219)
Water heating fuel used												861.6088	(219)
Annual totals kWh/year													
Space heating fuel - main system												2862.6047	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3574.4379	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2862.6047	3.4800	99.6186	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.6088	3.4800	29.9840	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.8472	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7703	(257)
SAP value		89.2541	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2862.6047	0.2160	618.3226	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.6088	0.2160	186.1075	(264)
Space and water heating			804.4301	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			726.6966 (272)
CO2 emissions per m2			9.0500 (273)
EI value			92.2297
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3675	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3124	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3280	0.3046	0.3124	0.2967	0.2967	0.2889	0.2811	0.2733	0.2655	0.2889	0.2733	0.2889	(22b)
Effective ac	0.5538	0.5464	0.5488	0.5440	0.5440	0.5417	0.5395	0.5374	0.5352	0.5417	0.5374	0.5417	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9438	37.4361	37.6012	37.2753	37.2753	37.1186	36.9661	36.8177	36.6736	37.1186	36.8177	37.1186	(38)
Heat transfer coeff	98.2706	97.7630	97.9280	97.6021	97.6021	97.4454	97.2929	97.1446	97.0004	97.4454	97.1446	97.4454	(39)
Average = Sum(39)m / 12 =												97.5070	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2235	1.2172	1.2192	1.2152	1.2152	1.2132	1.2113	1.2095	1.2077	1.2132	1.2095	1.2132	(40)
HLP (average)												1.2140	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8163	834.2492	918.7414	983.2791	984.8877	998.0471	954.5123	926.0408	886.7433	811.9657	746.1980	705.6803	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7594	57.0541	56.9579	57.1481	57.1481	57.2400	57.3298	57.4173	57.5026	57.2400	57.4173	57.2400	
alpha	4.7840	4.8036	4.7972	4.8099	4.8099	4.8160	4.8220	4.8278	4.8335	4.8160	4.8278	4.8160	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4059	0.6492	0.8810	0.9671	0.9878	(86)
MIT	20.0288	20.1664	20.4209	20.7003	20.8950	20.9825	20.9969	20.9965	20.9590	20.7456	20.3627	20.0035	(87)
Th 2	19.9013	19.9063	19.9047	19.9079	19.9079	19.9094	19.9110	19.9124	19.9139	19.9094	19.9124	19.9094	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6812	0.4447	0.2860	0.2945	0.5535	0.8366	0.9550	0.9839	(89)
MIT 2	18.6551	18.8554	19.2121	19.5883	19.8197	19.9004	19.9102	19.9115	19.8885	19.6557	19.1428	18.6252	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0001	19.1846	19.5157	19.8676	20.0897	20.1721	20.1831	20.1840	20.1573	19.9294	19.4491	18.9713	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6936	0.4686	0.3134	0.3226	0.5761	0.8376	0.9485	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8075	801.2714	847.6428	825.4963	683.0933	467.7228	299.1843	298.7197	510.8214	680.0883	707.7367	691.0071 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1385.6247	1357.4009	1225.6339	1011.8953	740.7723	474.7681	299.9599	299.5933	529.3623	831.1481	1121.9342	1361.4384 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	485.6960	373.7190	281.2254	134.2073	42.9132	0.0000	0.0000	0.0000	0.0000	112.3885	298.2221	498.8009 (98)

Space heating 2227.1725 (98)
Space heating per m2 (98) / (4) = 27.7287 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2397.3870 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.6960	373.7190	281.2254	134.2073	42.9132	0.0000	0.0000	0.0000	0.0000	112.3885	298.2221	498.8009	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	522.8159	402.2810	302.7184	144.4643	46.1929	0.0000	0.0000	0.0000	0.0000	120.9779	321.0142	536.9224	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1855	89.1917	89.1812	89.2001	89.0358	86.7000	86.7000	86.7000	86.7000	88.5472	88.9994	89.1989	(217)
Fuel for water heating, kWh/month	150.9852	114.8626	88.0981	40.6218	17.1969	0.0000	0.0000	14.9624	41.9393	89.6419	126.5682	151.2947	(219)
Water heating fuel used												836.1711	(219)

Annual totals kWh/year
Space heating fuel - main system 2397.3870 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602 -705.5602 (233)
Total delivered energy for all uses 3008.6647 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2397.3870	7.3800	176.9272	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	836.1711	7.3800	61.7094	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			281.1821	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2397.3870	0.2160	517.8356	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.1711	0.2160	180.6130	(264)
Space and water heating			698.4486	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			581.7289	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2397.3870	1.2200	2924.8121	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	836.1711	1.2200	1020.1288	(264)
Space and water heating			3944.9409	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3254.5180	(272)
Primary energy kWh/m2/year			40.5194	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 414 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	7 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.13	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.09		
CO_2 Emissions (t/year)	0.74	**DFEE**	46.10	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.13	$kgCO_2/m^2$	Pass
	-5.13 (-28.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.10	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 415 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 415	**Prop Type Ref**	
Property	8 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.03	**TER**	20.84
Environmental	92 A	**% DER<TER**	37.48		
CO_2 Emissions (t/year)	0.47	**DFEE**	47.80	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.63		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.59 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.07 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 3.80 m², No overhang
Windows facing West: 1.49 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Air permeability 3.6 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.5900	
Infiltration rate		0.3483	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2960	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3774	0.3700	0.3626	0.3256	0.3182	0.2812	0.2812	0.2738	0.2960	0.3182	0.3330	0.3478	(22b)
Effective ac	0.5712	0.5685	0.5658	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5555	0.5605	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.3385	22.2304	22.1243	21.6264	21.5332	21.0994	21.0994	21.0191	21.2665	21.5332	21.7217	21.9187	(38)
Heat transfer coeff	65.2361	65.1279	65.0219	64.5239	64.4308	63.9970	63.9970	63.9167	64.1641	64.4308	64.6192	64.8163	(39)
Average = Sum(39)m / 12 =												64.5235	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2717	1.2696	1.2675	1.2578	1.2560	1.2475	1.2475	1.2459	1.2508	1.2560	1.2596	1.2635	(40)
HLP (average)												1.2578	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	274.8889	273.1952	263.3948	247.7199	232.0754	216.7746	206.6900	211.5326	219.4569	235.3038	253.5002	266.8876	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	367.1472	433.2278	490.5501	543.7793	577.6475	566.1574	540.8941	507.7218	470.2461	414.3310	364.5163	345.5171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6093	54.7000	54.7892	55.2121	55.2919	55.6667	55.6667	55.7366	55.5217	55.2919	55.1306	54.9630	
alpha	4.6406	4.6467	4.6526	4.6808	4.6861	4.7111	4.7111	4.7158	4.7014	4.6861	4.6754	4.6642	
util living area													
	0.9957	0.9903	0.9765	0.9360	0.8389	0.6718	0.5088	0.5597	0.7989	0.9571	0.9912	0.9968	(86)
MIT	19.7035	19.8900	20.1687	20.5120	20.7941	20.9474	20.9885	20.9823	20.8794	20.5087	20.0363	19.6646	(87)
Th 2	19.8631	19.8648	19.8664	19.8741	19.8755	19.8822	19.8822	19.8834	19.8796	19.8755	19.8726	19.8696	(88)
util rest of house													
	0.9943	0.9870	0.9683	0.9132	0.7841	0.5747	0.3856	0.4334	0.7150	0.9370	0.9876	0.9957	(89)
MIT 2	18.1574	18.4293	18.8318	19.3178	19.6813	19.8488	19.8782	19.8766	19.7885	19.3247	18.6493	18.1052	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.8642	19.0970	19.4429	19.8637	20.1900	20.3510	20.3858	20.3820	20.2872	19.8659	19.2833	18.8180	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8642	19.0970	19.4429	19.8637	20.1900	20.3510	20.3858	20.3820	20.2872	19.8659	19.2833	18.8180	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9841	0.9645	0.9130	0.8010	0.6174	0.4422	0.4915	0.7484	0.9368	0.9851	0.9942	(94)
Useful gains	364.4026	426.3361	473.1173	496.4460	462.6718	349.5308	239.2046	249.5324	351.9433	388.1602	359.0998	343.5241	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	950.1096	924.6198	841.5726	707.4222	547.0172	368.0463	242.2774	254.5182	396.9945	597.0114	787.2763	947.4851	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	435.7660	334.8466	274.1307	151.9029	62.7530	0.0000	0.0000	0.0000	0.0000	155.3853	308.2871	449.3470	(98)
Space heating												2172.4187	(98)
Space heating per m2											(98) / (4) =	42.3473	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2338.4486	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	435.7660	334.8466	274.1307	151.9029	62.7530	0.0000	0.0000	0.0000	0.0000	155.3853	308.2871	449.3470	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	469.0700	360.4377	295.0815	163.5123	67.5489	0.0000	0.0000	0.0000	0.0000	167.2608	331.8483	483.6889	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1242	89.0439	88.8867	88.5427	87.8746	86.7000	86.7000	86.7000	86.7000	88.5314	88.9754	89.1589	(217)
Fuel for water heating, kWh/month													
	150.9032	132.4669	137.8157	121.8681	118.7614	105.2670	98.9250	111.5511	112.2971	126.4968	135.7851	146.4948	(219)
Water heating fuel used												1498.6320	(219)
Annual totals kWh/year													
Space heating fuel - main system												2338.4486	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3527.6142	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2338.4486	0.2160	505.1049	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1498.6320	0.2160	323.7045	(264)
Space and water heating			828.8094	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			668.1964	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0300	ZC1
Total Floor Area	TFA	51.3000	
Assumed number of occupants	N	1.7284	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3973	ZC2
CO2 emissions from cooking, equation (L16)		3.1283	ZC3
Total CO2 emissions		33.5556	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.5556	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	42.1812	36.7137	39.1135	36.3674	36.0458	33.3986	34.5119	36.0458	36.3674	39.1135	39.3361	42.1812	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (64)
								Total per year (kWh/year) = Sum(64)m =				1635.3511 (64)
Heat gains from water heating, kWh/month												
	51.3606	44.8758	46.6148	41.2068	39.8265	34.9407	33.2685	37.2868	37.7049	43.1241	46.2335	50.0728 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	69.0331	66.7794	62.6544	57.2316	53.5302	48.5287	44.7157	50.1166	52.3679	57.9625	64.2132	67.3021	(72)
Total internal gains													
	285.1184	282.9126	272.6018	256.4172	240.2613	224.4500	214.3683	219.7213	228.1583	244.5148	263.2200	277.1187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008 (83)
Total gains	365.8443	422.9412	471.3626	515.4692	542.6370	530.1600	506.7969	478.8869	447.5989	401.1636	360.3591	345.9195 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9958	0.9910	0.9790	0.9432	0.8539	0.6892	0.5231	0.5715	0.8088	0.9596	0.9914	0.9967	(86)
MIT	19.7466	19.9180	20.1805	20.5130	20.7901	20.9468	20.9887	20.9829	20.8819	20.5242	20.0736	19.7157	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9944	0.9880	0.9717	0.9226	0.8025	0.5942	0.4008	0.4472	0.7280	0.9407	0.9880	0.9957	(89)
MIT 2	18.2391	18.4898	18.8702	19.3460	19.7073	19.8839	19.9143	19.9133	19.8239	19.3718	18.7257	18.2007	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9853	0.9681	0.9220	0.8178	0.6358	0.4571	0.5043	0.7600	0.9405	0.9856	0.9942	(94)
Useful gains	363.1533	416.7065	456.3210	475.2761	443.7621	337.0971	231.6373	241.5204	340.1922	377.2926	355.1631	343.9302	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	928.3313	901.6352	819.0285	685.4691	529.6690	355.8228	234.6796	246.3539	384.3176	579.2762	765.9678	923.5361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating												2108.7545	(98)
Space heating per m2											(98) / (4) =	41.1063	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2257.7671	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	450.2060	348.8994	288.9233	162.0331	68.4312	0.0000	0.0000	0.0000	0.0000	160.8948	316.6803	461.6989	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3062	87.0435	86.5140	85.3779	83.3912	80.3000	80.3000	80.3000	80.3000	85.2405	86.7480	87.4103	(217)
Fuel for water heating, kWh/month													
	188.9145	165.5197	173.2665	155.7237	154.3598	141.1851	135.2661	150.7900	152.4553	163.5389	171.5409	184.2584	(219)
Water heating fuel used												1936.8188	(219)
Annual totals kWh/year													
Space heating fuel - main system												2257.7671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Total delivered energy for all uses												4508.8727	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2257.7671	0.2160	487.6777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1936.8188	0.2160	418.3529	(264)
Space and water heating			906.0306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Total CO2, kg/m2/year			1069.1454	(272)
Emissions per m2 for space and water heating			17.6614	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4209	(272b)
Emissions per m2 for pumps and fans			0.7588	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6614 * 1.00) + 2.4209 + 0.7588, rounded to 2 d.p.			20.8400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.5900	
Infiltration rate		0.3483	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2960	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3774	0.3700	0.3626	0.3256	0.3182	0.2812	0.2812	0.2738	0.2960	0.3182	0.3330	0.3478	(22b)
Effective ac	0.5712	0.5685	0.5658	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5555	0.5605	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.3385	22.2304	22.1243	21.6264	21.5332	21.0994	21.0994	21.0191	21.2665	21.5332	21.7217	21.9187	(38)
Heat transfer coeff	65.2361	65.1279	65.0219	64.5239	64.4308	63.9970	63.9970	63.9167	64.1641	64.4308	64.6192	64.8163	(39)
Average = Sum(39)m / 12 =												64.5235	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2717	1.2696	1.2675	1.2578	1.2560	1.2475	1.2475	1.2459	1.2508	1.2560	1.2596	1.2635	(40)
HLP (average)												1.2578	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

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Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	340.4040	407.1154	465.7453	520.7514	555.7735	545.9073	522.0229	487.0824	448.9776	391.2236	339.3323	319.4003	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6093	54.7000	54.7892	55.2121	55.2919	55.6667	55.6667	55.7366	55.5217	55.2919	55.1306	54.9630	
alpha	4.6406	4.6467	4.6526	4.6808	4.6861	4.7111	4.7111	4.7158	4.7014	4.6861	4.6754	4.6642	
util living area													
	0.9969	0.9924	0.9806	0.9444	0.8536	0.6902	0.5254	0.5802	0.8188	0.9649	0.9934	0.9977	(86)
MIT	19.6565	19.8452	20.1287	20.4812	20.7759	20.9410	20.9869	20.9795	20.8650	20.4745	19.9929	19.6184	(87)
Th 2	19.8631	19.8648	19.8664	19.8741	19.8755	19.8822	19.8822	19.8834	19.8796	19.8755	19.8726	19.8696	(88)
util rest of house													
	0.9958	0.9898	0.9738	0.9239	0.8013	0.5929	0.3991	0.4508	0.7378	0.9479	0.9907	0.9969	(89)
MIT 2	18.6518	18.8405	19.1215	19.4666	19.7293	19.8563	19.8791	19.8779	19.8085	19.4682	18.9946	18.6190	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1111	19.2998	19.5819	19.9304	20.2077	20.3522	20.3855	20.3815	20.2914	19.9282	19.4509	19.0758	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1111	19.2998	19.5819	19.9304	20.2077	20.3522	20.3855	20.3815	20.2914	19.9282	19.4509	19.0758	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9882	0.9716	0.9251	0.8184	0.6360	0.4573	0.5105	0.7707	0.9489	0.9894	0.9961	(94)
Useful gains	338.6582	402.3027	452.5216	481.7694	454.8455	347.1837	238.7259	248.6496	346.0188	371.2210	335.7269	318.1632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	966.2187	937.8284	850.6119	711.7238	548.1588	368.1207	242.2585	254.4817	397.2658	601.0218	798.1066	964.1964	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	466.9050	359.8733	296.1792	165.5672	69.4251	0.0000	0.0000	0.0000	0.0000	170.9718	332.9134	480.6487	(98)
Space heating												2342.4837	(98)
Space heating per m2											(98) / (4) =	45.6625	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	601.5720	473.5780	485.7669	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8827	0.9350	0.9150	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	530.9950	442.8048	444.4694	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.4180	674.2629	634.4069	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.1446	172.2048	141.3135	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												437.6629	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0361   43.0512   35.3284    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          109.4157 (107)
Space cooling per m2                                                                                                     2.1329 (108)
Energy for space heating                                                                                                45.6625 (99)
Energy for space cooling                                                                                                 2.1329 (108)
Total                                                                                                                   47.7953 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   47.8 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	328.8717	387.1113	437.3509	483.7440	512.5770	502.2344	480.2474	450.0588	417.6289	368.8452	325.4553	309.5716	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9973	0.9937	0.9843	0.9543	0.8745	0.7167	0.5490	0.6028	0.8379	0.9702	0.9944	0.9980	(86)
MIT	19.6812	19.8559	20.1246	20.4686	20.7627	20.9370	20.9861	20.9785	20.8600	20.4752	20.0128	19.6509	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9964	0.9916	0.9786	0.9370	0.8270	0.6218	0.4222	0.4742	0.7619	0.9556	0.9921	0.9973	(89)
MIT 2	18.6980	18.8736	19.1413	19.4834	19.7502	19.8898	19.9149	19.9142	19.8388	19.4970	19.0396	18.6753	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9902	0.9767	0.9375	0.8417	0.6636	0.4807	0.5335	0.7923	0.9561	0.9909	0.9966	(94)
Useful gains	327.4139	383.3033	427.1509	453.4944	431.4587	333.2823	230.8535	240.1229	330.9076	352.6689	322.4907	308.5312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.2408	913.0286	826.7081	688.8592	530.3395	355.7443	234.6264	246.2593	384.1998	582.1139	774.8944	937.8715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	457.4312	355.9754	297.2706	169.4627	73.5673	0.0000	0.0000	0.0000	0.0000	170.7070	325.7306	468.2292	(98)
Space heating												2318.3740	(98)
Space heating per m2											(98) / (4) =	45.1925	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	579.6997	456.3593	467.8108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8741	0.9304	0.9103	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	506.7211	424.5918	425.8391	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	652.3719	625.4344	591.1325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.8686	149.4268	122.9784	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												377.2738	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.2171   37.3567   30.7446    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              94.3184 (107)
Space cooling per m2                                                                                                        1.8386 (108)
Energy for space heating                                                                                                   45.1925 (99)
Energy for space cooling                                                                                                    1.8386 (108)
Total                                                                                                                      47.0310 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                      54.1 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1688	(8)
Pressure test			Yes	
Measured/design AP50			3.5900	
Infiltration rate			0.3483	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2960	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3108	0.2886	0.2960	0.2812	0.2812	0.2738	0.2664	0.2590	0.2516	0.2738	0.2590	0.2738	(22b)
Effective ac	0.5483	0.5417	0.5438	0.5395	0.5395	0.5375	0.5355	0.5335	0.5317	0.5375	0.5335	0.5375	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.4421	21.1819	21.2665	21.0994	21.0994	21.0191	20.9409	20.8649	20.7910	21.0191	20.8649	21.0191	(38)
Heat transfer coeff	64.3397	64.0795	64.1641	63.9970	63.9970	63.9167	63.8385	63.7625	63.6886	63.9167	63.7625	63.9167	(39)
Average = Sum(39)m / 12 =												63.9483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2542	1.2491	1.2508	1.2475	1.2475	1.2459	1.2444	1.2429	1.2415	1.2459	1.2429	1.2459	(40)
HLP (average)												1.2466	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7284	(42)
Average daily hot water use (litres/day)												75.2500	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397 (64)
RHI water heating demand												1322 (64)
Heat gains from water heating, kWh/month												
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3701	55.5950	55.5217	55.6667	55.6667	55.7366	55.8049	55.8714	55.9362	55.7366	55.8714	55.7366	
alpha	4.6913	4.7063	4.7014	4.7111	4.7111	4.7158	4.7203	4.7248	4.7291	4.7158	4.7248	4.7158	
util living area	0.9805	0.9694	0.9364	0.8557	0.7124	0.5033	0.3667	0.3825	0.6276	0.8675	0.9602	0.9840	(86)
MIT	20.0479	20.1798	20.4388	20.7233	20.9105	20.9858	20.9974	20.9970	20.9615	20.7531	20.3752	20.0218	(87)
Th 2	19.8769	19.8809	19.8796	19.8822	19.8822	19.8834	19.8846	19.8858	19.8869	19.8834	19.8858	19.8834	(88)
util rest of house	0.9745	0.9602	0.9173	0.8150	0.6410	0.4099	0.2630	0.2747	0.5312	0.8198	0.9460	0.9788	(89)
MIT 2	18.6644	18.8547	19.2155	19.5925	19.8091	19.8763	19.8840	19.8850	19.8636	19.6408	19.1389	18.6321	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2968	19.4605	19.7747	20.1094	20.3125	20.3835	20.3930	20.3933	20.3655	20.1493	19.7040	19.2673	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2968	19.4605	19.7747	20.1094	20.3125	20.3835	20.3930	20.3933	20.3655	20.1493	19.7040	19.2673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9559	0.9153	0.8241	0.6698	0.4524	0.3105	0.3241	0.5742	0.8325	0.9431	0.9752	(94)
Useful gains	500.7579	542.2865	572.9021	560.6580	464.6991	320.4067	209.6299	209.2864	347.5133	457.1495	479.5347	474.6955	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	926.2867	907.3945	819.6787	678.9725	499.9798	324.9205	210.2182	209.9899	360.8263	559.2251	752.6534	911.9211	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	316.5934	245.3526	183.6018	85.1865	26.2488	0.0000	0.0000	0.0000	0.0000	75.9442	196.6455	325.2959	(98)
Space heating												1454.8687	(98)
RHI space heating demand												1455	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.5900	
Infiltration rate		0.3483	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2960	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3774	0.3700	0.3626	0.3256	0.3182	0.2812	0.2812	0.2738	0.2960	0.3182	0.3330	0.3478	(22b)
Effective ac	0.5712	0.5685	0.5658	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5555	0.5605	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.3385	22.2304	22.1243	21.6264	21.5332	21.0994	21.0994	21.0191	21.2665	21.5332	21.7217	21.9187	(38)
Heat transfer coeff	65.2361	65.1279	65.0219	64.5239	64.4308	63.9970	63.9970	63.9167	64.1641	64.4308	64.6192	64.8163	(39)
Average = Sum(39)m / 12 =												64.5235	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2717	1.2696	1.2675	1.2578	1.2560	1.2475	1.2475	1.2459	1.2508	1.2560	1.2596	1.2635	(40)
HLP (average)												1.2578	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

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Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	494.3932	558.9712	610.9826	656.5158	682.3650	664.6815	636.7099	605.0403	572.8755	524.6564	482.8607	470.0549	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6093	54.7000	54.7892	55.2121	55.2919	55.6667	55.6667	55.7366	55.5217	55.2919	55.1306	54.9630	
alpha	4.6406	4.6467	4.6526	4.6808	4.6861	4.7111	4.7111	4.7158	4.7014	4.6861	4.6754	4.6642	
util living area													
	0.9859	0.9742	0.9488	0.8871	0.7667	0.5904	0.4369	0.4775	0.7049	0.9082	0.9738	0.9886	(86)
MIT	19.9217	20.0969	20.3492	20.6439	20.8634	20.9692	20.9939	20.9908	20.9301	20.6523	20.2318	19.8804	(87)
Th 2	19.8631	19.8648	19.8664	19.8741	19.8755	19.8822	19.8822	19.8834	19.8796	19.8755	19.8726	19.8696	(88)
util rest of house													
	0.9815	0.9663	0.9333	0.8536	0.7040	0.4980	0.3287	0.3659	0.6151	0.8732	0.9645	0.9850	(89)
MIT 2	18.4727	18.7246	19.0817	19.4857	19.7535	19.8637	19.8802	19.8801	19.8310	19.5085	18.9271	18.4178	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1351	19.3519	19.6611	20.0151	20.2609	20.3690	20.3893	20.3878	20.3334	20.0314	19.5235	19.0864	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1351	19.3519	19.6611	20.0151	20.2609	20.3690	20.3893	20.3878	20.3334	20.0314	19.5235	19.0864	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9778	0.9619	0.9299	0.8583	0.7269	0.5394	0.3784	0.4171	0.6535	0.8788	0.9608	0.9818	(94)
Useful gains	483.4345	537.6888	568.1590	563.4963	496.0030	358.5446	240.9057	252.3675	374.3677	461.0609	463.9379	461.4877	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	967.7824	941.2234	855.7597	717.1923	551.5852	369.2001	242.5024	254.8879	399.9594	607.6705	802.7978	964.8785	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	360.3549	271.1753	213.9749	110.6611	41.3532	0.0000	0.0000	0.0000	0.0000	109.0775	243.9791	374.5228	(98)
Space heating												1725.0987	(98)
Space heating per m2											(98) / (4) =	33.6277	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1856.9416	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	360.3549	271.1753	213.9749	110.6611	41.3532	0.0000	0.0000	0.0000	0.0000	109.0775	243.9791	374.5228	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	387.8955	291.9002	230.3282	119.1185	44.5136	0.0000	0.0000	0.0000	0.0000	117.4139	262.6255	403.1461	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0071	88.9053	88.7080	88.2912	87.5848	86.7000	86.7000	86.7000	86.7000	88.2499	88.8144	89.0501	(217)
Fuel for water heating, kWh/month													
	151.1016	132.6733	138.0934	122.2152	119.1544	105.2670	98.9250	111.5511	112.2971	126.9002	136.0312	146.6737	(219)
Water heating fuel used												1500.8832	(219)
Annual totals kWh/year													
Space heating fuel - main system												1856.9416	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3048.3584	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1856.9416	3.4800	64.6216	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1500.8832	3.4800	52.2307	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	239.2868	13.1900	31.5619	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			196.0337	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8550	(257)
SAP value		88.0731	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1856.9416	0.2160	401.0994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1500.8832	0.2160	324.1908	(264)
Space and water heating			725.2901	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			564.6771	(272)
CO2 emissions per m2			11.0100	(273)
EI value			92.1426	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8795 = 3.957, stars = 4
Water heating environmental impact	0.216 / 0.8795 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.5900	
Infiltration rate		0.3483	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2960	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3108	0.2886	0.2960	0.2812	0.2812	0.2738	0.2664	0.2590	0.2516	0.2738	0.2590	0.2738	(22b)
Effective ac	0.5483	0.5417	0.5438	0.5395	0.5395	0.5375	0.5355	0.5335	0.5317	0.5375	0.5335	0.5375	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.4421	21.1819	21.2665	21.0994	21.0994	21.0191	20.9409	20.8649	20.7910	21.0191	20.8649	21.0191	(38)
Heat transfer coeff	64.3397	64.0795	64.1641	63.9970	63.9970	63.9167	63.8385	63.7625	63.6886	63.9167	63.7625	63.9167	(39)
Average = Sum(39)m / 12 =												63.9483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2542	1.2491	1.2508	1.2475	1.2475	1.2459	1.2444	1.2429	1.2415	1.2459	1.2429	1.2459	(40)
HLP (average)												1.2466	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7284	(42)
Average daily hot water use (litres/day)												75.2500	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.3701	55.5950	55.5217	55.6667	55.6667	55.7366	55.8049	55.8714	55.9362	55.7366	55.8714	55.7366	
alpha	4.6913	4.7063	4.7014	4.7111	4.7111	4.7158	4.7203	4.7248	4.7291	4.7158	4.7248	4.7158	
util living area													
	0.9805	0.9694	0.9364	0.8557	0.7124	0.5033	0.3667	0.3825	0.6276	0.8675	0.9602	0.9840	(86)
MIT	20.0479	20.1798	20.4388	20.7233	20.9105	20.9858	20.9974	20.9970	20.9615	20.7531	20.3752	20.0218	(87)
Th 2	19.8769	19.8809	19.8796	19.8822	19.8822	19.8834	19.8846	19.8858	19.8869	19.8834	19.8858	19.8834	(88)
util rest of house													
	0.9745	0.9602	0.9173	0.8150	0.6410	0.4099	0.2630	0.2747	0.5312	0.8198	0.9460	0.9788	(89)
MIT 2	18.6644	18.8547	19.2155	19.5925	19.8091	19.8763	19.8840	19.8850	19.8636	19.6408	19.1389	18.6321	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2968	19.4605	19.7747	20.1094	20.3125	20.3835	20.3930	20.3933	20.3655	20.1493	19.7040	19.2673	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2968	19.4605	19.7747	20.1094	20.3125	20.3835	20.3930	20.3933	20.3655	20.1493	19.7040	19.2673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9559	0.9153	0.8241	0.6698	0.4524	0.3105	0.3241	0.5742	0.8325	0.9431	0.9752	(94)
Useful gains	500.7579	542.2865	572.9021	560.6580	464.6991	320.4067	209.6299	209.2864	347.5133	457.1495	479.5347	474.6955	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	926.2867	907.3945	819.6787	678.9725	499.9798	324.9205	210.2182	209.9899	360.8263	559.2251	752.6534	911.9211	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	316.5934	245.3526	183.6018	85.1865	26.2488	0.0000	0.0000	0.0000	0.0000	75.9442	196.6455	325.2959	(98)
Space heating												1454.8687	(98)
Space heating per m2											(98) / (4) =	28.3600	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1566.0589	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	316.5934	245.3526	183.6018	85.1865	26.2488	0.0000	0.0000	0.0000	0.0000	75.9442	196.6455	325.2959	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	340.7895	264.1040	197.6338	91.6969	28.2549	0.0000	0.0000	0.0000	0.0000	81.7484	211.6743	350.1570	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9215	88.8355	88.5914	88.0832	87.3247	86.7000	86.7000	86.7000	86.7000	87.9653	88.6547	88.9593	(217)
Fuel for water heating, kWh/month													
	151.2472	132.7776	138.2750	122.5038	119.5092	105.2670	98.9250	111.5511	112.2971	127.3108	136.2762	146.8234	(219)
Water heating fuel used												1502.7635	(219)
Annual totals kWh/year													
Space heating fuel - main system												1566.0589	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												2690.1709	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1566.0589	7.3800	115.5751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.7635	7.3800	110.9039	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	239.2868	28.6600	68.5796	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			224.9576	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1566.0589	0.2160	338.2687	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.7635	0.2160	324.5969	(264)
Space and water heating			662.8656	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			466.3455	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1566.0589	1.2200	1910.5918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.7635	1.2200	1833.3714	(264)
Space and water heating			3743.9633	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	239.2868	3.0700	734.6105	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			2581.5034	(272)
Primary energy kWh/m2/year			50.3217	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£90	£90	£0
Mains gas	£333	£333	£0
Space heating	£244	£244	£0
Water heating	£111	£111	£0
Lighting	£69	£69	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£224	£224	£0
Total cost of uses	£225	£225	£0
Delivered energy	52 kWh/m²	52 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	234.64 (P1)
Transmission heat loss coefficient	42.90 (37)
Summer heat loss coefficient	277.53 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0700	87.1704	0.7200	0.7000	0.7650	123.1114
East	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
South	3.8000	118.5567	0.7200	0.7000	0.7650	156.3306
West	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
total:						375.0832

	Jun	Jul	Aug	
Solar gains	402	375	338	(P3)
Internal gains	312	300	306	
Total summer gains	714	675	644	(P5)
Summer gain/loss ratio	2.57	2.43	2.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.22	19.98	19.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 415 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 415	**Prop Type Ref**	
Property	8 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.03	**TER**	20.84
Environmental	92 A	**% DER<TER**	37.48		
CO_2 Emissions (t/year)	0.47	**DFEE**	47.80	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.63		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.84	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.03	$kgCO_2/m^2$	Pass
	-7.81 (-37.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.09	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.80	$kWh/m^2/yr$	
	-6.3 (-11.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.59 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.07 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	3.80 m², No overhang
Windows facing West	1.49 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.59 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Air permeability	3.6	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 416 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 416	**Prop Type Ref**	
Property	9 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	14.05	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.12		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.31	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached Maisonette, total floor area 60 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.34 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.47 m², No overhang
Windows facing East: 1.49 m², No overhang
Windows facing South: 5.22 m², No overhang
Windows facing West: 1.30 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2884	0.2884	0.2808	0.3035	0.3263	0.3415	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.0837	26.9468	26.8125	26.1818	26.0638	25.5144	25.5144	25.4127	25.7260	26.0638	26.3025	26.5521	(38)
Heat transfer coeff	81.2654	81.1284	80.9941	80.3634	80.2454	79.6960	79.6960	79.5943	79.9076	80.2454	80.4841	80.7337	(39)
Average = Sum(39)m / 12 =												80.3628	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3486	1.3463	1.3441	1.3336	1.3317	1.3225	1.3225	1.3208	1.3260	1.3317	1.3356	1.3398	(40)
HLP (average)												1.3336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	308.2961	306.4753	295.4466	277.7386	259.9415	242.6260	231.2680	236.4967	245.4949	263.3889	283.9481	299.1929	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	429.2746	515.2394	588.8383	655.2357	696.2293	681.8683	652.1880	612.4972	567.7807	496.1499	429.3283	402.4252	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4945	51.5815	51.6670	52.0725	52.1491	52.5085	52.5085	52.5756	52.3695	52.1491	51.9944	51.8337	
alpha	4.4330	4.4388	4.4445	4.4715	4.4766	4.5006	4.5006	4.5050	4.4913	4.4766	4.4663	4.4556	
util living area													
	0.9958	0.9902	0.9763	0.9369	0.8446	0.6840	0.5219	0.5726	0.8057	0.9580	0.9914	0.9969	(86)
MIT	19.6017	19.8023	20.0975	20.4593	20.7613	20.9341	20.9845	20.9767	20.8582	20.4581	19.9551	19.5611	(87)
Th 2	19.8030	19.8047	19.8065	19.8146	19.8161	19.8232	19.8232	19.8245	19.8205	19.8161	19.8130	19.8098	(88)
util rest of house													
	0.9944	0.9869	0.9679	0.9139	0.7891	0.5829	0.3902	0.4385	0.7199	0.9379	0.9879	0.9958	(89)
MIT 2	17.9679	18.2604	18.6869	19.1998	19.5910	19.7815	19.8180	19.8157	19.7135	19.2102	18.4903	17.9134	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.6487	18.9029	19.2747	19.7247	20.0787	20.2618	20.3041	20.2995	20.1905	19.7302	19.1007	18.6000	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6487	18.9029	19.2747	19.7247	20.0787	20.2618	20.3041	20.2995	20.1905	19.7302	19.1007	18.6000	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9834	0.9631	0.9118	0.8029	0.6228	0.4455	0.4948	0.7499	0.9361	0.9850	0.9942	(94)
Useful gains	426.0280	506.7024	567.1116	597.4379	558.9739	424.6793	290.5791	303.0419	425.7544	464.4259	422.8723	400.0881	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1166.0536	1136.0330	1034.6736	869.9066	672.3486	451.2219	295.1989	310.3774	486.6787	732.6565	965.8639	1162.5632	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	550.5790	422.9101	347.8662	196.1774	84.3508	0.0000	0.0000	0.0000	0.0000	199.5636	390.9540	567.2815	(98)
Space heating												2759.6826	(98)
Space heating per m2											(98) / (4) =	45.7963	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2970.5948	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	550.5790	422.9101	347.8662	196.1774	84.3508	0.0000	0.0000	0.0000	0.0000	199.5636	390.9540	567.2815	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	592.6577	455.2316	374.4523	211.1705	90.7975	0.0000	0.0000	0.0000	0.0000	214.8155	420.8331	610.6367	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2150	89.1411	88.9982	88.6846	88.0464	86.7000	86.7000	86.7000	86.7000	88.6694	89.0803	89.2464	(217)
Fuel for water heating, kWh/month													
	162.0937	142.2515	147.9043	130.6500	127.2048	112.8685	105.9690	119.6348	120.4782	135.6232	145.7564	157.3335	(219)
Water heating fuel used												1607.7679	(219)
Annual totals kWh/year													
Space heating fuel - main system												2970.5948	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4303.9708	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2970.5948	0.2160	641.6485	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1607.7679	0.2160	347.2779	(264)
Space and water heating			988.9264	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			846.5169	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.0500	ZC1
Total Floor Area	TFA	60.2600	
Assumed number of occupants	N	1.9890	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0715	ZC2
CO2 emissions from cooking, equation (L16)		2.7669	ZC3
Total CO2 emissions		33.8885	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.8885	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	45.6500	39.7329	42.3300	39.3581	39.0100	36.1452	37.3500	39.0100	39.3581	42.3300	42.5710	45.6500	(61)
Total heat required for water heating calculated for each month													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
								Total per year (kWh/year) = Sum(64)m =				1769.8350	(64)
Heat gains from water heating, kWh/month													
	55.5843	48.5662	50.4482	44.5954	43.1016	37.8141	36.0043	40.3531	40.8056	46.6704	50.0355	54.1905	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	74.7101	72.2711	67.8068	61.9381	57.9323	52.5195	48.3929	54.2380	56.6744	62.7291	69.4938	72.8367	(72)
Total internal gains													
	319.6824	317.3078	305.7271	287.4681	269.1179	251.2502	239.8956	245.6763	255.2290	273.6741	294.7833	310.5810	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	425.5386	499.9764	562.4448	617.7780	650.8697	635.5873	608.2007	574.6767	537.2292	477.3400	421.9910	400.9093	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9960	0.9910	0.9785	0.9425	0.8546	0.6936	0.5282	0.5766	0.8103	0.9599	0.9917	0.9969	(86)
MIT	19.6903	19.8732	20.1471	20.4886	20.7750	20.9402	20.9867	20.9802	20.8718	20.4978	20.0271	19.6555	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9946	0.9879	0.9710	0.9216	0.8025	0.5964	0.4015	0.4481	0.7282	0.9408	0.9883	0.9959	(89)
MIT 2	18.1361	18.4033	18.7999	19.2872	19.6610	19.8462	19.8802	19.8787	19.7834	19.3107	18.6359	18.0912	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9848	0.9667	0.9196	0.8154	0.6349	0.4547	0.5020	0.7571	0.9393	0.9857	0.9944	(94)
Useful gains	422.4614	492.3986	543.7382	568.1216	530.6913	403.5094	276.5414	288.4971	406.7427	448.3875	415.9368	398.6646	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1113.0485	1082.4655	984.2000	824.9901	637.2052	427.5177	280.5025	294.7483	461.6698	696.2112	919.7639	1108.3779	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating												2577.3801	(98)
Space heating per m2											(98) / (4) =	42.7710	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2759.5076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	550.1036	424.5449	350.8604	198.0143	84.8462	0.0000	0.0000	0.0000	0.0000	197.4099	388.3891	565.3391	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5604	87.3009	86.7856	85.6842	83.6904	80.3000	80.3000	80.3000	80.3000	85.5573	87.0343	87.6635	(217)
Fuel for water heating, kWh/month													
	203.8564	178.6033	186.9285	167.9272	166.4566	152.7955	146.3898	163.1903	164.9925	176.3323	185.0369	198.8350	(219)
Water heating fuel used												2091.3443	(219)
Annual totals kWh/year													
Space heating fuel - main system												2759.5076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Total delivered energy for all uses												5200.2131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2759.5076	0.2160	596.0536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2091.3443	0.2160	451.7304	(264)
Space and water heating			1047.7840	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Total CO2, kg/m2/year			1229.1025	(272)
Emissions per m2 for space and water heating			17.3877	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3630	(272b)
Emissions per m2 for pumps and fans			0.6460	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3877 * 1.00) + 2.3630 + 0.6460, rounded to 2 d.p.			20.4000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2884	0.2884	0.2808	0.3035	0.3263	0.3415	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.0837	26.9468	26.8125	26.1818	26.0638	25.5144	25.5144	25.4127	25.7260	26.0638	26.3025	26.5521	(38)
Heat transfer coeff	81.2654	81.1284	80.9941	80.3634	80.2454	79.6960	79.6960	79.5943	79.9076	80.2454	80.4841	80.7337	(39)
Average = Sum(39)m / 12 =												80.3628	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3486	1.3463	1.3441	1.3336	1.3317	1.3225	1.3225	1.3208	1.3260	1.3317	1.3356	1.3398	(40)
HLP (average)												1.3336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	400.8945	487.5422	562.5567	630.8777	673.1204	660.5172	632.3296	590.7247	545.3271	471.7056	402.6362	374.7230	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4945	51.5815	51.6670	52.0725	52.1491	52.5085	52.5085	52.5756	52.3695	52.1491	51.9944	51.8337	
alpha	4.4330	4.4388	4.4445	4.4715	4.4766	4.5006	4.5006	4.5050	4.4913	4.4766	4.4663	4.4556	
util living area													
	0.9968	0.9921	0.9799	0.9440	0.8569	0.6998	0.5365	0.5904	0.8224	0.9646	0.9933	0.9977	(86)
MIT	19.5598	19.7624	20.0619	20.4317	20.7443	20.9277	20.9827	20.9737	20.8446	20.4274	19.9164	19.5199	(87)
Th 2	19.8030	19.8047	19.8065	19.8146	19.8161	19.8232	19.8232	19.8245	19.8205	19.8161	19.8130	19.8098	(88)
util rest of house													
	0.9957	0.9893	0.9726	0.9230	0.8037	0.5985	0.4020	0.4537	0.7393	0.9471	0.9905	0.9968	(89)
MIT 2	18.5084	18.7110	19.0078	19.3700	19.6497	19.7916	19.8192	19.8176	19.7390	19.3744	18.8718	18.4741	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9465	19.1491	19.4470	19.8124	20.1058	20.2650	20.3040	20.2994	20.1997	19.8132	19.3071	18.9099	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9465	19.1491	19.4470	19.8124	20.1058	20.2650	20.3040	20.2994	20.1997	19.8132	19.3071	18.9099	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9874	0.9699	0.9229	0.8183	0.6390	0.4586	0.5113	0.7692	0.9471	0.9889	0.9960	(94)
Useful gains	398.7527	481.3790	545.6097	582.2630	550.7863	422.0732	290.0121	302.0165	419.4780	446.7347	398.1802	373.2170	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1190.2557	1156.0083	1048.6326	876.9552	674.5286	451.4793	295.1961	310.3678	487.4137	739.3173	982.4739	1187.5817	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	588.8783	453.3509	374.2491	212.1784	92.0643	0.0000	0.0000	0.0000	0.0000	217.6815	420.6915	605.8873	(98)
Space heating												2964.9812	(98)
Space heating per m2											(98) / (4) =	49.2031	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	749.1428	589.7507	604.9168	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8643	0.9216	0.8996	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	647.4930	543.5036	544.1997	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.3257	811.9197	764.4492	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	143.1596	199.7016	163.8656	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												506.7268 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.7899	49.9254	40.9664	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												126.6817 (107)
Space cooling per m2												2.1023 (108)
Energy for space heating												49.2031 (99)
Energy for space cooling												2.1023 (108)
Total												51.3054 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	385.7722	461.4467	525.8828	583.6905	618.5844	605.6119	579.7146	543.7246	505.0413	442.6105	384.4636	361.8190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9973	0.9935	0.9834	0.9525	0.8727	0.7178	0.5512	0.6044	0.8359	0.9693	0.9943	0.9980	(86)
MIT	19.6307	19.8167	20.0964	20.4483	20.7499	20.9309	20.9842	20.9759	20.8516	20.4533	19.9718	19.5966	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9964	0.9912	0.9774	0.9344	0.8241	0.6208	0.4205	0.4721	0.7581	0.9541	0.9920	0.9973	(89)
MIT 2	18.6239	18.8105	19.0886	19.4369	19.7101	19.8537	19.8810	19.8798	19.8018	19.4491	18.9736	18.5964	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9896	0.9750	0.9341	0.8371	0.6595	0.4756	0.5278	0.7860	0.9539	0.9906	0.9966	(94)
Useful gains	384.0342	456.6256	512.7279	545.2031	517.7941	399.4181	275.6838	286.9784	396.9810	422.2205	380.8568	360.5938	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1133.0054	1098.8740	995.4685	830.3348	638.5804	427.5523	280.4571	294.6670	461.8437	700.9114	932.9704	1128.9672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.2346	431.5909	359.1590	205.2948	89.8650	0.0000	0.0000	0.0000	0.0000	207.3461	397.5218	571.6698	(98)
Space heating												2819.6819	(98)
Space heating per m2											(98) / (4) =	46.7919	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	704.7684	554.8177	568.8901	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8653	0.9238	0.9028	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.8029	512.5501	513.5980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	782.1507	750.4217	709.5141	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.0904	176.9765	145.7615	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  446.8284 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0226   44.2441   36.4404    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  111.7071 (107)
Space cooling per m2                                                                                             1.8538 (108)
Energy for space heating                                                                                        46.7919 (99)
Energy for space cooling                                                                                         1.8538 (108)
Total                                                                                                           48.6457 (109)
Target Fabric Energy Efficiency (TFEE)                                                                          55.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3187	0.2959	0.3035	0.2884	0.2884	0.2808	0.2732	0.2656	0.2580	0.2808	0.2656	0.2808	(22b)
Effective ac	0.5508	0.5438	0.5461	0.5416	0.5416	0.5394	0.5373	0.5353	0.5333	0.5394	0.5353	0.5394	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.9485	25.6189	25.7260	25.5144	25.5144	25.4127	25.3137	25.2174	25.1238	25.4127	25.2174	25.4127	(38)
Heat transfer coeff	80.1301	79.8005	79.9076	79.6960	79.6960	79.5943	79.4953	79.3990	79.3054	79.5943	79.3990	79.5943	(39)
Average = Sum(39)m / 12 =												79.6343	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3297	1.3243	1.3260	1.3225	1.3225	1.3208	1.3192	1.3176	1.3161	1.3208	1.3176	1.3208	(40)
HLP (average)												1.3215	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
RHI water heating demand												1419	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.2241	52.4398	52.3695	52.5085	52.5085	52.5756	52.6411	52.7050	52.7672	52.5756	52.7050	52.5756	
alpha	4.4816	4.4960	4.4913	4.5006	4.5006	4.5050	4.5094	4.5137	4.5178	4.5050	4.5137	4.5050	
util living area													
	0.9822	0.9714	0.9399	0.8638	0.7278	0.5201	0.3806	0.3966	0.6437	0.8765	0.9635	0.9855	(86)
MIT	19.9455	20.0886	20.3669	20.6756	20.8873	20.9802	20.9961	20.9955	20.9498	20.7096	20.2969	19.9178	(87)
Th 2	19.8176	19.8219	19.8205	19.8232	19.8232	19.8245	19.8258	19.8271	19.8283	19.8245	19.8271	19.8245	(88)
util rest of house													
	0.9765	0.9625	0.9213	0.8233	0.6542	0.4199	0.2677	0.2794	0.5423	0.8293	0.9500	0.9807	(89)
MIT 2	18.4750	18.6818	19.0710	19.4828	19.7308	19.8147	19.8249	19.8260	19.7979	19.5382	18.9857	18.4407	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0877	19.2680	19.6110	19.9798	20.2127	20.3004	20.3129	20.3133	20.2779	20.0263	19.5320	19.0562	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0877	19.2680	19.6110	19.9798	20.2127	20.3004	20.3129	20.3133	20.2779	20.0263	19.5320	19.0562	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9173	0.8293	0.6801	0.4614	0.3150	0.3285	0.5831	0.8385	0.9458	0.9765	(94)
Useful gains	585.1312	640.0382	682.6776	673.7950	563.2966	390.8706	254.4413	253.9819	422.5270	547.2044	564.6048	552.5052	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1136.8636	1114.6547	1007.7186	835.2024	614.6712	398.0031	255.4137	255.1314	442.3591	686.6039	923.5721	1118.7951	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	410.4889	318.9423	241.8305	116.2133	38.2227	0.0000	0.0000	0.0000	0.0000	103.7132	258.4565	421.3197	(98)
Space heating												1909.1872	(98)
RHI space heating demand												1909	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2884	0.2884	0.2808	0.3035	0.3263	0.3415	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.0837	26.9468	26.8125	26.1818	26.0638	25.5144	25.5144	25.4127	25.7260	26.0638	26.3025	26.5521	(38)
Heat transfer coeff	81.2654	81.1284	80.9941	80.3634	80.2454	79.6960	79.6960	79.5943	79.9076	80.2454	80.4841	80.7337	(39)
Average = Sum(39)m / 12 =												80.3628	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3486	1.3463	1.3441	1.3336	1.3317	1.3225	1.3225	1.3208	1.3260	1.3317	1.3356	1.3398	(40)
HLP (average)												1.3336	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	573.9511	658.1976	725.6954	783.2436	815.0111	793.5191	760.7137	722.7411	684.1258	621.3441	563.7487	543.9766	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.4945	51.5815	51.6670	52.0725	52.1491	52.5085	52.5085	52.5756	52.3695	52.1491	51.9944	51.8337	
alpha	4.4330	4.4388	4.4445	4.4715	4.4766	4.5006	4.5006	4.5050	4.4913	4.4766	4.4663	4.4556	
util living area													
	0.9872	0.9757	0.9515	0.8934	0.7797	0.6083	0.4532	0.4946	0.7204	0.9149	0.9762	0.9897	(86)
MIT	19.8109	20.0010	20.2716	20.5889	20.8328	20.9587	20.9911	20.9869	20.9117	20.5986	20.1431	19.7678	(87)
Th 2	19.8030	19.8047	19.8065	19.8146	19.8161	19.8232	19.8232	19.8245	19.8205	19.8161	19.8130	19.8098	(88)
util rest of house													
	0.9831	0.9682	0.9363	0.8603	0.7159	0.5105	0.3360	0.3742	0.6275	0.8808	0.9674	0.9864	(89)
MIT 2	18.2705	18.5443	18.9283	19.3655	19.6663	19.7985	19.8204	19.8199	19.7589	19.3912	18.7580	18.2131	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9124	19.1513	19.4880	19.8753	20.1524	20.2819	20.3082	20.3062	20.2393	19.8943	19.3352	18.8610	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9124	19.1513	19.4880	19.8753	20.1524	20.2819	20.3082	20.3062	20.2393	19.8943	19.3352	18.8610	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9629	0.9313	0.8622	0.7355	0.5501	0.3851	0.4246	0.6628	0.8834	0.9628	0.9828	(94)
Useful gains	561.9061	633.8037	675.8761	675.3190	599.4140	436.5128	292.9516	306.9088	453.4262	548.9065	542.7961	534.6389	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1187.4829	1156.1825	1051.9552	882.0089	678.2646	452.8286	295.5302	310.9097	490.5737	745.8266	984.7365	1183.6329	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	465.4291	351.0386	279.8029	148.8167	58.6648	0.0000	0.0000	0.0000	0.0000	146.5085	318.1971	482.8515	(98)
Space heating												2251.3093	(98)
Space heating per m2											(98) / (4) =	37.3599	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2423.3685	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	465.4291	351.0386	279.8029	148.8167	58.6648	0.0000	0.0000	0.0000	0.0000	146.5085	318.1971	482.8515	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	501.0002	377.8671	301.1872	160.1902	63.1484	0.0000	0.0000	0.0000	0.0000	157.7056	342.5157	519.7541	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1203	89.0280	88.8508	88.4706	87.7740	86.7000	86.7000	86.7000	86.7000	88.4287	88.9486	89.1586	(217)
Fuel for water heating, kWh/month													
	162.2661	142.4321	148.1498	130.9660	127.5996	112.8685	105.9690	119.6348	120.4782	135.9924	145.9722	157.4884	(219)
Water heating fuel used												1609.8171	(219)
Annual totals kWh/year													
Space heating fuel - main system												2423.3685	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3758.7937	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2423.3685	3.4800	84.3332	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1609.8171	3.4800	56.0216	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	274.3612	13.1900	36.1882	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			224.1626	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8944	(257)
SAP value		87.5226	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2423.3685	0.2160	523.4476	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1609.8171	0.2160	347.7205	(264)
Space and water heating			871.1681	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			728.7587	(272)
CO2 emissions per m2			12.0900	(273)
EI value			90.7226	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8805 = 3.952, stars = 4
Water heating environmental impact	0.216 / 0.8805 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3187	0.2959	0.3035	0.2884	0.2884	0.2808	0.2732	0.2656	0.2580	0.2808	0.2656	0.2808	(22b)
Effective ac	0.5508	0.5438	0.5461	0.5416	0.5416	0.5394	0.5373	0.5353	0.5333	0.5394	0.5353	0.5394	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.9485	25.6189	25.7260	25.5144	25.5144	25.4127	25.3137	25.2174	25.1238	25.4127	25.2174	25.4127	(38)
Heat transfer coeff	80.1301	79.8005	79.9076	79.6960	79.6960	79.5943	79.4953	79.3990	79.3054	79.5943	79.3990	79.5943	(39)
Average = Sum(39)m / 12 =												79.6343	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3297	1.3243	1.3260	1.3225	1.3225	1.3208	1.3192	1.3176	1.3161	1.3208	1.3176	1.3208	(40)
HLP (average)												1.3215	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.2241	52.4398	52.3695	52.5085	52.5085	52.5756	52.6411	52.7050	52.7672	52.5756	52.7050	52.5756	
alpha	4.4816	4.4960	4.4913	4.5006	4.5006	4.5050	4.5094	4.5137	4.5178	4.5050	4.5137	4.5050	
util living area													
	0.9822	0.9714	0.9399	0.8638	0.7278	0.5201	0.3806	0.3966	0.6437	0.8765	0.9635	0.9855	(86)
MIT	19.9455	20.0886	20.3669	20.6756	20.8873	20.9802	20.9961	20.9955	20.9498	20.7096	20.2969	19.9178	(87)
Th 2	19.8176	19.8219	19.8205	19.8232	19.8232	19.8245	19.8258	19.8271	19.8283	19.8245	19.8271	19.8245	(88)
util rest of house													
	0.9765	0.9625	0.9213	0.8233	0.6542	0.4199	0.2677	0.2794	0.5423	0.8293	0.9500	0.9807	(89)
MIT 2	18.4750	18.6818	19.0710	19.4828	19.7308	19.8147	19.8249	19.8260	19.7979	19.5382	18.9857	18.4407	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0877	19.2680	19.6110	19.9798	20.2127	20.3004	20.3129	20.3133	20.2779	20.0263	19.5320	19.0562	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0877	19.2680	19.6110	19.9798	20.2127	20.3004	20.3129	20.3133	20.2779	20.0263	19.5320	19.0562	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9173	0.8293	0.6801	0.4614	0.3150	0.3285	0.5831	0.8385	0.9458	0.9765	(94)
Useful gains	585.1312	640.0382	682.6776	673.7950	563.2966	390.8706	254.4413	253.9819	422.5270	547.2044	564.6048	552.5052	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1136.8636	1114.6547	1007.7186	835.2024	614.6712	398.0031	255.4137	255.1314	442.3591	686.6039	923.5721	1118.7951	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	410.4889	318.9423	241.8305	116.2133	38.2227	0.0000	0.0000	0.0000	0.0000	103.7132	258.4565	421.3197	(98)
Space heating												1909.1872	(98)
Space heating per m2											(98) / (4) =	31.6825	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2055.0992	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	410.4889	318.9423	241.8305	116.2133	38.2227	0.0000	0.0000	0.0000	0.0000	103.7132	258.4565	421.3197	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	441.8611	343.3178	260.3127	125.0951	41.1439	0.0000	0.0000	0.0000	0.0000	111.6396	278.2093	453.5196	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0438	88.9659	88.7455	88.2734	87.4924	86.7000	86.7000	86.7000	86.7000	88.1530	88.8040	89.0782	(217)
Fuel for water heating, kWh/month													
	162.4054	142.5316	148.3256	131.2586	128.0102	112.8685	105.9690	119.6348	120.4782	136.4177	146.2098	157.6307	(219)
Water heating fuel used												1611.7401	(219)
Annual totals kWh/year													
Space heating fuel - main system												2055.0992	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3323.2623	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2055.0992	7.3800	151.6663	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1611.7401	7.3800	118.9464	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	274.3612	28.6600	78.6319	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			279.1436	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2055.0992	0.2160	443.9014	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.7401	0.2160	348.1359	(264)
Space and water heating			792.0373	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			613.7208	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2055.0992	1.2200	2507.2210	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.7401	1.2200	1966.3229	(264)
Space and water heating			4473.5439	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	274.3612	3.0700	842.2889	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3418.7625	(272)
Primary energy kWh/m2/year			56.7335	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£100	£100	£0
Mains gas	£378	£378	£0
Space heating	£280	£280	£0
Water heating	£119	£119	£0
Lighting	£79	£79	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£279	£279	£0
Total cost of uses	£279	£279	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	376.89 (P1)
Transmission heat loss coefficient	54.18 (37)
Summer heat loss coefficient	431.07 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.4700	87.1704	0.7200	0.7000	0.7650	135.2108
East	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
South	5.2200	118.5567	0.7200	0.7000	0.7650	214.7489
West	1.3000	125.2818	0.7200	0.7000	0.7650	56.5153
total:						471.2501

	Jun	Jul	Aug	
Solar gains	504	471	428	(P3)
Internal gains	351	337	344	
Total summer gains	856	808	772	(P5)
Summer gain/loss ratio	1.98	1.87	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.63	19.42	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 416 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 416	**Prop Type Ref**	
Property	9 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	14.05	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.12		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.31	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.29		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.40	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.05	$kgCO_2/m^2$	Pass
	-6.35 (-31.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.31	$kWh/m^2/yr$	
	-4.6 (-8.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	4.47 m², No overhang		
Windows facing East	1.49 m², No overhang		
Windows facing South	5.22 m², No overhang		
Windows facing West	1.30 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 417 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 417	**Prop Type Ref**	
Property	10 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	14.19	**TER**	20.09
Environmental	91 B	**% DER<TER**	29.38		
CO_2 Emissions (t/year)	0.65	**DFEE**	48.33	**TFEE**	53.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.11		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached Maisonette, total floor area 64 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.09 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.23 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.44 m², No overhang
Windows facing South: 1.42 m², No overhang
Windows facing West: 3.59 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2026	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4141	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3520	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136	(22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.4500	1.2357	9.2063			(27)
Opening Type 7			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1100	0.1800	11.5398			(28a)
External Wall	53.5300	11.6900	41.8400	0.2700	11.2968			(29a)
Lower Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0237			(33)
Party wall			23.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2379	(36)
Total fabric heat loss					(33) + (36) =		46.2616	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.3563	29.1652	28.9779	28.0982	27.9336	27.1674	27.1674	27.0255	27.4625	27.9336	28.2666	28.6147	(38)
Heat transfer coeff	75.6179	75.4268	75.2395	74.3598	74.1952	73.4290	73.4290	73.2871	73.7241	74.1952	74.5282	74.8763	(39)
Average = Sum(39)m / 12 =												74.3590	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1795	1.1765	1.1736	1.1599	1.1573	1.1454	1.1454	1.1431	1.1500	1.1573	1.1625	1.1679	(40)
HLP (average)												1.1599	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0951	(42)
Average daily hot water use (litres/day)												83.9596	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5441	17.9680	18.5414	16.1648	15.5105	13.3844	12.4026	14.2322	14.4022	16.7843	18.3214	19.8959	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7967	10.6390	11.7534	11.3453	11.7024	11.3007	11.6623	11.6883	11.3250	11.7323	11.3874	11.7883	(61)
Total heat required for water heating calculated for each month													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
								Total per year (kWh/year) = Sum(64)m =				1459.1327	(64)
Heat gains from water heating, kWh/month													
	48.4886	42.4888	44.0384	38.6683	37.3073	32.4939	30.4080	34.4701	34.7560	40.1383	43.4593	47.0496	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.2556	16.2145	13.1865	9.9830	7.4624	6.3001	6.8075	8.8486	11.8766	15.0801	17.6006	18.7630	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	183.1809	185.0818	180.2917	170.0942	157.2217	145.1234	137.0410	135.1401	139.9302	150.1277	163.0002	175.0985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	65.1728	63.2274	59.1914	53.7060	50.1442	45.1305	40.8710	46.3308	48.2723	53.9494	60.3601	63.2387	(72)
Total internal gains													
	324.0365	321.9508	310.0967	291.2104	272.2554	253.9811	242.1466	247.7466	257.5062	276.5842	298.3881	314.5273	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.7200	0.7000	0.7700	9.0620	(74)
South	1.4200	46.7521	0.7200	0.7000	0.7700	23.1874	(78)
West	3.5900	19.6403	0.7200	0.7000	0.7700	24.6267	(80)

Solar gains	56.8761	103.4680	157.1383	217.6494	262.4521	268.1565	255.4126	221.2280	178.1858	118.7381	69.3708	47.8424	(83)
Total gains	380.9126	425.4188	467.2350	508.8598	534.7075	522.1376	497.5592	468.9747	435.6920	395.3224	367.7588	362.3697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.8761	59.0252	59.1721	59.8722	60.0050	60.6311	60.6311	60.7485	60.3884	60.0050	59.7369	59.4592	
alpha	4.9251	4.9350	4.9448	4.9915	5.0003	5.0421	5.0421	5.0499	5.0259	5.0003	4.9825	4.9639	
util living area													
	0.9981	0.9963	0.9913	0.9739	0.9197	0.7877	0.6215	0.6747	0.8914	0.9825	0.9963	0.9985	(86)
MIT	19.7139	19.8475	20.0843	20.4090	20.7100	20.9140	20.9797	20.9696	20.8238	20.4393	20.0214	19.6916	(87)
Th 2	19.9364	19.9388	19.9412	19.9522	19.9543	19.9640	19.9640	19.9658	19.9602	19.9543	19.9501	19.9457	(88)
util rest of house													
	0.9974	0.9950	0.9881	0.9631	0.8844	0.6997	0.4890	0.5440	0.8305	0.9733	0.9948	0.9980	(89)
MIT 2	18.2239	18.4206	18.7669	19.2417	19.6553	19.9026	19.9560	19.9524	19.8096	19.2916	18.6831	18.1978	(90)
Living area fraction										fLA = Living area / (4) =		0.5670	(91)
MIT	19.0687	19.2297	19.5138	19.9035	20.2533	20.4761	20.5364	20.5292	20.3846	19.9424	19.4419	19.0448	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0687	19.2297	19.5138	19.9035	20.2533	20.4761	20.5364	20.5292	20.3846	19.9424	19.4419	19.0448	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9939	0.9864	0.9625	0.8959	0.7462	0.5646	0.6183	0.8586	0.9732	0.9937	0.9974	(94)
Useful gains	379.6546	422.8193	460.8610	489.7797	479.0504	389.6098	280.9086	289.9725	374.0862	384.7099	365.4577	361.4320	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1116.7803	1080.8405	979.1549	818.2207	634.6158	431.4733	289.0479	302.6142	463.3296	693.1580	919.8195	1111.5203	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	548.4215	442.1902	385.6107	236.4775	115.7406	0.0000	0.0000	0.0000	0.0000	229.4854	399.1405	558.0657	(98)
Space heating												2915.1322	(98)
Space heating per m2											(98) / (4) =	45.4708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3124.4718	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	548.4215	442.1902	385.6107	236.4775	115.7406	0.0000	0.0000	0.0000	0.0000	229.4854	399.1405	558.0657	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	587.8044	473.9445	413.3019	253.4593	124.0521	0.0000	0.0000	0.0000	0.0000	245.9651	427.8033	598.1412	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5070	89.4540	89.3362	89.0613	88.4683	86.7000	86.7000	86.7000	86.7000	89.0061	89.3698	89.5357	(217)
Fuel for water heating, kWh/month													
	166.1963	145.8020	151.5203	133.7402	130.1097	115.9516	108.8193	122.9176	123.8055	138.8982	149.4130	161.3071	(219)
Water heating fuel used												1648.4809	(219)
Annual totals kWh/year													
Space heating fuel - main system												3124.4718	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												322.3996	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4539.9100	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3124.4718	0.2160	674.8859	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1648.4809	0.2160	356.0719	(264)
Space and water heating			1030.9578	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	322.3996	0.5190	167.3254	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			910.0086	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.1900	ZC1
Total Floor Area	TFA	64.1100	
Assumed number of occupants	N	2.0951	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9317	ZC2
CO2 emissions from cooking, equation (L16)		2.6405	ZC3
Total CO2 emissions		33.7622	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.7622	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3850	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			7.4500	1.3258	9.8769			(27)
Ground floor			64.1100	0.1300	8.3343			(28a)
External Wall	53.5300	11.6900	41.8400	0.1800	7.5312			(29a)
Lower Roof	16.3800		16.3800	0.1300	2.1294			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.9598			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4173	(36)
Total fabric heat loss					(33) + (36) =		42.3770	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.6907	28.5254	28.3635	27.6027	27.4604	26.7978	26.7978	26.6752	27.0531	27.4604	27.7483	28.0494	(38)
Heat transfer coeff	71.0677	70.9025	70.7405	69.9798	69.8375	69.1749	69.1749	69.0522	69.4301	69.8375	70.1254	70.4264	(39)
Average = Sum(39)m / 12 =												69.9791	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1085	1.1060	1.1034	1.0916	1.0893	1.0790	1.0790	1.0771	1.0830	1.0893	1.0938	1.0985	(40)
HLP (average)												1.0915	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0951 (42)
Average daily hot water use (litres/day)		83.9596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5441	17.9680	18.5414	16.1648	15.5105	13.3844	12.4026	14.2322	14.4022	16.7843	18.3214	19.8959	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	47.0634	40.9631	43.6406	40.5766	40.2178	37.2643	38.5064	40.2178	40.5766	43.6406	43.8890	47.0634	(61)
Total heat required for water heating calculated for each month													
	184.0240	160.7497	167.2497	148.3421	143.6213	126.4936	121.1905	135.0990	136.5910	155.5361	166.0317	179.7025	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	184.0240	160.7497	167.2497	148.3421	143.6213	126.4936	121.1905	135.0990	136.5910	155.5361	166.0317	179.7025	(64)
Total per year (kWh/year) = Sum(64)m =												1824.6312	(64)
Heat gains from water heating, kWh/month													
	57.3053	50.0698	52.0102	45.9762	44.4361	38.9848	37.1191	41.6025	42.0689	48.1154	51.5847	55.8683	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.2556	16.2145	13.1865	9.9830	7.4624	6.3001	6.8075	8.8486	11.8766	15.0801	17.6006	18.7630	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	183.1809	185.0818	180.2917	170.0942	157.2217	145.1234	137.0410	135.1401	139.9302	150.1277	163.0002	175.0985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	77.0232	74.5087	69.9061	63.8558	59.7259	54.1456	49.8912	55.9173	58.4291	64.6712	71.6454	75.0919	(72)
Total internal gains													
	335.8868	333.2320	320.8115	301.3601	281.8372	262.9962	251.1668	257.3331	267.6630	287.3061	309.6734	326.3805	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
South	1.4200	46.7521	0.6300	0.7000	0.7700	20.2890	(78)
West	3.5900	19.6403	0.6300	0.7000	0.7700	21.5483	(80)

Solar gains	49.7666	90.5345	137.4960	190.4433	229.6456	234.6369	223.4860	193.5745	155.9126	103.8959	60.6994	41.8621	(83)
Total gains	385.6535	423.7666	458.3075	491.8034	511.4828	497.6331	474.6528	450.9077	423.5756	391.2020	370.3728	368.2426	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6457	62.7917	62.9354	63.6196	63.7492	64.3598	64.3598	64.4742	64.1232	63.7492	63.4875	63.2161	
alpha	5.1764	5.1861	5.1957	5.2413	5.2499	5.2907	5.2907	5.2983	5.2749	5.2499	5.2325	5.2144	
util living area													
	0.9980	0.9963	0.9915	0.9749	0.9218	0.7881	0.6179	0.6679	0.8876	0.9817	0.9961	0.9984	(86)
MIT	19.8163	19.9377	20.1559	20.4561	20.7363	20.9250	20.9836	20.9755	20.8471	20.4930	20.1033	19.7941	(87)
Th 2	19.9939	19.9960	19.9980	20.0077	20.0096	20.0180	20.0180	20.0196	20.0148	20.0096	20.0059	20.0020	(88)
util rest of house													
	0.9973	0.9950	0.9884	0.9646	0.8880	0.7033	0.4918	0.5432	0.8273	0.9723	0.9945	0.9979	(89)
MIT 2	18.4141	18.5929	18.9120	19.3508	19.7359	19.9641	20.0115	20.0087	19.8839	19.4091	18.8424	18.3876	(90)
Living area fraction									fLA = Living area / (4) =			0.5670	(91)
MIT	19.2091	19.3554	19.6173	19.9775	20.3031	20.5089	20.5626	20.5569	20.4300	20.0237	19.5574	19.1850	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2091	19.3554	19.6173	19.9775	20.3031	20.5089	20.5626	20.5569	20.4300	20.0237	19.5574	19.1850	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9940	0.9869	0.9642	0.8993	0.7484	0.5637	0.6141	0.8557	0.9725	0.9935	0.9973	(94)
Useful gains	384.3399	421.2077	452.2932	474.2196	459.9915	372.4380	267.5658	276.9225	362.4644	380.4464	367.9673	367.2516	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1059.5579	1024.9245	927.9246	775.2021	600.8213	408.7484	274.1150	287.0418	439.4950	658.1252	873.5769	1055.3419	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	502.3622	405.6977	353.8698	216.7074	104.7774	0.0000	0.0000	0.0000	0.0000	206.5930	364.0389	511.9392	(98)
Space heating												2665.9857	(98)
Space heating per m2											(98) / (4) =	41.5846	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2854.3744	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	502.3622	405.6977	353.8698	216.7074	104.7774	0.0000	0.0000	0.0000	0.0000	206.5930	364.0389	511.9392	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	537.8611	434.3659	378.8756	232.0208	112.1813	0.0000	0.0000	0.0000	0.0000	221.1917	389.7633	548.1148	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	184.0240	160.7497	167.2497	148.3421	143.6213	126.4936	121.1905	135.0990	136.5910	155.5361	166.0317	179.7025	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4510	87.2845	86.8924	86.0042	84.2715	80.3000	80.3000	80.3000	80.3000	85.7667	86.9735	87.5392	(217)
Fuel for water heating, kWh/month													
	210.4310	184.1677	192.4792	172.4823	170.4269	157.5263	150.9222	168.2429	170.1009	181.3479	190.8992	205.2822	(219)
Water heating fuel used												2154.3087	(219)
Annual totals kWh/year													
Space heating fuel - main system												2854.3744	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												322.3996	(232)
Total delivered energy for all uses												5406.0826	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2854.3744	0.2160	616.5449	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2154.3087	0.2160	465.3307	(264)
Space and water heating			1081.8755	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	322.3996	0.5190	167.3254	(268)
Total CO2, kg/m2/year			1288.1259	(272)
Emissions per m2 for space and water heating			16.8753	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6100	(272b)
Emissions per m2 for pumps and fans			0.6072	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8753 * 1.00) + 2.6100 + 0.6072, rounded to 2 d.p.			20.0900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.3465	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3756	0.3682	0.3608	0.3240	0.3167	0.2798	0.2798	0.2725	0.2946	0.3167	0.3314	0.3461	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.4500	1.2357	9.2063			(27)
Opening Type 7			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1100	0.1800	11.5398			(28a)
External Wall	53.5300	11.6900	41.8400	0.2700	11.2968			(29a)
Lower Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0237			(33)
Party wall			23.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.2379	(36)
Total fabric heat loss					(33) + (36) =		46.2616	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.8823	27.7484	27.6172	27.0010	26.8858	26.3491	26.3491	26.2497	26.5558	26.8858	27.1190	27.3628	(38)
Heat transfer coeff	74.1438	74.0100	73.8788	73.2626	73.1473	72.6106	72.6106	72.5112	72.8174	73.1473	73.3806	73.6244	(39)
Average = Sum(39)m / 12 =												73.2621	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1565	1.1544	1.1524	1.1428	1.1410	1.1326	1.1326	1.1310	1.1358	1.1410	1.1446	1.1484	(40)
HLP (average)												1.1428	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0951	(42)
Average daily hot water use (litres/day)												83.9596	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	29.1041	25.4547	26.2669	22.9001	21.9732	18.9612	17.5704	20.1623	20.4031	23.7778	25.9553	28.1858	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.2556	16.2145	13.1865	9.9830	7.4624	6.3001	6.8075	8.8486	11.8766	15.0801	17.6006	18.7630	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	183.1809	185.0818	180.2917	170.0942	157.2217	145.1234	137.0410	135.1401	139.9302	150.1277	163.0002	175.0985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	39.1185	37.8790	35.3050	31.8058	29.5339	26.3350	23.6161	27.0998	28.3376	31.9594	36.0491	37.8841	(72)
Total internal gains													
	294.9821	293.6023	283.2103	266.3101	248.6452	232.1857	221.8916	225.5157	234.5715	251.5943	271.0770	286.1727	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.7200	0.7000	0.7700	9.0620	(74)
South	1.4200	46.7521	0.7200	0.7000	0.7700	23.1874	(78)
West	3.5900	19.6403	0.7200	0.7000	0.7700	24.6267	(80)

Solar gains	56.8761	103.4680	157.1383	217.6494	262.4521	268.1565	255.4126	221.2280	178.1858	118.7381	69.3708	47.8424	(83)
Total gains	351.8582	397.0704	440.3487	483.9596	511.0973	500.3421	477.3042	446.7437	412.7573	370.3324	340.4478	334.0152	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0466	60.1552	60.2620	60.7688	60.8646	61.3145	61.3145	61.3985	61.1404	60.8646	60.6712	60.4702	
alpha	5.0031	5.0103	5.0175	5.0513	5.0576	5.0876	5.0876	5.0932	5.0760	5.0576	5.0447	5.0313	
util living area													
	0.9987	0.9973	0.9932	0.9781	0.9289	0.8034	0.6379	0.6953	0.9056	0.9864	0.9974	0.9990	(86)
MIT	19.7024	19.8355	20.0718	20.3940	20.6984	20.9078	20.9779	20.9663	20.8111	20.4197	20.0022	19.6765	(87)
Th 2	19.9549	19.9566	19.9583	19.9661	19.9675	19.9743	19.9743	19.9756	19.9717	19.9675	19.9646	19.9615	(88)
util rest of house													
	0.9982	0.9963	0.9906	0.9689	0.8965	0.7178	0.5048	0.5645	0.8498	0.9790	0.9963	0.9986	(89)
MIT 2	18.7705	18.9046	19.1411	19.4646	19.7525	19.9286	19.9683	19.9652	19.8589	19.4941	19.0777	18.7498	(90)
Living area fraction										fLA = Living area / (4) =		0.5670	(91)
MIT	19.2989	19.4324	19.6688	19.9916	20.2888	20.4838	20.5408	20.5328	20.3988	20.0189	19.6019	19.2752	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2989	19.4324	19.6688	19.9916	20.2888	20.4838	20.5408	20.5328	20.3988	20.0189	19.6019	19.2752	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9957	0.9897	0.9691	0.9080	0.7635	0.5809	0.6391	0.8761	0.9795	0.9958	0.9983	(94)
Useful gains	351.0975	395.3659	435.7943	469.0290	464.0653	381.9864	277.2627	285.5222	361.6312	362.7408	339.0026	333.4597	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1112.0770	1075.5441	972.8944	812.5988	628.2499	427.2264	286.1417	299.6735	458.6596	688.9699	917.3957	1109.9057	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	566.1687	457.0797	399.6025	247.3703	122.1533	0.0000	0.0000	0.0000	0.0000	242.7144	416.4431	577.6759	(98)
Space heating												3029.2079	(98)
Space heating per m2											(98) / (4) =	47.2502	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	682.5400	537.3187	551.0855	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8238	0.8971	0.8699	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	562.2818	482.0309	479.3999	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	663.6858	635.2765	601.0701	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	73.0109	114.0148	90.5226	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												277.5483	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   18.2527   28.5037   22.6306    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          69.3871 (107)
Space cooling per m2                                                                                                    1.0823 (108)
Energy for space heating                                                                                               47.2502 (99)
Energy for space cooling                                                                                                1.0823 (108)
Total                                                                                                                  48.3325 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                  48.3 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3850	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			7.4500	1.3258	9.8769			(27)
Ground floor			64.1100	0.1300	8.3343			(28a)
External Wall	53.5300	11.6900	41.8400	0.1800	7.5312			(29a)
Lower Roof	16.3800		16.3800	0.1300	2.1294			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.9598			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4173	(36)
Total fabric heat loss					(33) + (36) =		42.3770	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.6907	28.5254	28.3635	27.6027	27.4604	26.7978	26.7978	26.6752	27.0531	27.4604	27.7483	28.0494	(38)
Heat transfer coeff	71.0677	70.9025	70.7405	69.9798	69.8375	69.1749	69.1749	69.0522	69.4301	69.8375	70.1254	70.4264	(39)
Average = Sum(39)m / 12 =												69.9791	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1085	1.1060	1.1034	1.0916	1.0893	1.0790	1.0790	1.0771	1.0830	1.0893	1.0938	1.0985	(40)
HLP (average)												1.0915	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0951 (42)
Average daily hot water use (litres/day)		83.9596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	29.1041	25.4547	26.2669	22.9001	21.9732	18.9612	17.5704	20.1623	20.4031	23.7778	25.9553	28.1858	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	104.7571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.2556	16.2145	13.1865	9.9830	7.4624	6.3001	6.8075	8.8486	11.8766	15.0801	17.6006	18.7630	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	183.1809	185.0818	180.2917	170.0942	157.2217	145.1234	137.0410	135.1401	139.9302	150.1277	163.0002	175.0985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	33.4757	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	39.1185	37.8790	35.3050	31.8058	29.5339	26.3350	23.6161	27.0998	28.3376	31.9594	36.0491	37.8841	(72)
Total internal gains													
	294.9821	293.6023	283.2103	266.3101	248.6452	232.1857	221.8916	225.5157	234.5715	251.5943	271.0770	286.1727	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.6300	0.7000	0.7700	7.9293	(74)
South	1.4200	46.7521	0.6300	0.7000	0.7700	20.2890	(78)
West	3.5900	19.6403	0.6300	0.7000	0.7700	21.5483	(80)

Solar gains	49.7666	90.5345	137.4960	190.4433	229.6456	234.6369	223.4860	193.5745	155.9126	103.8959	60.6994	41.8621	(83)
Total gains	344.7487	384.1369	420.7064	456.7534	478.2908	466.8226	445.3777	419.0902	390.4841	355.4901	331.7764	328.0349	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.6457	62.7917	62.9354	63.6196	63.7492	64.3598	64.3598	64.4742	64.1232	63.7492	63.4875	63.2161	
alpha	5.1764	5.1861	5.1957	5.2413	5.2499	5.2907	5.2907	5.2983	5.2749	5.2499	5.2325	5.2144	
util living area													
	0.9988	0.9977	0.9942	0.9815	0.9379	0.8179	0.6516	0.7067	0.9130	0.9879	0.9977	0.9991	(86)
MIT	19.7564	19.8802	20.1025	20.4100	20.7024	20.9096	20.9790	20.9682	20.8182	20.4443	20.0472	19.7350	(87)
Th 2	19.9939	19.9960	19.9980	20.0077	20.0096	20.0180	20.0180	20.0196	20.0148	20.0096	20.0059	20.0020	(88)
util rest of house													
	0.9984	0.9968	0.9920	0.9736	0.9092	0.7367	0.5220	0.5802	0.8610	0.9814	0.9967	0.9988	(89)
MIT 2	18.8556	18.9808	19.2039	19.5153	19.7941	19.9722	20.0121	20.0095	19.9044	19.5529	19.1558	18.8408	(90)
Living area fraction									fLA = Living area / (4) =			0.5670	(91)
MIT	19.3664	19.4908	19.7134	20.0226	20.3091	20.5037	20.5603	20.5531	20.4225	20.0583	19.6612	19.3478	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3664	19.4908	19.7134	20.0226	20.3091	20.5037	20.5603	20.5531	20.4225	20.0583	19.6612	19.3478	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9963	0.9912	0.9738	0.9191	0.7799	0.5961	0.6524	0.8855	0.9818	0.9962	0.9985	(94)
Useful gains	344.0858	382.7161	417.0250	444.7760	439.6029	364.0957	265.4964	273.4227	345.7691	349.0067	330.5242	327.5496	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1070.7330	1034.5202	934.7231	778.3553	601.2384	408.3885	273.9562	286.7778	438.9733	660.5459	880.8607	1066.8070	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	540.6255	438.0124	385.1673	240.1771	120.2568	0.0000	0.0000	0.0000	0.0000	231.7852	396.2422	550.0075	(98)
Space heating												2902.2741	(98)
Space heating per m2											(98) / (4) =	45.2702	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	650.2440	511.8942	524.7967	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8236	0.8986	0.8730	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	535.5240	459.9873	458.1586	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	624.5071	597.9598	568.7478	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	64.0678	102.6515	82.2783	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												248.9977	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   16.0170   25.6629   20.5696    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              62.2494 (107)
Space cooling per m2                                                                                                        0.9710 (108)
Energy for space heating                                                                                                   45.2702 (99)
Energy for space cooling                                                                                                    0.9710 (108)
Total                                                                                                                      46.2412 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        53.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2026	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4141	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3520	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3696	0.3432	0.3520	0.3344	0.3344	0.3256	0.3168	0.3080	0.2992	0.3256	0.3080	0.3256	(22b)
Effective ac	0.5683	0.5589	0.5619	0.5559	0.5559	0.5530	0.5502	0.5474	0.5448	0.5530	0.5474	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.4500	1.2357	9.2063			(27)
Opening Type 7			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1100	0.1800	11.5398			(28a)
External Wall	53.5300	11.6900	41.8400	0.2700	11.2968			(29a)
Lower Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0237			(33)
Party wall			23.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2379	(36)
Total fabric heat loss (33) + (36) =	46.2616	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7728	27.3131	27.4625	27.1674	27.1674	27.0255	26.8874	26.7531	26.6225	27.0255	26.7531	27.0255	(38)
Heat transfer coeff	74.0344	73.5747	73.7241	73.4290	73.4290	73.2871	73.1490	73.0147	72.8841	73.2871	73.0147	73.2871	(39)
Average = Sum(39)m / 12 =												73.3429	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1548	1.1476	1.1500	1.1454	1.1454	1.1431	1.1410	1.1389	1.1369	1.1431	1.1389	1.1431	(40)
HLP (average)												1.1440	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0951 (42)
Average daily hot water use (litres/day)	83.9596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5441	17.9680	18.5414	16.1648	15.5105	13.3844	12.4026	14.2322	14.4022	16.7843	18.3214	19.8959	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7967	10.6390	11.7534	11.3453	11.7024	11.3007	11.6623	11.6883	11.3250	11.7323	11.3874	11.7883	(61)
Total heat required for water heating calculated for each month													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
								Total per year (kWh/year) = Sum(64)m =				1459.1327	(64)
RHI water heating demand												1459	(64)
Heat gains from water heating, kWh/month													
	48.4886	42.4888	44.0384	38.6683	37.3073	32.4939	30.4080	34.4701	34.7560	40.1383	43.4593	47.0496	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.6390	40.5362	32.9662	24.9575	18.6561	15.7502	17.0187	22.1215	29.6915	37.7001	44.0016	46.9074	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	273.4044	276.2415	269.0921	253.8720	234.6593	216.6021	204.5388	201.7017	208.8510	224.0712	243.2838	261.3410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	65.1728	63.2274	59.1914	53.7060	50.1442	45.1305	40.8710	46.3308	48.2723	53.9494	60.3601	63.2387	(72)
Total internal gains													
	478.7850	474.5738	455.8185	427.1043	398.0283	372.0516	356.9973	364.7228	381.3836	410.2895	442.2144	466.0560	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	13.4839	0.7200	0.7000	0.7700	11.4913	(74)
South	1.4200	56.7559	0.7200	0.7000	0.7700	28.1490	(78)
West	3.5900	25.1925	0.7200	0.7000	0.7700	31.5886	(80)

Solar gains	71.2289	110.5701	169.9334	237.6576	272.8606	302.9862	286.2726	253.7800	203.8363	137.0968	86.6567	58.8575	(83)
Total gains	550.0139	585.1439	625.7519	664.7620	670.8889	675.0378	643.2699	618.5028	585.2199	547.3862	528.8711	524.9135	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1353	60.5111	60.3884	60.6311	60.6311	60.7485	60.8632	60.9752	61.0844	60.7485	60.9752	60.7485	
alpha	5.0090	5.0341	5.0259	5.0421	5.0421	5.0499	5.0575	5.0650	5.0723	5.0499	5.0650	5.0499	
util living area													
	0.9887	0.9836	0.9665	0.9167	0.8030	0.5967	0.4394	0.4555	0.7205	0.9200	0.9771	0.9904	(86)
MIT	20.0513	20.1506	20.3740	20.6554	20.8747	20.9781	20.9962	20.9955	20.9449	20.7067	20.3546	20.0426	(87)
Th 2	19.9563	19.9621	19.9602	19.9640	19.9640	19.9658	19.9675	19.9692	19.9708	19.9658	19.9692	19.9658	(88)
util rest of house													
	0.9851	0.9784	0.9554	0.8886	0.7404	0.4984	0.3253	0.3378	0.6275	0.8862	0.9685	0.9872	(89)
MIT 2	18.7282	18.8755	19.1929	19.5825	19.8537	19.9539	19.9664	19.9680	19.9345	19.6593	19.1758	18.7228	(90)
Living area fraction									fLA = Living area / (4) =			0.5670	(91)
MIT	19.4784	19.5985	19.8626	20.1908	20.4326	20.5346	20.5503	20.5506	20.5074	20.2532	19.8441	19.4711	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4784	19.5985	19.8626	20.1908	20.4326	20.5346	20.5503	20.5506	20.5074	20.2532	19.8441	19.4711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9830	0.9761	0.9542	0.8955	0.7705	0.5537	0.3902	0.4048	0.6783	0.8969	0.9672	0.9853	(94)
Useful gains	540.6370	571.1877	597.0645	595.2885	516.9245	373.7613	251.0292	250.3565	396.9399	490.9356	511.5091	517.2013	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1079.3044	1052.0060	948.2811	785.0147	582.4853	383.6291	252.3850	251.9429	423.2671	648.8231	872.0973	1060.5467	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	400.7685	323.1099	261.3051	136.6029	48.7773	0.0000	0.0000	0.0000	0.0000	117.4683	259.6235	404.2490	(98)
Space heating												1951.9044	(98)
RHI space heating demand												1952	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2026	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4141	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3520	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136	(22b)
Effective ac	0.6007	0.5968	0.5929	0.5749	0.5716	0.5559	0.5559	0.5530	0.5619	0.5716	0.5784	0.5855	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.4500	1.2357	9.2063			(27)
Opening Type 7			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1100	0.1800	11.5398			(28a)
External Wall	53.5300	11.6900	41.8400	0.2700	11.2968			(29a)
Lower Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0237			(33)
Party wall			23.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2379	(36)
Total fabric heat loss (33) + (36) =	46.2616	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.3563	29.1652	28.9779	28.0982	27.9336	27.1674	27.1674	27.0255	27.4625	27.9336	28.2666	28.6147	(38)
Heat transfer coeff	75.6179	75.4268	75.2395	74.3598	74.1952	73.4290	73.4290	73.2871	73.7241	74.1952	74.5282	74.8763	(39)
Average = Sum(39)m / 12 =												74.3590	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1795	1.1765	1.1736	1.1599	1.1573	1.1454	1.1454	1.1431	1.1500	1.1573	1.1625	1.1679	(40)
HLP (average)												1.1599	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0951 (42)
Average daily hot water use (litres/day)	83.9596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5441	17.9680	18.5414	16.1648	15.5105	13.3844	12.4026	14.2322	14.4022	16.7843	18.3214	19.8959	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7967	10.6390	11.7534	11.3453	11.7024	11.3007	11.6623	11.6883	11.3250	11.7323	11.3874	11.7883	(61)
Total heat required for water heating calculated for each month													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
								Total per year (kWh/year) = Sum(64)m =				1459.1327	(64)
Heat gains from water heating, kWh/month													
	48.4886	42.4888	44.0384	38.6683	37.3073	32.4939	30.4080	34.4701	34.7560	40.1383	43.4593	47.0496	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.6390	40.5362	32.9662	24.9575	18.6561	15.7502	17.0187	22.1215	29.6915	37.7001	44.0016	46.9074	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	273.4044	276.2415	269.0921	253.8720	234.6593	216.6021	204.5388	201.7017	208.8510	224.0712	243.2838	261.3410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	65.1728	63.2274	59.1914	53.7060	50.1442	45.1305	40.8710	46.3308	48.2723	53.9494	60.3601	63.2387	(72)
Total internal gains													
	478.7850	474.5738	455.8185	427.1043	398.0283	372.0516	356.9973	364.7228	381.3836	410.2895	442.2144	466.0560	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	10.6334	0.7200	0.7000	0.7700	9.0620	(74)
South	1.4200	46.7521	0.7200	0.7000	0.7700	23.1874	(78)
West	3.5900	19.6403	0.7200	0.7000	0.7700	24.6267	(80)

Solar gains	56.8761	103.4680	157.1383	217.6494	262.4521	268.1565	255.4126	221.2280	178.1858	118.7381	69.3708	47.8424	(83)
Total gains	535.6612	578.0419	612.9568	644.7538	660.4804	640.2081	612.4098	585.9508	559.5694	529.0276	511.5852	513.8984	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.8761	59.0252	59.1721	59.8722	60.0050	60.6311	60.6311	60.7485	60.3884	60.0050	59.7369	59.4592	
alpha	4.9251	4.9350	4.9448	4.9915	5.0003	5.0421	5.0421	5.0499	5.0259	5.0003	4.9825	4.9639	
util living area													
	0.9915	0.9864	0.9738	0.9379	0.8510	0.6855	0.5174	0.5598	0.7919	0.9469	0.9847	0.9930	(86)
MIT	19.9338	20.0608	20.2793	20.5685	20.8128	20.9544	20.9909	20.9867	20.9040	20.6040	20.2222	19.9084	(87)
Th 2	19.9364	19.9388	19.9412	19.9522	19.9543	19.9640	19.9640	19.9658	19.9602	19.9543	19.9501	19.9457	(88)
util rest of house													
	0.9888	0.9821	0.9651	0.9163	0.8004	0.5936	0.4009	0.4418	0.7114	0.9239	0.9790	0.9908	(89)
MIT 2	18.5434	18.7289	19.0444	19.4573	19.7747	19.9343	19.9607	19.9604	19.8873	19.5145	18.9721	18.5133	(90)
Living area fraction									fLA = Living area / (4) =			0.5670	(91)
MIT	19.3318	19.4841	19.7446	20.0874	20.3633	20.5127	20.5448	20.5423	20.4637	20.1322	19.6809	19.3043	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3318	19.4841	19.7446	20.0874	20.3633	20.5127	20.5448	20.5423	20.4637	20.1322	19.6809	19.3043	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9797	0.9631	0.9195	0.8218	0.6441	0.4672	0.5089	0.7530	0.9285	0.9772	0.9890	(94)
Useful gains	528.6149	566.3257	590.3620	592.8223	542.7967	412.3586	286.1238	298.1914	421.3727	491.1845	499.9138	508.2591	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1136.6726	1100.0314	996.5188	831.8908	642.7779	434.1628	289.6641	303.5769	469.1616	707.2431	937.6321	1130.9525	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	452.3949	358.6502	302.1806	172.1293	74.3861	0.0000	0.0000	0.0000	0.0000	160.7476	315.1572	463.2839	(98)
Space heating												2298.9299	(98)
Space heating per m2											(98) / (4) =	35.8591	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2464.0192	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	452.3949	358.6502	302.1806	172.1293	74.3861	0.0000	0.0000	0.0000	0.0000	160.7476	315.1572	463.2839	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	484.8820	384.4054	323.8806	184.4902	79.7278	0.0000	0.0000	0.0000	0.0000	172.2911	337.7891	496.5529	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3816	89.3110	89.1547	88.7922	88.0784	86.7000	86.7000	86.7000	86.7000	88.6989	89.1978	89.4176	(217)
Fuel for water heating, kWh/month													
	166.4295	146.0353	151.8287	134.1455	130.6857	115.9516	108.8193	122.9176	123.8055	139.3792	149.7011	161.5201	(219)
Water heating fuel used												1651.2192	(219)
Annual totals kWh/year													
Space heating fuel - main system												2464.0192	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												322.3996	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3882.1956	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2464.0192	3.4800	85.7479	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1651.2192	3.4800	57.4624	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	322.3996	13.1900	42.5245	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			232.4720	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8949	(257)
SAP value		87.5167	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2464.0192	0.2160	532.2281	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1651.2192	0.2160	356.6634	(264)
Space and water heating			888.8915	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	322.3996	0.5190	167.3254	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			767.9423	(272)
CO2 emissions per m2			11.9800	(273)
EI value			90.5688	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8824 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8824 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.1100 (1b)	x	2.3100 (2b)	=	148.0941	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.1100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	148.0941	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.2026	(8)
Pressure test		Yes	
Measured/design AP50		4.2300	
Infiltration rate		0.4141	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3520	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3696	0.3432	0.3520	0.3344	0.3344	0.3256	0.3168	0.3080	0.2992	0.3256	0.3080	0.3256	(22b)
Effective ac	0.5683	0.5589	0.5619	0.5559	0.5559	0.5530	0.5502	0.5474	0.5448	0.5530	0.5474	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.4500	1.2357	9.2063			(27)
Opening Type 7			4.2400	1.5000	6.3600			(26a)
Ground floor			64.1100	0.1800	11.5398			(28a)
External Wall	53.5300	11.6900	41.8400	0.2700	11.2968			(29a)
Lower Roof	16.3800		16.3800	0.1600	2.6208			(30)
Total net area of external elements Aum(A, m2)			134.0200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0237			(33)
Party wall			23.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.2379	(36)
Total fabric heat loss (33) + (36) =	46.2616	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7728	27.3131	27.4625	27.1674	27.1674	27.0255	26.8874	26.7531	26.6225	27.0255	26.7531	27.0255	(38)
Heat transfer coeff	74.0344	73.5747	73.7241	73.4290	73.4290	73.2871	73.1490	73.0147	72.8841	73.2871	73.0147	73.2871	(39)
Average = Sum(39)m / 12 =												73.3429	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1548	1.1476	1.1500	1.1454	1.1454	1.1431	1.1410	1.1389	1.1369	1.1431	1.1389	1.1431	(40)
HLP (average)												1.1440	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0951 (42)
Average daily hot water use (litres/day)	83.9596 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3556	88.9972	85.6388	82.2804	78.9220	75.5636	75.5636	78.9220	82.2804	85.6388	88.9972	92.3556	(44)
Energy conte	136.9606	119.7867	123.6091	107.7654	103.4035	89.2293	82.6841	94.8812	96.0144	111.8955	122.1427	132.6391	(45)
Energy content (annual)										Total = Sum(45)m =		1321.0116	(45)
Distribution loss (46)m = 0.15 x (45)m	20.5441	17.9680	18.5414	16.1648	15.5105	13.3844	12.4026	14.2322	14.4022	16.7843	18.3214	19.8959	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7967	10.6390	11.7534	11.3453	11.7024	11.3007	11.6623	11.6883	11.3250	11.7323	11.3874	11.7883	(61)
Total heat required for water heating calculated for each month													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
								Total per year (kWh/year) = Sum(64)m =				1459.1327	(64)
Heat gains from water heating, kWh/month													
	48.4886	42.4888	44.0384	38.6683	37.3073	32.4939	30.4080	34.4701	34.7560	40.1383	43.4593	47.0496	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	125.7085	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.6390	40.5362	32.9662	24.9575	18.6561	15.7502	17.0187	22.1215	29.6915	37.7001	44.0016	46.9074	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	273.4044	276.2415	269.0921	253.8720	234.6593	216.6021	204.5388	201.7017	208.8510	224.0712	243.2838	261.3410	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	49.6660	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	-83.8057	(71)
Water heating gains (Table 5)													
	65.1728	63.2274	59.1914	53.7060	50.1442	45.1305	40.8710	46.3308	48.2723	53.9494	60.3601	63.2387	(72)
Total internal gains													
	478.7850	474.5738	455.8185	427.1043	398.0283	372.0516	356.9973	364.7228	381.3836	410.2895	442.2144	466.0560	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4400	13.4839	0.7200	0.7000	0.7700	11.4913	(74)
South	1.4200	56.7559	0.7200	0.7000	0.7700	28.1490	(78)
West	3.5900	25.1925	0.7200	0.7000	0.7700	31.5886	(80)

Solar gains	71.2289	110.5701	169.9334	237.6576	272.8606	302.9862	286.2726	253.7800	203.8363	137.0968	86.6567	58.8575	(83)
Total gains	550.0139	585.1439	625.7519	664.7620	670.8889	675.0378	643.2699	618.5028	585.2199	547.3862	528.8711	524.9135	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1353	60.5111	60.3884	60.6311	60.6311	60.7485	60.8632	60.9752	61.0844	60.7485	60.9752	60.7485	
alpha	5.0090	5.0341	5.0259	5.0421	5.0421	5.0499	5.0575	5.0650	5.0723	5.0499	5.0650	5.0499	
util living area													
	0.9887	0.9836	0.9665	0.9167	0.8030	0.5967	0.4394	0.4555	0.7205	0.9200	0.9771	0.9904	(86)
MIT	20.0513	20.1506	20.3740	20.6554	20.8747	20.9781	20.9962	20.9955	20.9449	20.7067	20.3546	20.0426	(87)
Th 2	19.9563	19.9621	19.9602	19.9640	19.9640	19.9658	19.9675	19.9692	19.9708	19.9658	19.9692	19.9658	(88)
util rest of house													
	0.9851	0.9784	0.9554	0.8886	0.7404	0.4984	0.3253	0.3378	0.6275	0.8862	0.9685	0.9872	(89)
MIT 2	18.7282	18.8755	19.1929	19.5825	19.8537	19.9539	19.9664	19.9680	19.9345	19.6593	19.1758	18.7228	(90)
Living area fraction									fLA = Living area / (4) =			0.5670	(91)
MIT	19.4784	19.5985	19.8626	20.1908	20.4326	20.5346	20.5503	20.5506	20.5074	20.2532	19.8441	19.4711	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4784	19.5985	19.8626	20.1908	20.4326	20.5346	20.5503	20.5506	20.5074	20.2532	19.8441	19.4711	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9830	0.9761	0.9542	0.8955	0.7705	0.5537	0.3902	0.4048	0.6783	0.8969	0.9672	0.9853	(94)
Useful gains	540.6370	571.1877	597.0645	595.2885	516.9245	373.7613	251.0292	250.3565	396.9399	490.9356	511.5091	517.2013	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1079.3044	1052.0060	948.2811	785.0147	582.4853	383.6291	252.3850	251.9429	423.2671	648.8231	872.0973	1060.5467	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	400.7685	323.1099	261.3051	136.6029	48.7773	0.0000	0.0000	0.0000	0.0000	117.4683	259.6235	404.2490	(98)
Space heating												1951.9044	(98)
Space heating per m2											(98) / (4) =	30.4462	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2092.0733	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	400.7685	323.1099	261.3051	136.6029	48.7773	0.0000	0.0000	0.0000	0.0000	117.4683	259.6235	404.2490	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	429.5483	346.3128	280.0698	146.4126	52.2800	0.0000	0.0000	0.0000	0.0000	125.9038	278.2674	433.2787	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.7573	130.4257	135.3625	119.1107	115.1059	100.5300	94.3464	106.5695	107.3394	123.6278	133.5301	144.4274	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2963	89.2345	89.0384	88.5866	87.7411	86.7000	86.7000	86.7000	86.7000	88.4174	89.0442	89.3237	(217)
Fuel for water heating, kWh/month													
	166.5885	146.1607	152.0271	134.4567	131.1881	115.9516	108.8193	122.9176	123.8055	139.8229	149.9593	161.6899	(219)
Water heating fuel used												1653.3872	(219)
Annual totals kWh/year													
Space heating fuel - main system												2092.0733	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												322.3996	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =											-705.5602	-705.5602	(233)
Total delivered energy for all uses												3437.2999	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2092.0733	7.3800	154.3950	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1653.3872	7.3800	122.0200	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	322.3996	28.6600	92.3997	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			295.0962	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2092.0733	0.2160	451.8878	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1653.3872	0.2160	357.1316	(264)
Space and water heating			809.0195	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	322.3996	0.5190	167.3254	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			649.0841	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2092.0733	1.2200	2552.3295	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1653.3872	1.2200	2017.1324	(264)
Space and water heating			4569.4618	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	322.3996	3.0700	989.7667	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3623.4087	(272)
Primary energy kWh/m2/year			56.5186	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£114	£114	£0
Mains gas	£383	£383	£0
Space heating	£283	£283	£0
Water heating	£122	£122	£0
Lighting	£92	£92	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£295	£295	£0
Total cost of uses	£295	£295	£0
Delivered energy	54 kWh/m²	54 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		293.23 (P1)
Transmission heat loss coefficient		46.26 (37)
Summer heat loss coefficient		339.49 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.4400	87.1704	0.7200	0.7000	0.7650	73.8063
South	1.4200	118.5567	0.7200	0.7000	0.7650	58.4183
West	3.5900	125.2818	0.7200	0.7000	0.7650	156.0691
total:						288.2937

	Jun	Jul	Aug	
Solar gains	310	288	255	(P3)
Internal gains	369	354	362	
Total summer gains	679	642	616	(P5)
Summer gain/loss ratio	2.00	1.89	1.82	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.65	19.44	19.37	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 417 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 417	**Prop Type Ref**	
Property	10 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	14.19	**TER**	20.09
Environmental	91 B	**% DER<TER**	29.38		
CO_2 Emissions (t/year)	0.65	**DFEE**	48.33	**TFEE**	53.18
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.11		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.09	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.19	$kgCO_2/m^2$	Pass
	-5.90 (-29.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.18	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.33	$kWh/m^2/yr$	
	-4.9 (-9.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	2.44 m², No overhang 1.42 m², No overhang 3.59 m², No overhang		
Air change rate	6.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.23 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.039	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 418 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 418	**Prop Type Ref**	
Property	11 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	12.73	**TER**	19.58
Environmental	92 A	**% DER<TER**	34.98		
CO_2 Emissions (t/year)	0.51	**DFEE**	44.83	**TFEE**	49.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached Maisonette, total floor area 58 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.58 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.73 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.30 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 2.61 m², No overhang
Windows facing West: 4.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3297	0.2913	0.2913	0.2837	0.3067	0.3297	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0800	1.2357	8.7490			(27)
Opening Type 6			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1800	0.9882			(28a)
External Wall	58.7600	9.2000	49.5600	0.2700	13.3812			(29a)
Roof	53.7000		53.7000	0.1600	8.5920			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9439	(36)
Total fabric heat loss					(33) + (36) =		39.8343	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0994	25.9651	25.8333	25.2146	25.0989	24.5600	24.5600	24.4602	24.7676	25.0989	25.3331	25.5779	(38)
Heat transfer coeff	65.9338	65.7994	65.6677	65.0490	64.9332	64.3943	64.3943	64.2945	64.6019	64.9332	65.1674	65.4122	(39)
Average = Sum(39)m / 12 =												65.0484	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1411	1.1388	1.1365	1.1258	1.1238	1.1145	1.1145	1.1127	1.1181	1.1238	1.1279	1.1321	(40)
HLP (average)												1.1258	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9182	(42)
Average daily hot water use (litres/day)	79.7578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5159	17.0688	17.6134	15.3558	14.7343	12.7146	11.7819	13.5199	13.6814	15.9443	17.4045	18.9002	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7708	10.6172	11.7317	11.3271	11.6857	11.2869	11.6495	11.6730	11.3088	11.7127	11.3651	11.7632	(61)
Total heat required for water heating calculated for each month													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
								Total per year (kWh/year) = Sum(64)m =				1392.7918	(64)
Heat gains from water heating, kWh/month													
	46.2030	40.4901	41.9760	36.8705	35.5824	31.0057	29.0289	32.8874	33.1543	38.2714	41.4212	44.8361	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.4801	14.6374	11.9040	9.0121	6.7366	5.6873	6.1454	7.9880	10.7215	13.6134	15.8888	16.9381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.3154	169.0516	164.6764	155.3621	143.6045	132.5541	125.1717	123.4355	127.8106	137.1249	148.8825	159.9330	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	62.1009	60.2531	56.4194	51.2091	47.8258	43.0634	39.0174	44.2035	46.0476	51.4401	57.5295	60.2636	(72)
Total internal gains													
	300.6696	298.7155	287.7731	270.3566	252.9403	236.0782	225.1078	230.4003	239.3531	256.9517	277.0741	291.9080	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	19.6403	0.7200	0.7000	0.7700	17.9041	(76)
West	4.4700	19.6403	0.7200	0.7000	0.7700	30.6633	(80)

Solar gains	48.5673	95.0080	156.4647	228.1944	279.6608	286.2826	272.5527	234.1188	181.9749	112.7350	60.5578	39.9394	(83)
Total gains	349.2370	393.7235	444.2378	498.5510	532.6012	522.3608	497.6605	464.5190	421.3280	369.6868	337.6319	331.8475	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8565	60.9808	61.1031	61.6843	61.7943	62.3114	62.3114	62.4081	62.1112	61.7943	61.5722	61.3418	
alpha	5.0571	5.0654	5.0735	5.1123	5.1196	5.1541	5.1541	5.1605	5.1407	5.1196	5.1048	5.0895	
util living area													
	0.9979	0.9958	0.9887	0.9622	0.8843	0.7250	0.5555	0.6127	0.8598	0.9788	0.9959	0.9984	(86)
MIT	19.7748	19.9132	20.1642	20.4981	20.7830	20.9454	20.9887	20.9818	20.8635	20.4880	20.0705	19.7483	(87)
Th 2	19.9674	19.9693	19.9711	19.9798	19.9814	19.9890	19.9890	19.9904	19.9861	19.9814	19.9782	19.9747	(88)
util rest of house													
	0.9972	0.9944	0.9847	0.9477	0.8406	0.6349	0.4350	0.4901	0.7914	0.9680	0.9943	0.9979	(89)
MIT 2	18.3346	18.5379	18.9039	19.3861	19.7660	19.9521	19.9848	19.9828	19.8740	19.3803	18.7745	18.3011	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	18.7352	18.9204	19.2544	19.6954	20.0489	20.2284	20.2640	20.2606	20.1492	19.6884	19.1350	18.7036	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7352	18.9204	19.2544	19.6954	20.0489	20.2284	20.2640	20.2606	20.1492	19.6884	19.1350	18.7036	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9923	0.9808	0.9426	0.8439	0.6577	0.4687	0.5243	0.8041	0.9639	0.9922	0.9969	(94)
Useful gains	347.8449	390.6835	435.6982	469.9270	449.4671	343.5809	233.2655	243.5660	338.7932	356.3254	335.0140	330.8172	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	951.7656	922.5318	837.5522	702.2304	542.1192	362.4357	235.9418	248.2174	390.7900	590.1383	784.2870	948.7118	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	449.3170	357.4020	298.9793	167.2584	68.9332	0.0000	0.0000	0.0000	0.0000	173.9569	323.4766	459.7135	(98)
Space heating												2299.0369	(98)
Space heating per m2											(98) / (4) =	39.7895	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2464.1339	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	449.3170	357.4020	298.9793	167.2584	68.9332	0.0000	0.0000	0.0000	0.0000	173.9569	323.4766	459.7135	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	481.5831	383.0675	320.4494	179.2695	73.8833	0.0000	0.0000	0.0000	0.0000	186.4489	346.7059	492.7262	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4091	89.3421	89.1829	88.8077	88.0530	86.7000	86.7000	86.7000	86.7000	88.8095	89.2529	89.4437	(217)
Fuel for water heating, kWh/month													
	158.6831	139.2501	144.8200	128.0286	124.8274	110.7850	104.0318	117.4230	118.2446	132.8779	142.7350	154.0235	(219)
Water heating fuel used												1575.7300	(219)
Annual totals kWh/year													
Space heating fuel - main system												2464.1339	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												291.0431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3775.4646	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2464.1339	0.2160	532.2529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1575.7300	0.2160	340.3577	(264)
Space and water heating			872.6106	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	291.0431	0.5190	151.0514	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			735.3874	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.7300	ZC1
Total Floor Area	TFA	57.7800	
Assumed number of occupants	N	1.9182	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.1595	ZC2
CO2 emissions from cooking, equation (L16)		2.8563	ZC3
Total CO2 emissions		32.7458	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.7458	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3958	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3364	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4289	0.4205	0.4121	0.3700	0.3616	0.3196	0.3196	0.3112	0.3364	0.3616	0.3785	0.3953	(22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			7.0800	1.3258	9.3864			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	58.7600	9.2000	49.5600	0.1800	8.9208			(29a)
Roof	53.7000		53.7000	0.1300	6.9810			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.5459			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7429	(36)
Total fabric heat loss					(33) + (36) =		36.2888	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8035	26.6418	26.4833	25.7387	25.5994	24.9509	24.9509	24.8308	25.2007	25.5994	25.8812	26.1758	(38)
Heat transfer coeff	63.0923	62.9306	62.7721	62.0275	61.8882	61.2397	61.2397	61.1196	61.4895	61.8882	62.1700	62.4646	(39)
Average = Sum(39)m / 12 =												62.0268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0919	1.0891	1.0864	1.0735	1.0711	1.0599	1.0599	1.0578	1.0642	1.0711	1.0760	1.0811	(40)
HLP (average)												1.0735	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9182	(42)
Average daily hot water use (litres/day)												79.7578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5159	17.0688	17.6134	15.3558	14.7343	12.7146	11.7819	13.5199	13.6814	15.9443	17.4045	18.9002	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.7080	38.9130	41.4566	38.5459	38.2051	35.3993	36.5793	38.2051	38.5459	41.4566	41.6926	44.7080	(61)
Total heat required for water heating calculated for each month													
	174.8144	152.7049	158.8795	140.9181	136.4336	120.1631	115.1254	128.3378	129.7552	147.7521	157.7225	170.7091	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.8144	152.7049	158.8795	140.9181	136.4336	120.1631	115.1254	128.3378	129.7552	147.7521	157.7225	170.7091	(64)
								Total per year (kWh/year) = Sum(64)m =				1733.3156	(64)
Heat gains from water heating, kWh/month													
	54.4374	47.5640	49.4073	43.6752	42.2123	37.0338	35.2614	39.5204	39.9636	45.7074	49.0031	53.0723	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.4801	14.6374	11.9040	9.0121	6.7366	5.6873	6.1454	7.9880	10.7215	13.6134	15.8888	16.9381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.3154	169.0516	164.6764	155.3621	143.6045	132.5541	125.1717	123.4355	127.8106	137.1249	148.8825	159.9330	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	73.1685	70.7798	66.4076	60.6600	56.7369	51.4358	47.3944	53.1188	55.5049	61.4347	68.0599	71.3338	(72)
Total internal gains													
	311.7373	309.2422	297.7613	279.8076	261.8514	244.4505	233.4847	239.3156	248.8104	266.9463	287.6045	302.9782	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	19.6403	0.6300	0.7000	0.7700	15.6661	(76)
West	4.4700	19.6403	0.6300	0.7000	0.7700	26.8304	(80)

Solar gains	42.4964	83.1320	136.9066	199.6701	244.7032	250.4973	238.4836	204.8539	159.2280	98.6431	52.9880	34.9470	(83)
Total gains	354.2337	392.3742	434.6679	479.4777	506.5546	494.9478	471.9684	444.1695	408.0384	365.5895	340.5925	337.9252	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5973	63.7607	63.9218	64.6891	64.8347	65.5212	65.5212	65.6500	65.2551	64.8347	64.5408	64.2364	
alpha	5.2398	5.2507	5.2615	5.3126	5.3223	5.3681	5.3681	5.3767	5.3503	5.3223	5.3027	5.2824	
util living area													
	0.9978	0.9958	0.9892	0.9645	0.8903	0.7310	0.5585	0.6120	0.8585	0.9781	0.9956	0.9983	(86)
MIT	19.8497	19.9769	20.2103	20.5251	20.7946	20.9502	20.9903	20.9846	20.8778	20.5283	20.1349	19.8279	(87)
Th 2	20.0074	20.0097	20.0120	20.0225	20.0245	20.0337	20.0337	20.0354	20.0302	20.0245	20.0205	20.0163	(88)
util rest of house													
	0.9971	0.9943	0.9853	0.9509	0.8489	0.6439	0.4423	0.4941	0.7916	0.9672	0.9939	0.9977	(89)
MIT 2	18.4728	18.6599	19.0006	19.4577	19.8187	19.9997	20.0300	20.0289	19.9295	19.4698	18.8990	18.4473	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	18.8557	19.0262	19.3371	19.7546	20.0901	20.2641	20.2971	20.2947	20.1932	19.7642	19.2427	18.8313	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8557	19.0262	19.3371	19.7546	20.0901	20.2641	20.2971	20.2947	20.1932	19.7642	19.2427	18.8313	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9923	0.9817	0.9463	0.8521	0.6661	0.4748	0.5271	0.8045	0.9634	0.9919	0.9967	(94)
Useful gains	352.7513	389.3650	426.7209	453.7205	431.6153	329.6884	224.1046	234.1064	328.2652	352.2043	337.8280	336.8118	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	918.3548	888.9696	805.8090	673.2820	519.2503	346.8652	226.4097	238.0413	374.6704	567.1549	754.9118	913.9366	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	420.8090	335.7343	282.0415	158.0843	65.2004	0.0000	0.0000	0.0000	0.0000	159.9233	300.3003	429.3809	(98)
Space heating												2151.4740	(98)
Space heating per m2											(98) / (4) =	37.2356	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2303.5053	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.8090	335.7343	282.0415	158.0843	65.2004	0.0000	0.0000	0.0000	0.0000	159.9233	300.3003	429.3809	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	450.5450	359.4586	301.9717	169.2551	69.8077	0.0000	0.0000	0.0000	0.0000	171.2240	321.5207	459.7226	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.8144	152.7049	158.8795	140.9181	136.4336	120.1631	115.1254	128.3378	129.7552	147.7521	157.7225	170.7091	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.1816	86.9797	86.4805	85.3411	83.3098	80.3000	80.3000	80.3000	80.3000	85.2507	86.6471	87.2772	(217)
Fuel for water heating, kWh/month													
	200.5174	175.5638	183.7171	165.1234	163.7666	149.6427	143.3691	159.8230	161.5880	173.3148	182.0286	195.5941	(219)
Water heating fuel used												2054.0487	(219)
Annual totals kWh/year													
Space heating fuel - main system												2303.5053	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												291.0431	(232)
Total delivered energy for all uses												4723.5971	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2303.5053	0.2160	497.5572	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2054.0487	0.2160	443.6745	(264)
Space and water heating			941.2317	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	291.0431	0.5190	151.0514	(268)
Total CO2, kg/m2/year			1131.2080	(272)
Emissions per m2 for space and water heating			16.2899	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6143	(272b)
Emissions per m2 for pumps and fans			0.6737	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2899 * 1.00) + 2.6143 + 0.6737, rounded to 2 d.p.			19.5800	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3297	0.2913	0.2913	0.2837	0.3067	0.3297	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0800	1.2357	8.7490			(27)
Opening Type 6			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1800	0.9882			(28a)
External Wall	58.7600	9.2000	49.5600	0.2700	13.3812			(29a)
Roof	53.7000		53.7000	0.1600	8.5920			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9439	(36)
Total fabric heat loss					(33) + (36) =		39.8343	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0994	25.9651	25.8333	25.2146	25.0989	24.5600	24.5600	24.4602	24.7676	25.0989	25.3331	25.5779	(38)
Heat transfer coeff	65.9338	65.7994	65.6677	65.0490	64.9332	64.3943	64.3943	64.2945	64.6019	64.9332	65.1674	65.4122	(39)
Average = Sum(39)m / 12 =												65.0484	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1411	1.1388	1.1365	1.1258	1.1238	1.1145	1.1145	1.1127	1.1181	1.1238	1.1279	1.1321	(40)
HLP (average)												1.1258	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9182	(42)
Average daily hot water use (litres/day)												79.7578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.6476	24.1808	24.9524	21.7541	20.8736	18.0123	16.6910	19.1532	19.3820	22.5878	24.6564	26.7752	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.4801	14.6374	11.9040	9.0121	6.7366	5.6873	6.1454	7.9880	10.7215	13.6134	15.8888	16.9381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.3154	169.0516	164.6764	155.3621	143.6045	132.5541	125.1717	123.4355	127.8106	137.1249	148.8825	159.9330	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	37.1607	35.9833	33.5381	30.2140	28.0559	25.0171	22.4342	25.7436	26.9194	30.3600	34.2449	35.9882	(72)
Total internal gains													
	272.7295	271.4456	261.8918	246.3615	230.1704	215.0318	205.5246	208.9403	217.2248	232.8716	250.7896	264.6326	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	19.6403	0.7200	0.7000	0.7700	17.9041	(76)
West	4.4700	19.6403	0.7200	0.7000	0.7700	30.6633	(80)

Solar gains	48.5673	95.0080	156.4647	228.1944	279.6608	286.2826	272.5527	234.1188	181.9749	112.7350	60.5578	39.9394	(83)
Total gains	321.2969	366.4537	418.3565	474.5560	509.8312	501.3144	478.0773	443.0591	399.1997	345.6066	311.3474	304.5720	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8565	60.9808	61.1031	61.6843	61.7943	62.3114	62.3114	62.4081	62.1112	61.7943	61.5722	61.3418	
alpha	5.0571	5.0654	5.0735	5.1123	5.1196	5.1541	5.1541	5.1605	5.1407	5.1196	5.1048	5.0895	
util living area													
	0.9986	0.9970	0.9913	0.9687	0.8985	0.7460	0.5757	0.6375	0.8796	0.9839	0.9972	0.9989	(86)
MIT	19.7297	19.8696	20.1243	20.4655	20.7619	20.9376	20.9867	20.9782	20.8453	20.4525	20.0284	19.7041	(87)
Th 2	19.9674	19.9693	19.9711	19.9798	19.9814	19.9890	19.9890	19.9904	19.9861	19.9814	19.9782	19.9747	(88)
util rest of house													
	0.9981	0.9959	0.9881	0.9563	0.8580	0.6565	0.4521	0.5122	0.8161	0.9755	0.9960	0.9986	(89)
MIT 2	18.8077	18.9487	19.2033	19.5440	19.8177	19.9597	19.9856	19.9841	19.8971	19.5372	19.1146	18.7880	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	19.0641	19.2049	19.4594	19.8003	20.0803	20.2317	20.2640	20.2606	20.1608	19.7917	19.3688	19.0428	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0641	19.2049	19.4594	19.8003	20.0803	20.2317	20.2640	20.2606	20.1608	19.7917	19.3688	19.0428	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9948	0.9860	0.9536	0.8626	0.6797	0.4869	0.5475	0.8289	0.9734	0.9950	0.9981	(94)
Useful gains	320.5045	364.5655	412.4819	452.5155	439.7719	340.7619	232.7639	242.5650	330.9112	336.4099	309.8003	303.9991	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	973.4558	941.2502	851.0143	709.0537	544.1584	362.6504	235.9431	248.2128	391.5398	596.8477	799.5225	970.8996	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.7958	387.5321	326.2681	184.7075	77.6635	0.0000	0.0000	0.0000	0.0000	193.7657	352.6000	496.1740	(98)
Space heating												2504.5068	(98)
Space heating per m2											(98) / (4) =	43.3456	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	605.3067	476.5181	488.6385	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8706	0.9296	0.9056	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	526.9914	442.9674	442.5324	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	658.4854	629.9811	590.3829	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	94.6757	139.1382	110.0008	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												343.8146	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   23.6689   34.7846   27.5002    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          85.9537 (107)
Space cooling per m2                                                                                                    1.4876 (108)
Energy for space heating                                                                                               43.3456 (99)
Energy for space cooling                                                                                                1.4876 (108)
Total                                                                                                                  44.8332 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                  44.8 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3958	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3364	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4289	0.4205	0.4121	0.3700	0.3616	0.3196	0.3196	0.3112	0.3364	0.3616	0.3785	0.3953	(22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5781	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			7.0800	1.3258	9.3864			(27)
Ground floor			5.4900	0.1300	0.7137			(28a)
External Wall	58.7600	9.2000	49.5600	0.1800	8.9208			(29a)
Roof	53.7000		53.7000	0.1300	6.9810			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.5459			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7429	(36)
Total fabric heat loss					(33) + (36) =		36.2888	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8035	26.6418	26.4833	25.7387	25.5994	24.9509	24.9509	24.8308	25.2007	25.5994	25.8812	26.1758	(38)
Heat transfer coeff	63.0923	62.9306	62.7721	62.0275	61.8882	61.2397	61.2397	61.1196	61.4895	61.8882	62.1700	62.4646	(39)
Average = Sum(39)m / 12 =												62.0268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0919	1.0891	1.0864	1.0735	1.0711	1.0599	1.0599	1.0578	1.0642	1.0711	1.0760	1.0811	(40)
HLP (average)												1.0735	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9182	(42)
Average daily hot water use (litres/day)												79.7578	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.6476	24.1808	24.9524	21.7541	20.8736	18.0123	16.6910	19.1532	19.3820	22.5878	24.6564	26.7752	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	95.9111	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.4801	14.6374	11.9040	9.0121	6.7366	5.6873	6.1454	7.9880	10.7215	13.6134	15.8888	16.9381	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	167.3154	169.0516	164.6764	155.3621	143.6045	132.5541	125.1717	123.4355	127.8106	137.1249	148.8825	159.9330	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	32.5911	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	37.1607	35.9833	33.5381	30.2140	28.0559	25.0171	22.4342	25.7436	26.9194	30.3600	34.2449	35.9882	(72)
Total internal gains													
	272.7295	271.4456	261.8918	246.3615	230.1704	215.0318	205.5246	208.9403	217.2248	232.8716	250.7896	264.6326	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	19.6403	0.6300	0.7000	0.7700	15.6661	(76)
West	4.4700	19.6403	0.6300	0.7000	0.7700	26.8304	(80)

Solar gains	42.4964	83.1320	136.9066	199.6701	244.7032	250.4973	238.4836	204.8539	159.2280	98.6431	52.9880	34.9470	(83)
Total gains	315.2259	354.5777	398.7984	446.0317	474.8736	465.5291	444.0082	413.7943	376.4529	331.5147	303.7776	299.5796	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5973	63.7607	63.9218	64.6891	64.8347	65.5212	65.5212	65.6500	65.2551	64.8347	64.5408	64.2364	
alpha	5.2398	5.2507	5.2615	5.3126	5.3223	5.3681	5.3681	5.3767	5.3503	5.3223	5.3027	5.2824	
util living area													
	0.9987	0.9974	0.9926	0.9734	0.9106	0.7625	0.5898	0.6496	0.8883	0.9856	0.9975	0.9990	(86)
MIT	19.7863	19.9160	20.1542	20.4785	20.7640	20.9389	20.9875	20.9796	20.8516	20.4774	20.0754	19.7653	(87)
Th 2	20.0074	20.0097	20.0120	20.0225	20.0245	20.0337	20.0337	20.0354	20.0302	20.0245	20.0205	20.0163	(88)
util rest of house													
	0.9983	0.9965	0.9899	0.9628	0.8740	0.6767	0.4690	0.5280	0.8288	0.9780	0.9964	0.9987	(89)
MIT 2	18.8964	19.0276	19.2664	19.5932	19.8594	20.0044	20.0304	20.0293	19.9433	19.5973	19.1957	18.8826	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	19.1439	19.2747	19.5133	19.8394	20.1110	20.2643	20.2966	20.2936	20.1959	19.8421	19.4404	19.1281	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1439	19.2747	19.5133	19.8394	20.1110	20.2643	20.2966	20.2936	20.1959	19.8421	19.4404	19.1281	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9955	0.9881	0.9603	0.8778	0.6989	0.5030	0.5622	0.8407	0.9762	0.9955	0.9983	(94)
Useful gains	314.5294	352.9958	394.0523	428.3273	416.8427	325.3509	223.3531	232.6553	316.4860	323.6174	302.4246	299.0742	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	936.5346	904.6058	816.8714	678.5448	520.5392	346.8817	226.3778	237.9766	374.8328	571.9770	767.2024	932.4759	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	462.7719	370.6819	314.5774	180.1566	77.1502	0.0000	0.0000	0.0000	0.0000	184.7795	334.6401	471.2509	(98)
Space heating												2396.0084	(98)
Space heating per m2											(98) / (4) =	41.4678	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	575.6531	453.1737	464.5090	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8705	0.9309	0.9084	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	501.0839	421.8690	421.9396	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	616.6584	590.1601	556.1772	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	83.2136	125.2086	99.8728	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												308.2950	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   20.8034   31.3021   24.9682    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              77.0737 (107)
Space cooling per m2                                                                                                        1.3339 (108)
Energy for space heating                                                                                                   41.4678 (99)
Energy for space cooling                                                                                                    1.3339 (108)
Total                                                                                                                      42.8017 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                        49.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3220	0.2990	0.3067	0.2913	0.2913	0.2837	0.2760	0.2683	0.2607	0.2837	0.2683	0.2837	(22b)
Effective ac	0.5518	0.5447	0.5470	0.5424	0.5424	0.5402	0.5381	0.5360	0.5340	0.5402	0.5360	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0800	1.2357	8.7490			(27)
Opening Type 6			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1800	0.9882			(28a)
External Wall	58.7600	9.2000	49.5600	0.2700	13.3812			(29a)
Roof	53.7000		53.7000	0.1600	8.5920			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9439	(36)
Total fabric heat loss					(33) + (36) =		39.8343	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9858	24.6625	24.7676	24.5600	24.5600	24.4602	24.3631	24.2686	24.1768	24.4602	24.2686	24.4602	(38)
Heat transfer coeff	64.8201	64.4968	64.6019	64.3943	64.3943	64.2945	64.1974	64.1029	64.0111	64.2945	64.1029	64.2945	(39)
Average = Sum(39)m / 12 =												64.3338	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1218	1.1162	1.1181	1.1145	1.1145	1.1127	1.1111	1.1094	1.1078	1.1127	1.1094	1.1127	(40)
HLP (average)												1.1134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9182	(42)
Average daily hot water use (litres/day)												79.7578	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5159	17.0688	17.6134	15.3558	14.7343	12.7146	11.7819	13.5199	13.6814	15.9443	17.4045	18.9002	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7708	10.6172	11.7317	11.3271	11.6857	11.2869	11.6495	11.6730	11.3088	11.7127	11.3651	11.7632	(61)
Total heat required for water heating calculated for each month													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
								Total per year (kWh/year) = Sum(64)m =				1392.7918	(64)
RHI water heating demand												1393	(64)
Heat gains from water heating, kWh/month													
	46.2030	40.4901	41.9760	36.8705	35.5824	31.0057	29.0289	32.8874	33.1543	38.2714	41.4212	44.8361	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.2002	36.5936	29.7599	22.5302	16.8416	14.2184	15.3634	19.9700	26.8037	34.0334	39.7220	42.3452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.7245	252.3158	245.7857	231.8838	214.3351	197.8419	186.8234	184.2320	190.7622	204.6641	222.2127	238.7060	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	62.1009	60.2531	56.4194	51.2091	47.8258	43.0634	39.0174	44.2035	46.0476	51.4401	57.5295	60.2636	(72)
Total internal gains													
	442.8175	438.9545	421.7570	395.4150	368.7945	344.9157	330.9962	338.1975	353.4054	379.9296	409.2562	431.1068	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	25.1925	0.7200	0.7000	0.7700	22.9655	(76)
West	4.4700	25.1925	0.7200	0.7000	0.7700	39.3318	(80)

Solar gains	62.2973	103.6624	171.6290	250.7741	291.1828	323.4064	305.6330	269.6622	210.4763	132.6071	77.4222	50.3570	(83)
Total gains	505.1147	542.6169	593.3860	646.1891	659.9773	668.3220	636.6292	607.8597	563.8818	512.5367	486.6784	481.4638	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9021	62.2124	62.1112	62.3114	62.3114	62.4081	62.5025	62.5946	62.6844	62.4081	62.5946	62.4081	
alpha	5.1268	5.1475	5.1407	5.1541	5.1541	5.1605	5.1668	5.1730	5.1790	5.1605	5.1730	5.1605	
util living area	0.9874	0.9809	0.9574	0.8888	0.7505	0.5369	0.3913	0.4088	0.6741	0.9047	0.9741	0.9893	(86)
MIT	20.1098	20.2144	20.4501	20.7281	20.9148	20.9875	20.9980	20.9976	20.9621	20.7487	20.4012	20.0960	(87)
Th 2	19.9830	19.9876	19.9861	19.9890	19.9890	19.9904	19.9918	19.9931	19.9944	19.9904	19.9931	19.9904	(88)
util rest of house	0.9833	0.9749	0.9440	0.8555	0.6850	0.4471	0.2913	0.3046	0.5831	0.8673	0.9645	0.9859	(89)
MIT 2	18.8321	18.9856	19.3185	19.6952	19.9168	19.9839	19.9913	19.9925	19.9702	19.7321	19.2597	18.8180	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	19.1874	19.3274	19.6333	19.9824	20.1944	20.2630	20.2713	20.2720	20.2460	20.0148	19.5772	19.1735	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1874	19.3274	19.6333	19.9824	20.1944	20.2630	20.2713	20.2720	20.2460	20.0148	19.5772	19.1735	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9699	0.9383	0.8552	0.6992	0.4719	0.3192	0.3337	0.6071	0.8683	0.9594	0.9821	(94)
Useful gains	494.5959	526.2817	556.7490	552.6293	461.4685	315.3801	203.2034	202.8657	342.3065	445.0611	466.9333	472.8561	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	926.1136	904.7202	816.1320	675.0102	495.4734	319.0934	203.5866	203.3352	355.0082	553.8853	748.5420	911.2758	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	321.0492	254.3107	192.9810	88.1142	25.2997	0.0000	0.0000	0.0000	0.0000	80.9653	202.7583	326.1843	(98)
Space heating												1491.6626	(98)
RHI space heating demand												1492	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3910	0.3833	0.3756	0.3373	0.3297	0.2913	0.2913	0.2837	0.3067	0.3297	0.3450	0.3603	(22b)
Effective ac	0.5764	0.5735	0.5706	0.5569	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5595	0.5649	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0800	1.2357	8.7490			(27)
Opening Type 6			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1800	0.9882			(28a)
External Wall	58.7600	9.2000	49.5600	0.2700	13.3812			(29a)
Roof	53.7000		53.7000	0.1600	8.5920			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9439	(36)
Total fabric heat loss					(33) + (36) =		39.8343	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.0994	25.9651	25.8333	25.2146	25.0989	24.5600	24.5600	24.4602	24.7676	25.0989	25.3331	25.5779	(38)
Heat transfer coeff	65.9338	65.7994	65.6677	65.0490	64.9332	64.3943	64.3943	64.2945	64.6019	64.9332	65.1674	65.4122	(39)
Average = Sum(39)m / 12 =												65.0484	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1411	1.1388	1.1365	1.1258	1.1238	1.1145	1.1145	1.1127	1.1181	1.1238	1.1279	1.1321	(40)
HLP (average)												1.1258	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9182	(42)
Average daily hot water use (litres/day)	79.7578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5159	17.0688	17.6134	15.3558	14.7343	12.7146	11.7819	13.5199	13.6814	15.9443	17.4045	18.9002	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7708	10.6172	11.7317	11.3271	11.6857	11.2869	11.6495	11.6730	11.3088	11.7127	11.3651	11.7632	(61)
Total heat required for water heating calculated for each month													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
								Total per year (kWh/year) = Sum(64)m =				1392.7918	(64)
Heat gains from water heating, kWh/month													
	46.2030	40.4901	41.9760	36.8705	35.5824	31.0057	29.0289	32.8874	33.1543	38.2714	41.4212	44.8361	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.2002	36.5936	29.7599	22.5302	16.8416	14.2184	15.3634	19.9700	26.8037	34.0334	39.7220	42.3452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.7245	252.3158	245.7857	231.8838	214.3351	197.8419	186.8234	184.2320	190.7622	204.6641	222.2127	238.7060	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	62.1009	60.2531	56.4194	51.2091	47.8258	43.0634	39.0174	44.2035	46.0476	51.4401	57.5295	60.2636	(72)
Total internal gains													
	442.8175	438.9545	421.7570	395.4150	368.7945	344.9157	330.9962	338.1975	353.4054	379.9296	409.2562	431.1068	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	19.6403	0.7200	0.7000	0.7700	17.9041	(76)
West	4.4700	19.6403	0.7200	0.7000	0.7700	30.6633	(80)

Solar gains	48.5673	95.0080	156.4647	228.1944	279.6608	286.2826	272.5527	234.1188	181.9749	112.7350	60.5578	39.9394	(83)
Total gains	491.3848	533.9625	578.2217	623.6094	648.4554	631.1983	603.5489	572.3162	535.3803	492.6646	469.8140	471.0462	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8565	60.9808	61.1031	61.6843	61.7943	62.3114	62.3114	62.4081	62.1112	61.7943	61.5722	61.3418	
alpha	5.0571	5.0654	5.0735	5.1123	5.1196	5.1541	5.1541	5.1605	5.1407	5.1196	5.1048	5.0895	
util living area													
	0.9906	0.9843	0.9671	0.9168	0.8054	0.6258	0.4643	0.5083	0.7521	0.9370	0.9828	0.9923	(86)
MIT	19.9998	20.1306	20.3597	20.6484	20.8667	20.9720	20.9950	20.9921	20.9296	20.6510	20.2753	19.9702	(87)
Th 2	19.9674	19.9693	19.9711	19.9798	19.9814	19.9890	19.9890	19.9904	19.9861	19.9814	19.9782	19.9747	(88)
util rest of house													
	0.9876	0.9794	0.9567	0.8905	0.7497	0.5382	0.3604	0.4011	0.6699	0.9113	0.9765	0.9899	(89)
MIT 2	18.6614	18.8515	19.1801	19.5843	19.8580	19.9714	19.9873	19.9874	19.9343	19.5982	19.0688	18.6238	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	19.0336	19.2073	19.5082	19.8802	20.1385	20.2497	20.2675	20.2668	20.2111	19.8910	19.4043	18.9983	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0336	19.2073	19.5082	19.8802	20.1385	20.2497	20.2675	20.2668	20.2111	19.8910	19.4043	18.9983	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9840	0.9747	0.9508	0.8875	0.7590	0.5616	0.3894	0.4311	0.6896	0.9085	0.9719	0.9867	(94)
Useful gains	483.5239	520.4566	549.7631	553.4633	492.1928	354.4896	235.0232	246.7014	369.1925	447.5937	456.6070	464.7812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	971.4441	941.4093	854.2175	714.2530	547.9400	363.8092	236.1680	248.6154	394.7904	603.2964	801.8414	967.9890	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	363.0126	282.8802	226.5141	115.7686	41.4759	0.0000	0.0000	0.0000	0.0000	115.8428	248.5688	374.3866	(98)
Space heating												1768.4495	(98)
Space heating per m2											(98) / (4) =	30.6066	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1895.4443	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	363.0126	282.8802	226.5141	115.7686	41.4759	0.0000	0.0000	0.0000	0.0000	115.8428	248.5688	374.3866	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	389.0810	303.1942	242.7804	124.0821	44.4543	0.0000	0.0000	0.0000	0.0000	124.1616	266.4189	401.2718	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2585	89.1690	88.9587	88.4796	87.6574	86.7000	86.7000	86.7000	86.7000	88.4467	89.0471	89.3026	(217)
Fuel for water heating, kWh/month													
	158.9507	139.5204	145.1850	128.5034	125.3907	110.7850	104.0318	117.4230	118.2446	133.4230	143.0648	154.2668	(219)
Water heating fuel used												1578.7892	(219)
Annual totals kWh/year													
Space heating fuel - main system												1895.4443	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												291.0431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3209.8342	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1895.4443	3.4800	65.9615	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1578.7892	3.4800	54.9419	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	291.0431	13.1900	38.3886	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			206.0291	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8419	(257)
SAP value		88.2553	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1895.4443	0.2160	409.4160	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1578.7892	0.2160	341.0185	(264)
Space and water heating			750.4344	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	291.0431	0.5190	151.0514	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			613.2112	(272)
CO2 emissions per m2			10.6100	(273)
EI value			92.0052	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8809 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8809 = 0.2452, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0800 (1b)	x	2.8300 (2b)	=	11.5464	(1b) - (3b)
First floor	53.7000 (1c)	x	2.3400 (2c)	=	125.6580	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	137.2044	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1458	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3608	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3067	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3220	0.2990	0.3067	0.2913	0.2913	0.2837	0.2760	0.2683	0.2607	0.2837	0.2683	0.2837	(22b)
Effective ac	0.5518	0.5447	0.5470	0.5424	0.5424	0.5402	0.5381	0.5360	0.5340	0.5402	0.5360	0.5402	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0800	1.2357	8.7490			(27)
Opening Type 6			2.1200	1.5000	3.1800			(26a)
Ground floor			5.4900	0.1800	0.9882			(28a)
External Wall	58.7600	9.2000	49.5600	0.2700	13.3812			(29a)
Roof	53.7000		53.7000	0.1600	8.5920			(30)
Total net area of external elements Aum(A, m2)			117.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8904			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9439	(36)
Total fabric heat loss					(33) + (36) =		39.8343	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9858	24.6625	24.7676	24.5600	24.5600	24.4602	24.3631	24.2686	24.1768	24.4602	24.2686	24.4602	(38)
Heat transfer coeff	64.8201	64.4968	64.6019	64.3943	64.3943	64.2945	64.1974	64.1029	64.0111	64.2945	64.1029	64.2945	(39)
Average = Sum(39)m / 12 =												64.3338	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1218	1.1162	1.1181	1.1145	1.1145	1.1127	1.1111	1.1094	1.1078	1.1127	1.1094	1.1127	(40)
HLP (average)												1.1134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy			1.9182	(42)
Average daily hot water use (litres/day)			79.7578	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	87.7335	84.5432	81.3529	78.1626	74.9723	71.7820	71.7820	74.9723	78.1626	81.3529	84.5432	87.7335	(44)
Energy conte	130.1063	113.7918	117.4229	102.3722	98.2285	84.7638	78.5461	90.1328	91.2092	106.2956	116.0299	126.0010	(45)
Energy content (annual)										Total = Sum(45)m =		1254.9002	(45)
Distribution loss (46)m = 0.15 x (45)m	19.5159	17.0688	17.6134	15.3558	14.7343	12.7146	11.7819	13.5199	13.6814	15.9443	17.4045	18.9002	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7708	10.6172	11.7317	11.3271	11.6857	11.2869	11.6495	11.6730	11.3088	11.7127	11.3651	11.7632	(61)
Total heat required for water heating calculated for each month													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
								Total per year (kWh/year) = Sum(64)m =				1392.7918	(64)
Heat gains from water heating, kWh/month													
	46.2030	40.4901	41.9760	36.8705	35.5824	31.0057	29.0289	32.8874	33.1543	38.2714	41.4212	44.8361	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	115.0933	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	41.2002	36.5936	29.7599	22.5302	16.8416	14.2184	15.3634	19.9700	26.8037	34.0334	39.7220	42.3452	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	249.7245	252.3158	245.7857	231.8838	214.3351	197.8419	186.8234	184.2320	190.7622	204.6641	222.2127	238.7060	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	48.4276	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	-76.7289	(71)
Water heating gains (Table 5)													
	62.1009	60.2531	56.4194	51.2091	47.8258	43.0634	39.0174	44.2035	46.0476	51.4401	57.5295	60.2636	(72)
Total internal gains													
	442.8175	438.9545	421.7570	395.4150	368.7945	344.9157	330.9962	338.1975	353.4054	379.9296	409.2562	431.1068	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	2.6100	25.1925	0.7200	0.7000	0.7700	22.9655	(76)
West	4.4700	25.1925	0.7200	0.7000	0.7700	39.3318	(80)

Solar gains	62.2973	103.6624	171.6290	250.7741	291.1828	323.4064	305.6330	269.6622	210.4763	132.6071	77.4222	50.3570	(83)
Total gains	505.1147	542.6169	593.3860	646.1891	659.9773	668.3220	636.6292	607.8597	563.8818	512.5367	486.6784	481.4638	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9021	62.2124	62.1112	62.3114	62.3114	62.4081	62.5025	62.5946	62.6844	62.4081	62.5946	62.4081	
alpha	5.1268	5.1475	5.1407	5.1541	5.1541	5.1605	5.1668	5.1730	5.1790	5.1605	5.1730	5.1605	
util living area													
	0.9874	0.9809	0.9574	0.8888	0.7505	0.5369	0.3913	0.4088	0.6741	0.9047	0.9741	0.9893	(86)
MIT	20.1098	20.2144	20.4501	20.7281	20.9148	20.9875	20.9980	20.9976	20.9621	20.7487	20.4012	20.0960	(87)
Th 2	19.9830	19.9876	19.9861	19.9890	19.9890	19.9904	19.9918	19.9931	19.9944	19.9904	19.9931	19.9904	(88)
util rest of house													
	0.9833	0.9749	0.9440	0.8555	0.6850	0.4471	0.2913	0.3046	0.5831	0.8673	0.9645	0.9859	(89)
MIT 2	18.8321	18.9856	19.3185	19.6952	19.9168	19.9839	19.9913	19.9925	19.9702	19.7321	19.2597	18.8180	(90)
Living area fraction									fLA = Living area / (4) =			0.2781	(91)
MIT	19.1874	19.3274	19.6333	19.9824	20.1944	20.2630	20.2713	20.2720	20.2460	20.0148	19.5772	19.1735	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1874	19.3274	19.6333	19.9824	20.1944	20.2630	20.2713	20.2720	20.2460	20.0148	19.5772	19.1735	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9699	0.9383	0.8552	0.6992	0.4719	0.3192	0.3337	0.6071	0.8683	0.9594	0.9821	(94)
Useful gains	494.5959	526.2817	556.7490	552.6293	461.4685	315.3801	203.2034	202.8657	342.3065	445.0611	466.9333	472.8561	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	926.1136	904.7202	816.1320	675.0102	495.4734	319.0934	203.5866	203.3352	355.0082	553.8853	748.5420	911.2758	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	321.0492	254.3107	192.9810	88.1142	25.2997	0.0000	0.0000	0.0000	0.0000	80.9653	202.7583	326.1843	(98)
Space heating												1491.6626	(98)
Space heating per m2											(98) / (4) =	25.8162	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1598.7810	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	321.0492	254.3107	192.9810	88.1142	25.2997	0.0000	0.0000	0.0000	0.0000	80.9653	202.7583	326.1843	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	344.1042	272.5731	206.8392	94.4418	27.1165	0.0000	0.0000	0.0000	0.0000	86.7795	217.3187	349.6080	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	141.8771	124.4090	129.1546	113.6993	109.9143	96.0506	90.1956	101.8058	102.5181	118.0083	127.3950	137.7642	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1653	89.0849	88.8213	88.2359	87.3516	86.7000	86.7000	86.7000	86.7000	88.1297	88.8760	89.2002	(217)
Fuel for water heating, kWh/month													
	159.1169	139.6522	145.4095	128.8584	125.8297	110.7850	104.0318	117.4230	118.2446	133.9030	143.3402	154.4439	(219)
Water heating fuel used												1581.0381	(219)
Annual totals kWh/year													
Space heating fuel - main system												1598.7810	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												291.0431	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2840.3020	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1598.7810	7.3800	117.9900	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1581.0381	7.3800	116.6806	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	291.0431	28.6600	83.4130	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			244.3650	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1598.7810	0.2160	345.3367	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1581.0381	0.2160	341.5042	(264)
Space and water heating			686.8409	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	291.0431	0.5190	151.0514	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			510.6315	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1598.7810	1.2200	1950.5128	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1581.0381	1.2200	1928.8665	(264)
Space and water heating			3879.3793	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	291.0431	3.0700	893.5023	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			2837.0618	(272)
Primary energy kWh/m2/year			49.1011	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£105	£105	£0
Mains gas	£342	£342	£0
Space heating	£246	£246	£0
Water heating	£117	£117	£0
Lighting	£83	£83	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£245	£245	£0
Total cost of uses	£244	£244	£0
Delivered energy	49 kWh/m²	49 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	49 kWh/m²	49 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	362.22	(P1)
Transmission heat loss coefficient	39.83	(37)
Summer heat loss coefficient	402.05	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	2.6100	125.2818	0.7200	0.7000	0.7650	113.4653
West	4.4700	125.2818	0.7200	0.7000	0.7650	194.3256
total:						307.7908

	Jun	Jul	Aug	
Solar gains	331	308	271	(P3)
Internal gains	342	328	335	
Total summer gains	673	636	606	(P5)
Summer gain/loss ratio	1.67	1.58	1.51	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.32	19.13	19.06	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 418 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 418	**Prop Type Ref**	
Property	11 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	12.73	**TER**	19.58
Environmental	92 A	**% DER<TER**	34.98		
CO_2 Emissions (t/year)	0.51	**DFEE**	44.83	**TFEE**	49.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.92		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.58	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.73	$kgCO_2/m^2$	Pass
	-6.85 (-35.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.83	$kWh/m^2/yr$	
	-4.4 (-8.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing West	2.61 m², No overhang 4.47 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 419 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 419	**Prop Type Ref**	
Property	12 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.43	**TER**	18.51
Environmental	90 B	**% DER<TER**	27.45		
CO_2 Emissions (t/year)	0.79	**DFEE**	47.70	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.51 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.43 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.31 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3600	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	102.3247	102.1223	101.9238	100.9916	100.8171	100.0052	100.0052	99.8548	100.3179	100.8171	101.1700	101.5389	(39)
Average = Sum(39)m / 12 =												100.9907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2740	1.2714	1.2690	1.2574	1.2552	1.2451	1.2451	1.2432	1.2490	1.2552	1.2596	1.2642	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5106	54.6186	54.7250	55.2301	55.3257	55.7749	55.7749	55.8589	55.6010	55.3257	55.1327	54.9324	
alpha	4.6340	4.6412	4.6483	4.6820	4.6884	4.7183	4.7183	4.7239	4.7067	4.6884	4.6755	4.6622	
util living area													
	0.9968	0.9921	0.9807	0.9492	0.8719	0.7214	0.5535	0.5983	0.8222	0.9636	0.9931	0.9977	(86)
MIT	19.6563	19.8507	20.1264	20.4623	20.7510	20.9293	20.9838	20.9768	20.8627	20.4812	19.9987	19.6187	(87)
Th 2	19.8613	19.8633	19.8652	19.8744	19.8761	19.8841	19.8841	19.8856	19.8810	19.8761	19.8726	19.8690	(88)
util rest of house													
	0.9957	0.9894	0.9739	0.9301	0.8232	0.6244	0.4224	0.4667	0.7419	0.9460	0.9903	0.9969	(89)
MIT 2	18.0874	18.3715	18.7713	19.2524	19.6340	19.8374	19.8784	19.8764	19.7746	19.2884	18.5950	18.0379	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4813	18.7430	19.1116	19.5562	19.9145	20.1116	20.1560	20.1527	20.0479	19.5880	18.9475	18.4349	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4813	18.7430	19.1116	19.5562	19.9145	20.1116	20.1560	20.1527	20.0479	19.5880	18.9475	18.4349	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9856	0.9677	0.9234	0.8251	0.6458	0.4555	0.4998	0.7556	0.9401	0.9870	0.9953	(94)
Useful gains	532.0304	635.3286	705.1644	732.6881	681.8336	517.9046	350.5432	366.9044	526.2459	581.8047	529.5125	498.8099	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.1019	1413.6760	1285.4210	1076.1909	828.1643	551.1881	355.6150	374.7280	596.6786	906.1422	1198.6141	1445.3964	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	683.7892	523.0494	431.7109	247.3220	108.8701	0.0000	0.0000	0.0000	0.0000	241.3071	481.7531	704.2604	(98)
Space heating												3422.0623	(98)
Space heating per m2											(98) / (4) =	42.6054	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3667.8052	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	683.7892	523.0494	431.7109	247.3220	108.8701	0.0000	0.0000	0.0000	0.0000	241.3071	481.7531	704.2604	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	732.8931	560.6103	462.7127	265.0825	116.6882	0.0000	0.0000	0.0000	0.0000	258.6357	516.3484	754.8343	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5830	89.5015	89.3505	89.0229	88.3318	86.7000	86.7000	86.7000	86.7000	88.9715	89.4341	89.6164	(217)
Fuel for water heating, kWh/month													
	182.2783	159.9307	166.1780	146.6431	142.7308	126.8692	118.9361	134.5284	135.5568	152.2994	163.8020	176.8670	(219)
Water heating fuel used												1806.6197	(219)
Annual totals kWh/year													
Space heating fuel - main system												3667.8052	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5274.6493	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3667.8052	0.2160	792.2459	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1806.6197	0.2160	390.2299	(264)
Space and water heating			1182.4758	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1078.7922	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.4300	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.8883	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8883	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	102.1900	16.1600	86.0300	0.1800	15.4854			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.0846			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.8447	(36)
Total fabric heat loss	(33) + (36) =	56.9294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	97.4496	97.2065	96.9681	95.8487	95.6392	94.6642	94.6642	94.4836	95.0398	95.6392	96.0629	96.5059	(39)
Average = Sum(39)m / 12 =												95.8477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2133	1.2102	1.2073	1.1933	1.1907	1.1786	1.1786	1.1763	1.1833	1.1907	1.1960	1.2015	(40)
HLP (average)												1.1933	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.2376	57.3807	57.5218	58.1936	58.3210	58.9217	58.9217	59.0343	58.6889	58.3210	58.0638	57.7973	
alpha	4.8158	4.8254	4.8348	4.8796	4.8881	4.9281	4.9281	4.9356	4.9126	4.8881	4.8709	4.8532	
util living area													
	0.9970	0.9929	0.9830	0.9548	0.8825	0.7331	0.5623	0.6051	0.8293	0.9660	0.9935	0.9978	(86)
MIT	19.7278	19.9059	20.1632	20.4832	20.7599	20.9338	20.9856	20.9795	20.8722	20.5112	20.0570	19.6965	(87)
Th 2	19.9094	19.9118	19.9142	19.9253	19.9274	19.9372	19.9372	19.9390	19.9334	19.9274	19.9232	19.9188	(88)
util rest of house													
	0.9960	0.9905	0.9769	0.9377	0.8372	0.6398	0.4352	0.4781	0.7526	0.9497	0.9909	0.9970	(89)
MIT 2	18.2251	18.4860	18.8599	19.3217	19.6906	19.8926	19.9319	19.9306	19.8329	19.3694	18.7153	18.1859	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6025	18.8426	19.1872	19.6133	19.9591	20.1540	20.1965	20.1940	20.0939	19.6562	19.0522	18.5653	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6025	18.8426	19.1872	19.6133	19.9591	20.1540	20.1965	20.1940	20.0939	19.6562	19.0522	18.5653	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9715	0.9315	0.8388	0.6604	0.4674	0.5101	0.7658	0.9443	0.9878	0.9956	(94)
Useful gains	525.3728	615.4709	674.9529	696.8431	648.7636	494.5085	335.8941	351.4895	504.0423	560.6343	519.0050	494.9155	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1393.7734	1355.3092	1230.2551	1026.8601	789.8979	525.7673	340.4583	358.4693	569.6608	866.1248	1148.1654	1386.3333	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	646.0900	497.1713	413.1448	237.6123	105.0040	0.0000	0.0000	0.0000	0.0000	227.2849	452.9955	663.2149	(98)
Space heating												3242.5177	(98)
Space heating per m2											(98) / (4) =	40.3700	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3471.6464	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	646.0900	497.1713	413.1448	237.6123	105.0040	0.0000	0.0000	0.0000	0.0000	227.2849	452.9955	663.2149	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	691.7452	532.3034	442.3392	254.4029	112.4240	0.0000	0.0000	0.0000	0.0000	243.3457	485.0059	710.0802	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7667	87.5015	87.0158	85.9833	84.0371	80.3000	80.3000	80.3000	80.3000	85.7540	87.2356	87.8630	(217)
Fuel for water heating, kWh/month													
	230.6115	203.1342	212.5278	190.7649	188.9713	174.1812	166.8789	186.0308	188.0853	200.5511	210.4483	224.9203	(219)
Water heating fuel used												2377.1055	(219)
Annual totals kWh/year													
Space heating fuel - main system												3471.6464	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6279.4186	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3471.6464	0.2160	749.8756	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2377.1055	0.2160	513.4548	(264)
Space and water heating			1263.3304	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1486.8464	(272)
Emissions per m2 for space and water heating			15.7287	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7287 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.5100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	102.3247	102.1223	101.9238	100.9916	100.8171	100.0052	100.0052	99.8548	100.3179	100.8171	101.1700	101.5389	(39)
Average = Sum(39)m / 12 =												100.9907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2740	1.2714	1.2690	1.2574	1.2552	1.2451	1.2451	1.2432	1.2490	1.2552	1.2596	1.2642	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5106	54.6186	54.7250	55.2301	55.3257	55.7749	55.7749	55.8589	55.6010	55.3257	55.1327	54.9324	
alpha	4.6340	4.6412	4.6483	4.6820	4.6884	4.7183	4.7183	4.7239	4.7067	4.6884	4.6755	4.6622	
util living area													
	0.9975	0.9935	0.9835	0.9548	0.8823	0.7360	0.5675	0.6150	0.8369	0.9690	0.9946	0.9982	(86)
MIT	19.6209	19.8169	20.0961	20.4381	20.7351	20.9229	20.9821	20.9740	20.8507	20.4551	19.9659	19.5840	(87)
Th 2	19.8613	19.8633	19.8652	19.8744	19.8761	19.8841	19.8841	19.8856	19.8810	19.8761	19.8726	19.8690	(88)
util rest of house													
	0.9967	0.9913	0.9775	0.9374	0.8358	0.6394	0.4340	0.4813	0.7592	0.9535	0.9923	0.9976	(89)
MIT 2	18.6149	18.8114	19.0889	19.4275	19.6985	19.8489	19.8797	19.8784	19.8007	19.4508	18.9680	18.5842	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8675	19.0639	19.3418	19.6813	19.9588	20.1186	20.1565	20.1536	20.0644	19.7030	19.2186	18.8353	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8675	19.0639	19.3418	19.6813	19.9588	20.1186	20.1565	20.1536	20.0644	19.7030	19.2186	18.8353	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9891	0.9739	0.9337	0.8398	0.6616	0.4680	0.5153	0.7739	0.9505	0.9905	0.9968	(94)
Useful gains	501.7652	607.2976	681.4166	715.8568	672.6503	515.0533	349.9960	365.9375	519.8927	562.6451	502.1940	469.0174	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1490.6181	1446.4515	1308.8884	1088.8195	832.6283	551.8906	355.6719	374.8121	598.3371	917.7370	1226.0405	1486.0528	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	735.7066	563.9114	466.8390	268.5332	119.0236	0.0000	0.0000	0.0000	0.0000	264.1884	521.1695	756.6743	(98)
Space heating												3696.0460	(98)
Space heating per m2											(98) / (4) =	46.0165	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	940.0489	740.0385	758.8968	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8505	0.9145	0.8951	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	799.4820	676.7853	679.2576	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	145.9938	214.0584	180.6588	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												540.7110 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.4985	53.5146	45.1647	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												135.1778 (107)
Space cooling per m2												1.6830 (108)
Energy for space heating												46.0165 (99)
Energy for space cooling												1.6830 (108)
Total												47.6995 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3945	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	102.1900	16.1600	86.0300	0.1800	15.4854			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.0846			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.8447	(36)
Total fabric heat loss (33) + (36) =	56.9294	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	97.4496	97.2065	96.9681	95.8487	95.6392	94.6642	94.6642	94.4836	95.0398	95.6392	96.0629	96.5059	(39)
Average = Sum(39)m / 12 =												95.8477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2133	1.2102	1.2073	1.1933	1.1907	1.1786	1.1786	1.1763	1.1833	1.1907	1.1960	1.2015	(40)
HLP (average)												1.1933	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.2376	57.3807	57.5218	58.1936	58.3210	58.9217	58.9217	59.0343	58.6889	58.3210	58.0638	57.7973	
alpha	4.8158	4.8254	4.8348	4.8796	4.8881	4.9281	4.9281	4.9356	4.9126	4.8881	4.8709	4.8532	
util living area													
	0.9980	0.9948	0.9867	0.9626	0.8978	0.7559	0.5852	0.6319	0.8521	0.9737	0.9955	0.9985	(86)
MIT	19.6770	19.8572	20.1191	20.4470	20.7358	20.9240	20.9829	20.9753	20.8537	20.4722	20.0092	19.6463	(87)
Th 2	19.9094	19.9118	19.9142	19.9253	19.9274	19.9372	19.9372	19.9390	19.9334	19.9274	19.9232	19.9188	(88)
util rest of house													
	0.9973	0.9929	0.9818	0.9479	0.8561	0.6637	0.4546	0.5019	0.7799	0.9606	0.9936	0.9980	(89)
MIT 2	18.7089	18.8902	19.1514	19.4798	19.7465	19.9015	19.9328	19.9319	19.8527	19.5103	19.0513	18.6856	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9520	19.1330	19.3944	19.7227	19.9950	20.1582	20.1965	20.1939	20.1041	19.7518	19.2919	18.9269	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9520	19.1330	19.3944	19.7227	19.9950	20.1582	20.1965	20.1939	20.1041	19.7518	19.2919	18.9269	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9788	0.9445	0.8592	0.6847	0.4878	0.5349	0.7932	0.9578	0.9921	0.9973	(94)
Useful gains	482.1591	574.8916	639.6309	670.2776	633.2834	489.5700	334.9642	349.9013	493.3172	531.0974	479.2166	452.1328	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1427.8323	1383.5408	1250.3484	1037.3402	793.3231	526.1666	340.4597	358.4632	570.6297	875.2743	1171.1892	1421.2299	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	703.5809	543.4123	454.3738	264.2851	119.0695	0.0000	0.0000	0.0000	0.0000	256.0676	498.2203	721.0083	(98)
Space heating												3560.0178	(98)
Space heating per m2											(98) / (4) =	44.3229	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	889.8435	700.5151	718.0757	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8483	0.9146	0.8957	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	754.8382	640.6802	643.1678	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.6927	187.7080	158.8068	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												471.2075	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   31.1732   46.9270   39.7017    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          117.8019 (107)
Space cooling per m2                                                                                                     1.4667 (108)
Energy for space heating                                                                                                44.3229 (99)
Energy for space cooling                                                                                                 1.4667 (108)
Total                                                                                                                   45.7896 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    52.7 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3100	
Infiltration rate		0.3600	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	100.6467	100.1596	100.3179	100.0052	100.0052	99.8548	99.7085	99.5662	99.4278	99.8548	99.5662	99.8548	(39)
Average = Sum(39)m / 12 =												99.9140	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2531	1.2470	1.2490	1.2451	1.2451	1.2432	1.2414	1.2396	1.2379	1.2432	1.2396	1.2432	(40)
HLP (average)												1.2439	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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If cylinder contains dedicated solar storage
              0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss   11.8491   10.6889   11.8029   11.3868   11.7406   11.3322   11.6915   11.7233   11.3619   11.7771   11.4382   11.8391 (61)
Total heat required for water heating calculated for each month
             163.2903  143.1403  148.4809  130.5460  126.0767  109.9956  103.1176  116.6361  117.5277  135.5031  146.4948  158.5018 (62)
Solar input    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             163.2903  143.1403  148.4809  130.5460  126.0767  109.9956  103.1176  116.6361  117.5277  135.5031  146.4948  158.5018 (64)
                                                                              Total per year (kWh/year) = Sum(64)m =   1599.3110 (64)
RHI water heating demand                                                                                                1599 (64)
Heat gains from water heating, kWh/month
              53.3165   46.7123   48.3962   42.4671   40.9519   35.6386   33.3221   37.8143   38.1406   44.0832   47.7659   51.7251 (65)
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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)                                             21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          55.4194   55.6889   55.6010   55.7749   55.7749   55.8589   55.9408   56.0208   56.0988   55.8589   56.0208   55.8589
alpha         4.6946    4.7126    4.7067    4.7183    4.7183    4.7239    4.7294    4.7347    4.7399    4.7239    4.7347    4.7239
util living area
              0.9852    0.9757    0.9485    0.8830    0.7594    0.5523    0.4039    0.4153    0.6602    0.8862    0.9683    0.9881 (86)

MIT          19.9904   20.1285   20.3878   20.6761   20.8827   20.9794   20.9962   20.9957   20.9528   20.7251   20.3307   19.9648 (87)
Th 2         19.8778   19.8826   19.8810   19.8841   19.8841   19.8856   19.8870   19.8884   19.8898   19.8856   19.8884   19.8856 (88)
util rest of house
              0.9805    0.9681    0.9323    0.8469    0.6901    0.4525    0.2905    0.2991    0.5624    0.8424    0.9565    0.9842 (89)
MIT 2        18.5829   18.7838   19.1482   19.5377   19.7851   19.8749   19.8861   19.8873   19.8606   19.6106   19.0798   18.5521 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.2511 (91)
MIT          18.9363   19.1214   19.4595   19.8236   20.0607   20.1523   20.1648   20.1657   20.1349   19.8905   19.3939   18.9069 (92)
Temperature adjustment                                                                                                  0.0000
adjusted MIT 18.9363   19.1214   19.4595   19.8236   20.0607   20.1523   20.1648   20.1657   20.1349   19.8905   19.3939   18.9069 (93)
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8. Space heating requirement

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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation   0.9751    0.9613    0.9248    0.8446    0.7020    0.4771    0.3192    0.3285    0.5852    0.8426    0.9497    0.9795 (94)
Useful gains 733.1087  801.9946  849.6526  830.4940  691.3732  476.1839  304.6377  304.1677  518.9501  684.1901  708.6979  691.2112 (95)
Ext temp.     4.9000    5.3000    7.0000    9.5000   12.5000   15.3000   17.1000   17.1000   14.7000   11.4000    7.9000    5.0000 (96)
Heat loss rate W
             1412.7121 1384.3493 1249.9068 1032.4125  756.1109  484.5243  305.5901  305.2383  540.3757  847.8128 1144.4060 1388.6697 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              505.6249  391.3423  297.7891  145.3813   48.1648    0.0000    0.0000    0.0000    0.0000  121.7352  313.7098  518.9091 (98)
Space heating                                                                                                          2342.6567 (98)
RHI space heating demand                                                                                                  2343 (98)
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	102.3247	102.1223	101.9238	100.9916	100.8171	100.0052	100.0052	99.8548	100.3179	100.8171	101.1700	101.5389	(39)
Average = Sum(39)m / 12 =												100.9907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2740	1.2714	1.2690	1.2574	1.2552	1.2451	1.2451	1.2432	1.2490	1.2552	1.2596	1.2642	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5106	54.6186	54.7250	55.2301	55.3257	55.7749	55.7749	55.8589	55.6010	55.3257	55.1327	54.9324	
alpha	4.6340	4.6412	4.6483	4.6820	4.6884	4.7183	4.7183	4.7239	4.7067	4.6884	4.6755	4.6622	
util living area													
	0.9896	0.9795	0.9587	0.9093	0.8084	0.6411	0.4785	0.5153	0.7365	0.9232	0.9800	0.9918	(86)
MIT	19.8558	20.0409	20.2948	20.5917	20.8271	20.9569	20.9912	20.9875	20.9160	20.6172	20.1785	19.8157	(87)
Th 2	19.8613	19.8633	19.8652	19.8744	19.8761	19.8841	19.8841	19.8856	19.8810	19.8761	19.8726	19.8690	(88)
util rest of house													
	0.9863	0.9731	0.9456	0.8802	0.7496	0.5454	0.3615	0.3967	0.6476	0.8922	0.9726	0.9892	(89)
MIT 2	18.3767	18.6442	19.0064	19.4208	19.7170	19.8574	19.8811	19.8809	19.8211	19.4654	18.8521	18.3241	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7481	18.9949	19.3299	19.7148	19.9958	20.1335	20.1599	20.1588	20.0960	19.7547	19.1852	18.6986	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7481	18.9949	19.3299	19.7148	19.9958	20.1335	20.1599	20.1588	20.0960	19.7547	19.1852	18.6986	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9667	0.9378	0.8754	0.7565	0.5679	0.3911	0.4266	0.6662	0.8881	0.9665	0.9853	(94)
Useful gains	702.6026	795.1640	842.9058	833.6361	736.3682	533.7345	353.3295	371.2852	559.9359	687.6512	680.1207	667.5336	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1478.3983	1439.4038	1307.6756	1092.2039	836.3561	553.3779	356.0059	375.3352	601.5099	922.9469	1222.6565	1472.1761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	577.1920	432.9291	345.7887	186.1688	74.3910	0.0000	0.0000	0.0000	0.0000	175.0600	390.6258	598.6540	(98)
Space heating												2780.8095	(98)
Space heating per m2										(98) / (4) =		34.6216	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2980.5032	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	577.1920	432.9291	345.7887	186.1688	74.3910	0.0000	0.0000	0.0000	0.0000	175.0600	390.6258	598.6540	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	618.6409	464.0184	370.6203	199.5379	79.7331	0.0000	0.0000	0.0000	0.0000	187.6313	418.6772	641.6442	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4807	89.3779	89.1875	88.7805	88.0019	86.7000	86.7000	86.7000	86.7000	88.6932	89.2888	89.5219	(217)
Fuel for water heating, kWh/month													
	182.4867	160.1519	166.4817	147.0435	143.2659	126.8692	118.9361	134.5284	135.5568	152.7774	164.0685	177.0537	(219)
Water heating fuel used												1809.2198	(219)
Annual totals kWh/year													
Space heating fuel - main system												2980.5032	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4589.9474	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2980.5032	3.4800	103.7215	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.2198	3.4800	62.9608	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			260.3320	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8725	(257)
SAP value		87.8289	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2980.5032	0.2160	643.7887	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.2198	0.2160	390.7915	(264)
Space and water heating			1034.5802	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			930.8966	(272)
CO2 emissions per m2			11.5900	(273)
EI value			90.0463	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8826 = 3.943, stars = 4
Water heating environmental impact	0.216 / 0.8826 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1445	(8)
Pressure test				Yes	
Measured/design AP50				4.3100	
Infiltration rate				0.3600	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	100.6467	100.1596	100.3179	100.0052	100.0052	99.8548	99.7085	99.5662	99.4278	99.8548	99.5662	99.8548	(39)
Average = Sum(39)m / 12 =												99.9140	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2531	1.2470	1.2490	1.2451	1.2451	1.2432	1.2414	1.2396	1.2379	1.2432	1.2396	1.2432	(40)
HLP (average)												1.2439	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4194	55.6889	55.6010	55.7749	55.7749	55.8589	55.9408	56.0208	56.0988	55.8589	56.0208	55.8589	
alpha	4.6946	4.7126	4.7067	4.7183	4.7183	4.7239	4.7294	4.7347	4.7399	4.7239	4.7347	4.7239	
util living area													
	0.9852	0.9757	0.9485	0.8830	0.7594	0.5523	0.4039	0.4153	0.6602	0.8862	0.9683	0.9881	(86)
MIT	19.9904	20.1285	20.3878	20.6761	20.8827	20.9794	20.9962	20.9957	20.9528	20.7251	20.3307	19.9648	(87)
Th 2	19.8778	19.8826	19.8810	19.8841	19.8841	19.8856	19.8870	19.8884	19.8898	19.8856	19.8884	19.8856	(88)
util rest of house													
	0.9805	0.9681	0.9323	0.8469	0.6901	0.4525	0.2905	0.2991	0.5624	0.8424	0.9565	0.9842	(89)
MIT 2	18.5829	18.7838	19.1482	19.5377	19.7851	19.8749	19.8861	19.8873	19.8606	19.6106	19.0798	18.5521	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9363	19.1214	19.4595	19.8236	20.0607	20.1523	20.1648	20.1657	20.1349	19.8905	19.3939	18.9069	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9363	19.1214	19.4595	19.8236	20.0607	20.1523	20.1648	20.1657	20.1349	19.8905	19.3939	18.9069	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9613	0.9248	0.8446	0.7020	0.4771	0.3192	0.3285	0.5852	0.8426	0.9497	0.9795	(94)
Useful gains	733.1087	801.9946	849.6526	830.4940	691.3732	476.1839	304.6377	304.1677	518.9501	684.1901	708.6979	691.2112	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1412.7121	1384.3493	1249.9068	1032.4125	756.1109	484.5243	305.5901	305.2383	540.3757	847.8128	1144.4060	1388.6697	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.6249	391.3423	297.7891	145.3813	48.1648	0.0000	0.0000	0.0000	0.0000	121.7352	313.7098	518.9091	(98)
Space heating												2342.6567	(98)
Space heating per m2											(98) / (4) =	29.1665	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2510.8861	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	505.6249	391.3423	297.7891	145.3813	48.1648	0.0000	0.0000	0.0000	0.0000	121.7352	313.7098	518.9091	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	541.9345	419.4452	319.1738	155.8213	51.6236	0.0000	0.0000	0.0000	0.0000	130.4772	336.2378	556.1727	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3939	89.3069	89.0695	88.5602	87.6661	86.7000	86.7000	86.7000	86.7000	88.3672	89.1220	89.4311	(217)
Fuel for water heating, kWh/month													
	182.6638	160.2792	166.7023	147.4093	143.8147	126.8692	118.9361	134.5284	135.5568	153.3410	164.3756	177.2333	(219)
Water heating fuel used												1811.7096	(219)
Annual totals kWh/year													
Space heating fuel - main system												2510.8861	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4047.7022	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2510.8861	7.3800	185.3034	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1811.7096	7.3800	133.7042	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			347.2231	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2510.8861	0.2160	542.3514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.7096	0.2160	391.3293	(264)
Space and water heating			933.6807	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			791.0110	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2510.8861	1.2200	3063.2810	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1811.7096	1.2200	2210.2857	(264)
Space and water heating			5273.5667	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4429.6438	(272)
Primary energy kWh/m2/year			55.1499	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (23.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£426	£354	£72
Space heating	£314	£314	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£347	£290	£58
Total cost of uses	£348	£290	£58
Delivered energy	50 kWh/m²	39 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	42 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3901	0.3825	0.3748	0.3366	0.3289	0.2907	0.2907	0.2830	0.3060	0.3289	0.3442	0.3595	(22b)
Effective ac	0.5761	0.5731	0.5703	0.5566	0.5541	0.5423	0.5423	0.5401	0.5468	0.5541	0.5593	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4729	39.2704	39.0720	38.1397	37.9653	37.1534	37.1534	37.0030	37.4661	37.9653	38.3182	38.6870	(38)
Heat transfer coeff	102.3247	102.1223	101.9238	100.9916	100.8171	100.0052	100.0052	99.8548	100.3179	100.8171	101.1700	101.5389	(39)
Average = Sum(39)m / 12 =												100.9907	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2740	1.2714	1.2690	1.2574	1.2552	1.2451	1.2451	1.2432	1.2490	1.2552	1.2596	1.2642	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5106	54.6186	54.7250	55.2301	55.3257	55.7749	55.7749	55.8589	55.6010	55.3257	55.1327	54.9324	
alpha	4.6340	4.6412	4.6483	4.6820	4.6884	4.7183	4.7183	4.7239	4.7067	4.6884	4.6755	4.6622	
util living area													
	0.9896	0.9795	0.9587	0.9093	0.8084	0.6411	0.4785	0.5153	0.7365	0.9232	0.9800	0.9918	(86)
MIT	19.8558	20.0409	20.2948	20.5917	20.8271	20.9569	20.9912	20.9875	20.9160	20.6172	20.1785	19.8157	(87)
Th 2	19.8613	19.8633	19.8652	19.8744	19.8761	19.8841	19.8841	19.8856	19.8810	19.8761	19.8726	19.8690	(88)
util rest of house													
	0.9863	0.9731	0.9456	0.8802	0.7496	0.5454	0.3615	0.3967	0.6476	0.8922	0.9726	0.9892	(89)
MIT 2	18.3767	18.6442	19.0064	19.4208	19.7170	19.8574	19.8811	19.8809	19.8211	19.4654	18.8521	18.3241	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7481	18.9949	19.3299	19.7148	19.9958	20.1335	20.1599	20.1588	20.0960	19.7547	19.1852	18.6986	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7481	18.9949	19.3299	19.7148	19.9958	20.1335	20.1599	20.1588	20.0960	19.7547	19.1852	18.6986	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9818	0.9667	0.9378	0.8754	0.7565	0.5679	0.3911	0.4266	0.6662	0.8881	0.9665	0.9853	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.6026	795.1640	842.9058	833.6361	736.3682	533.7345	353.3295	371.2852	559.9359	687.6512	680.1207	667.5336	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1478.3983	1439.4038	1307.6756	1092.2039	836.3561	553.3779	356.0059	375.3352	601.5099	922.9469	1222.6565	1472.1761	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	577.1920	432.9291	345.7887	186.1688	74.3910	0.0000	0.0000	0.0000	0.0000	175.0600	390.6258	598.6540	(98)
Space heating												2780.8095	(98)
Space heating per m2											(98) / (4) =	34.6216	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2980.5032	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	577.1920	432.9291	345.7887	186.1688	74.3910	0.0000	0.0000	0.0000	0.0000	175.0600	390.6258	598.6540	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	618.6409	464.0184	370.6203	199.5379	79.7331	0.0000	0.0000	0.0000	0.0000	187.6313	418.6772	641.6442	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5789	89.5891	89.6088	89.6787	89.8248	86.7000	86.7000	86.7000	86.7000	89.1073	89.4415	89.6030	(217)
Fuel for water heating, kWh/month	154.9529	114.1675	88.0426	41.5770	12.0918	0.0000	0.0000	21.8860	47.3352	93.4499	131.3170	154.0260	(219)
Water heating fuel used												858.8460	(219)
Annual totals kWh/year													
Space heating fuel - main system												2980.5032	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3689.5736	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2980.5032	3.4800	103.7215	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	858.8460	3.4800	29.8878	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			233.8539	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7837	(257)
SAP value		89.0668	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2980.5032	0.2160	643.7887	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	858.8460	0.2160	185.5107	(264)
Space and water heating			829.2994	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			751.5659 (272)
CO2 emissions per m2			9.3600 (273)
EI value			91.9638
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3100	
Infiltration rate			0.3600	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3060	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3213	0.2983	0.3060	0.2907	0.2907	0.2830	0.2754	0.2677	0.2601	0.2830	0.2677	0.2830	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5423	0.5423	0.5401	0.5379	0.5358	0.5338	0.5401	0.5358	0.5401	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	102.1900	16.1600	86.0300	0.2700	23.2281			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			182.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.8139			(33)
Party Wall			38.0300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0379	(36)
Total fabric heat loss (33) + (36) =	62.8518	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7949	37.3078	37.4661	37.1534	37.1534	37.0030	36.8567	36.7143	36.5760	37.0030	36.7143	37.0030	(38)
Heat transfer coeff	100.6467	100.1596	100.3179	100.0052	100.0052	99.8548	99.7085	99.5662	99.4278	99.8548	99.5662	99.8548	(39)
Average = Sum(39)m / 12 =												99.9140	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2531	1.2470	1.2490	1.2451	1.2451	1.2432	1.2414	1.2396	1.2379	1.2432	1.2396	1.2432	(40)
HLP (average)												1.2439	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4194	55.6889	55.6010	55.7749	55.7749	55.8589	55.9408	56.0208	56.0988	55.8589	56.0208	55.8589	
alpha	4.6946	4.7126	4.7067	4.7183	4.7183	4.7239	4.7294	4.7347	4.7399	4.7239	4.7347	4.7239	
util living area													
	0.9852	0.9757	0.9485	0.8830	0.7594	0.5523	0.4039	0.4153	0.6602	0.8862	0.9683	0.9881	(86)
MIT	19.9904	20.1285	20.3878	20.6761	20.8827	20.9794	20.9962	20.9957	20.9528	20.7251	20.3307	19.9648	(87)
Th 2	19.8778	19.8826	19.8810	19.8841	19.8841	19.8856	19.8870	19.8884	19.8898	19.8856	19.8884	19.8856	(88)
util rest of house													
	0.9805	0.9681	0.9323	0.8469	0.6901	0.4525	0.2905	0.2991	0.5624	0.8424	0.9565	0.9842	(89)
MIT 2	18.5829	18.7838	19.1482	19.5377	19.7851	19.8749	19.8861	19.8873	19.8606	19.6106	19.0798	18.5521	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9363	19.1214	19.4595	19.8236	20.0607	20.1523	20.1648	20.1657	20.1349	19.8905	19.3939	18.9069	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9363	19.1214	19.4595	19.8236	20.0607	20.1523	20.1648	20.1657	20.1349	19.8905	19.3939	18.9069	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9613	0.9248	0.8446	0.7020	0.4771	0.3192	0.3285	0.5852	0.8426	0.9497	0.9795	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	733.1087	801.9946	849.6526	830.4940	691.3732	476.1839	304.6377	304.1677	518.9501	684.1901	708.6979	691.2112 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1412.7121	1384.3493	1249.9068	1032.4125	756.1109	484.5243	305.5901	305.2383	540.3757	847.8128	1144.4060	1388.6697 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	505.6249	391.3423	297.7891	145.3813	48.1648	0.0000	0.0000	0.0000	0.0000	121.7352	313.7098	518.9091 (98)
Space heating												2342.6567 (98)
Space heating per m2											(98) / (4) =	29.1665 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2510.8861 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	505.6249	391.3423	297.7891	145.3813	48.1648	0.0000	0.0000	0.0000	0.0000	121.7352	313.7098	518.9091	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	541.9345	419.4452	319.1738	155.8213	51.6236	0.0000	0.0000	0.0000	0.0000	130.4772	336.2378	556.1727	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5181	89.5286	89.5238	89.5579	89.4043	86.7000	86.7000	86.7000	86.7000	88.8438	89.3200	89.5326	(217)
Fuel for water heating, kWh/month	150.4644	114.4625	87.7864	40.4728	17.1316	0.0000	0.0000	14.9625	41.9449	89.3600	126.1438	150.7679	(219)
Water heating fuel used												833.4969	(219)

Annual totals kWh/year	
Space heating fuel - main system	2510.8861 (211)
Space heating fuel - secondary	0.0000 (215)
Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
pump for solar water heating	50.0000 (230g)
Total electricity for the above, kWh/year	125.0000 (231)
Electricity for lighting (calculated in Appendix L)	355.6668 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) = -705.5602	-705.5602 (233)
Total delivered energy for all uses	3119.4895 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2510.8861	7.3800	185.3034	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.4969	7.3800	61.5121	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			289.3610	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2510.8861	0.2160	542.3514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.4969	0.2160	180.0353	(264)
Space and water heating			722.3867	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			605.6670	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2510.8861	1.2200	3063.2810	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.4969	1.2200	1016.8662	(264)
Space and water heating			4080.1472	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3389.7243	(272)
Primary energy kWh/m2/year			42.2027	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	62.85	(37)
Summer heat loss coefficient	610.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.65	1.56	1.51	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.30	19.11	19.06	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 419 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 419	**Prop Type Ref**	
Property	12 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.43	**TER**	18.51
Environmental	90 B	**% DER<TER**	27.45		
CO_2 Emissions (t/year)	0.79	**DFEE**	47.70	**TFEE**	52.66
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.42		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.51	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.43	$kgCO_2/m^2$	Pass
	-5.08 (-27.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.66	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.70	$kWh/m^2/yr$	
	-5.0 (-9.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.31 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 420 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 420	**Prop Type Ref**	
Property	14 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.54	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.95		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.71	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.98 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing South: 7.79 m², No overhang
Windows facing West: 1.53 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9800	
Infiltration rate		0.3234	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3505	0.3437	0.3368	0.3024	0.2955	0.2612	0.2612	0.2543	0.2749	0.2955	0.3093	0.3230	(22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6653	44.4755	44.2894	43.4157	43.2522	42.4911	42.4911	42.3502	42.7843	43.2522	43.5829	43.9286	(38)
Heat transfer coeff	108.2094	108.0197	107.8336	106.9598	106.7964	106.0353	106.0353	105.8944	106.3285	106.7964	107.1271	107.4728	(39)
Average = Sum(39)m / 12 =												106.9591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1583	1.1563	1.1469	1.1451	1.1370	1.1370	1.1355	1.1401	1.1451	1.1487	1.1524	(40)
HLP (average)												1.1469	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8505	59.9557	60.0591	60.5497	60.6424	61.0777	61.0777	61.1589	60.9093	60.6424	60.4552	60.2607	
alpha	4.9900	4.9970	5.0039	5.0366	5.0428	5.0718	5.0718	5.0773	5.0606	5.0428	5.0303	5.0174	
util living area													
	0.9980	0.9949	0.9873	0.9648	0.9021	0.7618	0.5900	0.6348	0.8542	0.9741	0.9955	0.9985	(86)
MIT	19.7476	19.9165	20.1627	20.4702	20.7474	20.9277	20.9842	20.9773	20.8627	20.5007	20.0602	19.7134	(87)
Th 2	19.9519	19.9535	19.9551	19.9627	19.9641	19.9707	19.9707	19.9720	19.9682	19.9641	19.9613	19.9583	(88)
util rest of house													
	0.9973	0.9932	0.9828	0.9510	0.8622	0.6720	0.4623	0.5079	0.7838	0.9613	0.9936	0.9980	(89)
MIT 2	18.2840	18.5314	18.8899	19.3343	19.7089	19.9205	19.9647	19.9623	19.8565	19.3842	18.7474	18.2385	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6625	18.8896	19.2191	19.6281	19.9775	20.1810	20.2284	20.2248	20.1167	19.6730	19.0869	18.6200	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6625	18.8896	19.2191	19.6281	19.9775	20.1810	20.2284	20.2248	20.1167	19.6730	19.0869	18.6200	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9784	0.9453	0.8628	0.6921	0.4956	0.5408	0.7955	0.9565	0.9914	0.9970	(94)
Useful gains	560.0068	658.7351	724.6068	752.9331	710.1979	551.4878	378.7663	395.8034	556.5646	604.2034	553.7402	526.5973	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1554.1591	1511.1522	1371.5444	1147.4719	884.0066	591.7822	384.7379	405.0268	639.7515	968.9623	1284.1261	1549.7573	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	739.6493	572.8243	481.3215	284.0679	129.3137	0.0000	0.0000	0.0000	0.0000	271.3806	525.8778	761.2311	(98)
Space heating												3765.6663	(98)
Space heating per m2											(98) / (4) =	40.3781	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4036.0839	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	739.6493	572.8243	481.3215	284.0679	129.3137	0.0000	0.0000	0.0000	0.0000	271.3806	525.8778	761.2311	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	792.7646	613.9596	515.8859	304.4672	138.5999	0.0000	0.0000	0.0000	0.0000	290.8688	563.6418	815.8961	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6013	89.5290	89.3938	89.0985	88.4455	86.7000	86.7000	86.7000	86.7000	89.0312	89.4612	89.6338	(217)
Fuel for water heating, kWh/month													
	190.8575	167.4287	173.9075	153.3492	149.1487	132.6794	124.3201	140.7076	141.8108	159.2961	171.4538	185.1743	(219)
Water heating fuel used												1890.1337	(219)
Annual totals kWh/year													
Space heating fuel - main system												4036.0839	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5713.0377	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4036.0839	0.2160	871.7941	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.1337	0.2160	408.2689	(264)
Space and water heating			1280.0630	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1169.4226	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5400	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.0667	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0667	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0733	(36)
Total fabric heat loss	(33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			3.9800	
Infiltration rate			0.3234	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3505	0.3437	0.3368	0.3024	0.2955	0.2612	0.2612	0.2543	0.2749	0.2955	0.3093	0.3230	(22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6653	44.4755	44.2894	43.4157	43.2522	42.4911	42.4911	42.3502	42.7843	43.2522	43.5829	43.9286	(38)
Heat transfer coeff	108.2094	108.0197	107.8336	106.9598	106.7964	106.0353	106.0353	105.8944	106.3285	106.7964	107.1271	107.4728	(39)
Average = Sum(39)m / 12 =												106.9591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1583	1.1563	1.1469	1.1451	1.1370	1.1370	1.1355	1.1401	1.1451	1.1487	1.1524	(40)
HLP (average)												1.1469	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206 (72)

Total internal gains

	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8505	59.9557	60.0591	60.5497	60.6424	61.0777	61.0777	61.1589	60.9093	60.6424	60.4552	60.2607	
alpha	4.9900	4.9970	5.0039	5.0366	5.0428	5.0718	5.0718	5.0773	5.0606	5.0428	5.0303	5.0174	
util living area	0.9985	0.9959	0.9894	0.9692	0.9115	0.7768	0.6053	0.6528	0.8683	0.9784	0.9965	0.9989	(86)
MIT	19.7151	19.8853	20.1343	20.4466	20.7310	20.9208	20.9823	20.9743	20.8503	20.4759	20.0300	19.6816	(87)
Th 2	19.9519	19.9535	19.9551	19.9627	19.9641	19.9707	19.9707	19.9720	19.9682	19.9641	19.9613	19.9583	(88)
util rest of house	0.9979	0.9945	0.9855	0.9569	0.8741	0.6882	0.4756	0.5243	0.8012	0.9673	0.9950	0.9985	(89)
MIT 2	18.7807	18.9516	19.2000	19.5116	19.7765	19.9326	19.9661	19.9644	19.8835	19.5448	19.1026	18.7524	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0224	19.1931	19.4416	19.7534	20.0234	20.1882	20.2289	20.2256	20.1336	19.7856	19.3424	18.9927	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0224	19.1931	19.4416	19.7534	20.0234	20.1882	20.2289	20.2256	20.1336	19.7856	19.3424	18.9927	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9931	0.9830	0.9538	0.8766	0.7088	0.5096	0.5579	0.8137	0.9649	0.9938	0.9980	(94)
Useful gains	528.1496	628.7361	698.3574	733.1360	698.4784	547.6266	378.0341	394.5209	548.4730	582.5526	524.6746	495.3356	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1593.1000	1543.9312	1395.5389	1160.8777	888.9087	592.5438	384.7927	405.1067	641.5388	980.9920	1311.4975	1589.8131	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	792.3231	615.0111	518.7030	307.9740	141.6801	0.0000	0.0000	0.0000	0.0000	296.4389	566.5125	814.2912	(98)
Space heating												4052.9339	(98)
Space heating per m2											(98) / (4) =	43.4584	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	996.7321	784.6614	804.7974	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8387	0.9090	0.8888	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	835.9099	713.2649	715.3261	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	121.5950	188.5729	158.3057	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											468.4736	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.3987	47.1432	39.5764	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											117.1184	(107)
Space cooling per m2											1.2558	(108)
Energy for space heating											43.4584	(99)
Energy for space cooling											1.2558	(108)
Total											44.7143	(109)
Dwelling Fabric Energy Efficiency (DFEE)											44.7	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)
West	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(80)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9800	
Infiltration rate		0.3234	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2887	0.2681	0.2749	0.2612	0.2612	0.2543	0.2474	0.2406	0.2337	0.2543	0.2406	0.2543	(22b)
Effective ac	0.5417	0.5359	0.5378	0.5341	0.5341	0.5323	0.5306	0.5289	0.5273	0.5323	0.5289	0.5323	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0924	42.6358	42.7843	42.4911	42.4911	42.3502	42.2130	42.0796	41.9500	42.3502	42.0796	42.3502	(38)
Heat transfer coeff	106.6366	106.1800	106.3285	106.0353	106.0353	105.8944	105.7572	105.6238	105.4941	105.8944	105.6238	105.8944	(39)
Average = Sum(39)m / 12 =												105.9498	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1434	1.1385	1.1401	1.1370	1.1370	1.1355	1.1340	1.1326	1.1312	1.1355	1.1326	1.1355	(40)
HLP (average)												1.1361	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
Total per year (kWh/year) = Sum(64)m =												1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335 (83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7332	60.9944	60.9093	61.0777	61.0777	61.1589	61.2383	61.3156	61.3910	61.1589	61.3156	61.1589	
alpha	5.0489	5.0663	5.0606	5.0718	5.0718	5.0773	5.0826	5.0877	5.0927	5.0773	5.0877	5.0773	
util living area													
	0.9888	0.9817	0.9606	0.9059	0.7910	0.5826	0.4265	0.4372	0.6886	0.9044	0.9752	0.9910	(86)
MIT	20.0627	20.1822	20.4159	20.6840	20.8854	20.9807	20.9967	20.9964	20.9558	20.7394	20.3743	20.0399	(87)
Th 2	19.9655	19.9695	19.9682	19.9707	19.9707	19.9720	19.9732	19.9743	19.9754	19.9720	19.9743	19.9720	(88)
util rest of house													
	0.9852	0.9759	0.9479	0.8755	0.7276	0.4861	0.3160	0.3243	0.5959	0.8666	0.9659	0.9881	(89)
MIT 2	18.7514	18.9260	19.2571	19.6244	19.8708	19.9616	19.9723	19.9733	19.9469	19.7045	19.2074	18.7234	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8731	0.7385	0.5107	0.3448	0.3537	0.6182	0.8666	0.9604	0.9845	(94)
Useful gains	781.0695	846.9916	891.6864	873.5048	735.4188	512.3361	330.8001	330.3378	557.3709	726.8463	752.7122	738.5129	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1513.2308	1481.3017	1335.1443	1102.5981	809.3855	521.5476	331.7845	331.4383	581.0452	907.7415	1226.2046	1489.2897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	544.7280	426.2564	329.9327	164.9472	55.0313	0.0000	0.0000	0.0000	0.0000	134.5860	340.9145	558.5780	(98)
Space heating												2554.9740	(98)
RHI space heating demand												2555	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9800	
Infiltration rate		0.3234	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3505	0.3437	0.3368	0.3024	0.2955	0.2612	0.2612	0.2543	0.2749	0.2955	0.3093	0.3230	(22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6653	44.4755	44.2894	43.4157	43.2522	42.4911	42.4911	42.3502	42.7843	43.2522	43.5829	43.9286	(38)
Heat transfer coeff	108.2094	108.0197	107.8336	106.9598	106.7964	106.0353	106.0353	105.8944	106.3285	106.7964	107.1271	107.4728	(39)
Average = Sum(39)m / 12 =												106.9591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1583	1.1563	1.1469	1.1451	1.1370	1.1370	1.1355	1.1401	1.1451	1.1487	1.1524	(40)
HLP (average)												1.1469	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8505	59.9557	60.0591	60.5497	60.6424	61.0777	61.0777	61.1589	60.9093	60.6424	60.4552	60.2607	
alpha	4.9900	4.9970	5.0039	5.0366	5.0428	5.0718	5.0718	5.0773	5.0606	5.0428	5.0303	5.0174	
util living area													
	0.9922	0.9847	0.9687	0.9285	0.8380	0.6726	0.5033	0.5399	0.7632	0.9371	0.9845	0.9939	(86)
MIT	19.9434	20.1046	20.3320	20.6050	20.8308	20.9590	20.9922	20.9889	20.9209	20.6394	20.2375	19.9063	(87)
Th 2	19.9519	19.9535	19.9551	19.9627	19.9641	19.9707	19.9707	19.9720	19.9682	19.9641	19.9613	19.9583	(88)
util rest of house													
	0.9897	0.9799	0.9586	0.9047	0.7856	0.5815	0.3900	0.4256	0.6806	0.9111	0.9788	0.9919	(89)
MIT 2	18.5685	18.8025	19.1290	19.5137	19.8035	19.9442	19.9679	19.9676	19.9096	19.5685	19.0024	18.5193	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9241	19.1393	19.4401	19.7960	20.0692	20.2067	20.2328	20.2317	20.1712	19.8455	19.3219	18.8780	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9241	19.1393	19.4401	19.7960	20.0692	20.2067	20.2328	20.2317	20.1712	19.8455	19.3219	18.8780	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9523	0.9002	0.7915	0.6035	0.4195	0.4553	0.6983	0.9075	0.9740	0.9891	(94)
Useful gains	751.4333	840.2407	884.2760	874.6152	779.6240	572.4571	382.3776	401.4652	599.5317	729.1434	724.3172	715.5076	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1582.4663	1538.1218	1395.3783	1165.4296	893.8030	594.5056	385.2100	405.7591	645.5381	987.3813	1309.2918	1577.4908	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	618.2885	468.9761	380.2601	209.3864	84.9492	0.0000	0.0000	0.0000	0.0000	192.1290	421.1817	641.3155	(98)
Space heating												3016.4865	(98)
Space heating per m2											(98) / (4) =	32.3449	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3233.1045	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	618.2885	468.9761	380.2601	209.3864	84.9492	0.0000	0.0000	0.0000	0.0000	192.1290	421.1817	641.3155	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.6886	502.6539	407.5671	224.4227	91.0495	0.0000	0.0000	0.0000	0.0000	205.9261	451.4273	687.3693	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4949	89.4009	89.2249	88.8433	88.0754	86.7000	86.7000	86.7000	86.7000	88.7353	89.3100	89.5356	(217)
Fuel for water heating, kWh/month													
	191.0845	167.6686	174.2368	153.7896	149.7753	132.6794	124.3201	140.7076	141.8108	159.8273	171.7440	185.3773	(219)
Water heating fuel used												1893.0212	(219)
Annual totals kWh/year													
Space heating fuel - main system												3233.1045	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4912.9458	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3233.1045	3.4800	112.5120	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1893.0212	3.4800	65.8771	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			270.2707	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8210	(257)
SAP value		88.5468	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3233.1045	0.2160	698.3506	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.0212	0.2160	408.8926	(264)
Space and water heating			1107.2432	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			996.6028	(272)
CO2 emissions per m2			10.6900	(273)
EI value			90.3410	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8829 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8829 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9800	
Infiltration rate		0.3234	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2887	0.2681	0.2749	0.2612	0.2612	0.2543	0.2474	0.2406	0.2337	0.2543	0.2406	0.2543	(22b)
Effective ac	0.5417	0.5359	0.5378	0.5341	0.5341	0.5323	0.5306	0.5289	0.5273	0.5323	0.5289	0.5323	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0924	42.6358	42.7843	42.4911	42.4911	42.3502	42.2130	42.0796	41.9500	42.3502	42.0796	42.3502	(38)
Heat transfer coeff	106.6366	106.1800	106.3285	106.0353	106.0353	105.8944	105.7572	105.6238	105.4941	105.8944	105.6238	105.8944	(39)
Average = Sum(39)m / 12 =												105.9498	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1434	1.1385	1.1401	1.1370	1.1370	1.1355	1.1340	1.1326	1.1312	1.1355	1.1326	1.1355	(40)
HLP (average)												1.1361	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7332	60.9944	60.9093	61.0777	61.0777	61.1589	61.2383	61.3156	61.3910	61.1589	61.3156	61.1589	
alpha	5.0489	5.0663	5.0606	5.0718	5.0718	5.0773	5.0826	5.0877	5.0927	5.0773	5.0877	5.0773	
util living area													
	0.9888	0.9817	0.9606	0.9059	0.7910	0.5826	0.4265	0.4372	0.6886	0.9044	0.9752	0.9910	(86)
MIT	20.0627	20.1822	20.4159	20.6840	20.8854	20.9807	20.9967	20.9964	20.9558	20.7394	20.3743	20.0399	(87)
Th 2	19.9655	19.9695	19.9682	19.9707	19.9707	19.9720	19.9732	19.9743	19.9754	19.9720	19.9743	19.9720	(88)
util rest of house													
	0.9852	0.9759	0.9479	0.8755	0.7276	0.4861	0.3160	0.3243	0.5959	0.8666	0.9659	0.9881	(89)
MIT 2	18.7514	18.9260	19.2571	19.6244	19.8708	19.9616	19.9723	19.9733	19.9469	19.7045	19.2074	18.7234	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8731	0.7385	0.5107	0.3448	0.3537	0.6182	0.8666	0.9604	0.9845	(94)
Useful gains	781.0695	846.9916	891.6864	873.5048	735.4188	512.3361	330.8001	330.3378	557.3709	726.8463	752.7122	738.5129	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1513.2308	1481.3017	1335.1443	1102.5981	809.3855	521.5476	331.7845	331.4383	581.0452	907.7415	1226.2046	1489.2897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	544.7280	426.2564	329.9327	164.9472	55.0313	0.0000	0.0000	0.0000	0.0000	134.5860	340.9145	558.5780	(98)
Space heating												2554.9740	(98)
Space heating per m2											(98) / (4) =	27.3962	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2738.4502	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	544.7280	426.2564	329.9327	164.9472	55.0313	0.0000	0.0000	0.0000	0.0000	134.5860	340.9145	558.5780	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	583.8456	456.8665	353.6256	176.7923	58.9831	0.0000	0.0000	0.0000	0.0000	144.2508	365.3961	598.6902	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4129	89.3349	89.1149	88.6326	87.7296	86.7000	86.7000	86.7000	86.7000	88.4163	89.1513	89.4492	(217)
Fuel for water heating, kWh/month													
	191.2596	167.7924	174.4519	154.1552	150.3658	132.6794	124.3201	140.7076	141.8108	160.4039	172.0497	185.5565	(219)
Water heating fuel used												1895.5528	(219)
Annual totals kWh/year													
Space heating fuel - main system												2738.4502	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4337.4731	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2738.4502	7.3800	202.0976	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.5528	7.3800	139.8918	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			364.0040	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2738.4502	0.2160	591.5052	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5528	0.2160	409.4394	(264)
Space and water heating			1000.9446	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			847.0457	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2738.4502	1.2200	3340.9092	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.5528	1.2200	2312.5744	(264)
Space and water heating			5653.4836	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4743.1371	(272)
Primary energy kWh/m2/year			50.8593	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£449	£375	£74
Space heating	£331	£331	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£364	£305	£60
Total cost of uses	£365	£305	£60
Delivered energy	47 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	39 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			3.9800	
Infiltration rate			0.3234	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3505	0.3437	0.3368	0.3024	0.2955	0.2612	0.2612	0.2543	0.2749	0.2955	0.3093	0.3230	(22b)
Effective ac	0.5614	0.5590	0.5567	0.5457	0.5437	0.5341	0.5341	0.5323	0.5378	0.5437	0.5478	0.5522	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6653	44.4755	44.2894	43.4157	43.2522	42.4911	42.4911	42.3502	42.7843	43.2522	43.5829	43.9286	(38)
Heat transfer coeff	108.2094	108.0197	107.8336	106.9598	106.7964	106.0353	106.0353	105.8944	106.3285	106.7964	107.1271	107.4728	(39)
Average = Sum(39)m / 12 =												106.9591	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1583	1.1563	1.1469	1.1451	1.1370	1.1370	1.1355	1.1401	1.1451	1.1487	1.1524	(40)
HLP (average)												1.1469	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1815 (H8)
Utilisation factor												0.5710 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-862.7264 (H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435 (64)
								Total per year (kWh/year) = Sum(64)m =				818.2658 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)
West	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(80)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8505	59.9557	60.0591	60.5497	60.6424	61.0777	61.0777	61.1589	60.9093	60.6424	60.4552	60.2607	
alpha	4.9900	4.9970	5.0039	5.0366	5.0428	5.0718	5.0718	5.0773	5.0606	5.0428	5.0303	5.0174	
util living area													
	0.9922	0.9847	0.9687	0.9285	0.8380	0.6726	0.5033	0.5399	0.7632	0.9371	0.9845	0.9939	(86)
MIT	19.9434	20.1046	20.3320	20.6050	20.8308	20.9590	20.9922	20.9889	20.9209	20.6394	20.2375	19.9063	(87)
Th 2	19.9519	19.9535	19.9551	19.9627	19.9641	19.9707	19.9707	19.9720	19.9682	19.9641	19.9613	19.9583	(88)
util rest of house													
	0.9897	0.9799	0.9586	0.9047	0.7856	0.5815	0.3900	0.4256	0.6806	0.9111	0.9788	0.9919	(89)
MIT 2	18.5685	18.8025	19.1290	19.5137	19.8035	19.9442	19.9679	19.9676	19.9096	19.5685	19.0024	18.5193	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9241	19.1393	19.4401	19.7960	20.0692	20.2067	20.2328	20.2317	20.1712	19.8455	19.3219	18.8780	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9241	19.1393	19.4401	19.7960	20.0692	20.2067	20.2328	20.2317	20.1712	19.8455	19.3219	18.8780	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9749	0.9523	0.9002	0.7915	0.6035	0.4195	0.4553	0.6983	0.9075	0.9740	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4333	840.2407	884.2760	874.6152	779.6240	572.4571	382.3776	401.4652	599.5317	729.1434	724.3172	715.5076	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1582.4663	1538.1218	1395.3783	1165.4296	893.8030	594.5056	385.2100	405.7591	645.5381	987.3813	1309.2918	1577.4908	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	618.2885	468.9761	380.2601	209.3864	84.9492	0.0000	0.0000	0.0000	0.0000	192.1290	421.1817	641.3155	(98)

Space heating 3016.4865 (98)
Space heating per m2 (98) / (4) = 32.3449 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3233.1045 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	618.2885	468.9761	380.2601	209.3864	84.9492	0.0000	0.0000	0.0000	0.0000	192.1290	421.1817	641.3155	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	662.6886	502.6539	407.5671	224.4227	91.0495	0.0000	0.0000	0.0000	0.0000	205.9261	451.4273	687.3693	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5894	89.6028	89.6243	89.6859	89.7663	86.7000	86.7000	86.7000	86.7000	89.1332	89.4567	89.6137	(217)
Fuel for water heating, kWh/month	162.9584	120.6999	94.1297	46.0991	15.8141	0.0000	0.0000	25.6169	51.6716	99.2396	138.2908	161.8542	(219)

Water heating fuel used 916.3745 (219)
Annual totals kWh/year
Space heating fuel - main system 3233.1045 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 411.3521 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) = -699.5320 -699.5320 (233)
Total delivered energy for all uses 3986.2991 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3233.1045	3.4800	112.5120	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.3745	3.4800	31.8898	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			242.8784	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7378 (257)
SAP value 89.7076
SAP rating (Section 12) 90 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3233.1045	0.2160	698.3506	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.3745	0.2160	197.9369	(264)
Space and water heating			896.2875	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			811.5971 (272)
CO2 emissions per m2			8.7000 (273)
EI value			92.1341
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.9800	
Infiltration rate		0.3234	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2749	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2887	0.2681	0.2749	0.2612	0.2612	0.2543	0.2474	0.2406	0.2337	0.2543	0.2406	0.2543	(22b)
Effective ac	0.5417	0.5359	0.5378	0.5341	0.5341	0.5323	0.5306	0.5289	0.5273	0.5323	0.5289	0.5323	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.0924	42.6358	42.7843	42.4911	42.4911	42.3502	42.2130	42.0796	41.9500	42.3502	42.0796	42.3502	(38)
Heat transfer coeff	106.6366	106.1800	106.3285	106.0353	106.0353	105.8944	105.7572	105.6238	105.4941	105.8944	105.6238	105.8944	(39)
Average = Sum(39)m / 12 =												105.9498	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1434	1.1385	1.1401	1.1370	1.1370	1.1355	1.1340	1.1326	1.1312	1.1355	1.1326	1.1355	(40)
HLP (average)												1.1361	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3223 (H8)
Utilisation factor												0.5306 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-897.1283 (H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656 (63)
								Solar input (sum of months) = Sum(63)m =				-897.1283 (63)
Output from w/h												
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132 (64)
									Total per year (kWh/year) = Sum(64)m =			793.5279 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)
West	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(80)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7332	60.9944	60.9093	61.0777	61.0777	61.1589	61.2383	61.3156	61.3910	61.1589	61.3156	61.1589	
alpha	5.0489	5.0663	5.0606	5.0718	5.0718	5.0773	5.0826	5.0877	5.0927	5.0773	5.0877	5.0773	
util living area													
	0.9888	0.9817	0.9606	0.9059	0.7910	0.5826	0.4265	0.4372	0.6886	0.9044	0.9752	0.9910	(86)
MIT	20.0627	20.1822	20.4159	20.6840	20.8854	20.9807	20.9967	20.9964	20.9558	20.7394	20.3743	20.0399	(87)
Th 2	19.9655	19.9695	19.9682	19.9707	19.9707	19.9720	19.9732	19.9743	19.9754	19.9720	19.9743	19.9720	(88)
util rest of house													
	0.9852	0.9759	0.9479	0.8755	0.7276	0.4861	0.3160	0.3243	0.5959	0.8666	0.9659	0.9881	(89)
MIT 2	18.7514	18.9260	19.2571	19.6244	19.8708	19.9616	19.9723	19.9733	19.9469	19.7045	19.2074	18.7234	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0905	19.2509	19.5568	19.8984	20.1332	20.2252	20.2372	20.2379	20.2078	19.9721	19.5092	19.0639	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9707	0.9416	0.8731	0.7385	0.5107	0.3448	0.3537	0.6182	0.8666	0.9604	0.9845	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.0695	846.9916	891.6864	873.5048	735.4188	512.3361	330.8001	330.3378	557.3709	726.8463	752.7122	738.5129	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1513.2308	1481.3017	1335.1443	1102.5981	809.3855	521.5476	331.7845	331.4383	581.0452	907.7415	1226.2046	1489.2897	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	544.7280	426.2564	329.9327	164.9472	55.0313	0.0000	0.0000	0.0000	0.0000	134.5860	340.9145	558.5780	(98)

Space heating 2554.9740 (98)
Space heating per m2 (98) / (4) = 27.3962 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2738.4502 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.7280	426.2564	329.9327	164.9472	55.0313	0.0000	0.0000	0.0000	0.0000	134.5860	340.9145	558.5780	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	583.8456	456.8665	353.6256	176.7923	58.9831	0.0000	0.0000	0.0000	0.0000	144.2508	365.3961	598.6902	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5324	89.5468	89.5459	89.5723	89.3640	86.7000	86.7000	86.7000	86.7000	88.8777	89.3415	89.5467	(217)
Fuel for water heating, kWh/month	158.3163	120.9224	93.7354	44.7976	20.7731	0.0000	0.0000	18.3443	46.0088	94.9598	132.9393	158.4794	(219)
Water heating fuel used												889.2764	(219)

Annual totals kWh/year
Space heating fuel - main system 2738.4502 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 411.3521 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) = -782.8819 -782.8819 (233)
Total delivered energy for all uses 3381.1967 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2738.4502	7.3800	202.0976	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.2764	7.3800	65.6286	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			304.0708	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2738.4502	0.2160	591.5052	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2764	0.2160	192.0837	(264)
Space and water heating			783.5889	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			655.6400	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2738.4502	1.2200	3340.9092	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2764	1.2200	1084.9172	(264)
Space and water heating			4425.8264	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3668.9799	(272)
Primary energy kWh/m2/year			39.3414	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
West	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 420 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 420	**Prop Type Ref**	
Property	14 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.54	**TER**	17.41
Environmental	90 B	**% DER<TER**	27.95		
CO_2 Emissions (t/year)	0.85	**DFEE**	44.71	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.54	$kgCO_2/m^2$	Pass
	-4.87 (-28.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.71	$kWh/m^2/yr$	
	-5.2 (-10.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.98 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	4.09 m², No overhang 7.79 m², No overhang 1.53 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.98 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	4.0	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 421 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 421	**Prop Type Ref**	
Property	15 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.50	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.18		
CO_2 Emissions (t/year)	0.84	**DFEE**	44.55	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.5 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.77 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.09 m², No overhang
Windows facing East: 1.53 m², No overhang
Windows facing South: 7.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3392	0.3325	0.3259	0.2926	0.2860	0.2527	0.2527	0.2461	0.2660	0.2860	0.2993	0.3126	(22b)
Effective ac	0.5575	0.5553	0.5531	0.5428	0.5409	0.5319	0.5319	0.5303	0.5354	0.5409	0.5448	0.5488	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3531	44.1754	44.0013	43.1833	43.0302	42.3178	42.3178	42.1859	42.5922	43.0302	43.3398	43.6635	(38)
Heat transfer coeff	107.8973	107.7196	107.5454	106.7275	106.5744	105.8620	105.8620	105.7301	106.1364	106.5744	106.8840	107.2077	(39)
Average = Sum(39)m / 12 =												106.7267	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1550	1.1532	1.1444	1.1428	1.1351	1.1351	1.1337	1.1381	1.1428	1.1461	1.1496	(40)
HLP (average)												1.1444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	409.3686	407.0489	392.0925	367.9933	343.4241	319.9358	304.8250	311.2333	323.7589	348.0808	375.9578	396.9604	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	562.2584	664.9372	740.6049	796.4678	823.1369	796.8445	764.2832	731.8615	699.6046	631.6995	558.5638	528.1708 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0237	60.1227	60.2200	60.6815	60.7687	61.1776	61.1776	61.2540	61.0195	60.7687	60.5927	60.4097	
alpha	5.0016	5.0082	5.0147	5.0454	5.0512	5.0785	5.0785	5.0836	5.0680	5.0512	5.0395	5.0273	
util living area													
	0.9980	0.9949	0.9873	0.9646	0.9017	0.7612	0.5892	0.6341	0.8537	0.9740	0.9955	0.9985	(86)
MIT	19.7521	19.9207	20.1665	20.4727	20.7490	20.9283	20.9844	20.9775	20.8637	20.5028	20.0631	19.7172	(87)
Th 2	19.9546	19.9561	19.9576	19.9647	19.9661	19.9722	19.9722	19.9734	19.9699	19.9661	19.9634	19.9606	(88)
util rest of house													
	0.9973	0.9932	0.9827	0.9508	0.8617	0.6714	0.4618	0.5074	0.7833	0.9612	0.9936	0.9980	(89)
MIT 2	18.2924	18.5394	18.8970	19.3393	19.7126	19.9224	19.9663	19.9638	19.8590	19.3886	18.7532	18.2457	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.6699	18.8966	19.2253	19.6324	19.9806	20.1826	20.2296	20.2260	20.1188	19.6767	19.0920	18.6263	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6699	18.8966	19.2253	19.6324	19.9806	20.1826	20.2296	20.2260	20.1188	19.6767	19.0920	18.6263	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9907	0.9784	0.9452	0.8624	0.6915	0.4950	0.5403	0.7950	0.9564	0.9914	0.9970	(94)
Useful gains	560.0096	658.7319	724.5759	752.8189	709.8657	551.0205	378.3331	395.3929	556.2203	604.1423	553.7389	526.5997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1550.4768	1507.7109	1368.5532	1145.4446	882.5041	590.9814	384.2372	404.5237	638.8160	967.3481	1281.7546	1546.6129	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	736.9077	570.5139	479.1192	282.6906	128.4430	0.0000	0.0000	0.0000	0.0000	270.2251	524.1713	758.8899	(98)
Space heating												3750.9606	(98)
Space heating per m2											(98) / (4) =	40.2205	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4020.3222 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	736.9077	570.5139	479.1192	282.6906	128.4430	0.0000	0.0000	0.0000	0.0000	270.2251	524.1713	758.8899	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	789.8260	611.4833	513.5254	302.9909	137.6667	0.0000	0.0000	0.0000	0.0000	289.6304	561.8128	813.3868	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5992	89.5265	89.3907	89.0946	88.4394	86.7000	86.7000	86.7000	86.7000	89.0276	89.4591	89.6321	(217)
Fuel for water heating, kWh/month													
	190.8619	167.4333	173.9136	153.3559	149.1589	132.6794	124.3201	140.7076	141.8108	159.3024	171.4578	185.1778	(219)
Water heating fuel used												1890.1795	(219)
Annual totals kWh/year													
Space heating fuel - main system												4020.3222	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												5697.3218	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4020.3222	0.2160	868.3896	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1890.1795	0.2160	408.2788	(264)
Space and water heating			1276.6684	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1166.0280	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5000	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		30.0267	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0267	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0733	(36)
Total fabric heat loss	(33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	556.2835	645.8410	710.1048	755.3177	774.9234	748.3247	717.9516	691.0400	665.0427	609.3207	548.8832	524.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9981	0.9954	0.9889	0.9690	0.9115	0.7737	0.5997	0.6423	0.8610	0.9759	0.9957	0.9986	(86)
MIT	19.8024	19.9581	20.1899	20.4852	20.7525	20.9307	20.9854	20.9793	20.8700	20.5246	20.1066	19.7748	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9974	0.9939	0.9849	0.9568	0.8748	0.6874	0.4754	0.5192	0.7938	0.9640	0.9940	0.9981	(89)
MIT 2	18.3900	18.6187	18.9569	19.3872	19.7514	19.9648	20.0082	20.0066	19.9032	19.4493	18.8437	18.3559	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7553	18.9651	19.2758	19.6712	20.0103	20.2146	20.2610	20.2582	20.1532	19.7274	19.1703	18.7229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9916	0.9810	0.9516	0.8750	0.7067	0.5078	0.5511	0.8050	0.9596	0.9919	0.9972	(94)
Useful gains	554.1879	640.4465	696.6163	718.7690	678.0600	528.8180	364.5586	380.8565	535.3691	584.7114	544.4406	523.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1503.4527	1459.2970	1322.3416	1102.2426	848.5976	567.6018	370.1004	389.3063	614.3211	932.0282	1237.8933	1496.1449	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating												3606.4351	(98)
Space heating per m2											(98) / (4) =	38.6708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3861.2795	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	706.2530	550.2675	465.5396	276.1010	126.8800	0.0000	0.0000	0.0000	0.0000	258.4037	499.2860	723.7042	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	756.1596	589.1515	498.4364	295.6114	135.8458	0.0000	0.0000	0.0000	0.0000	276.6635	534.5674	774.8439	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8661	87.6245	87.1709	86.2313	84.3714	80.3000	80.3000	80.3000	80.3000	85.9507	87.3570	87.9572	(217)
Fuel for water heating, kWh/month													
	239.1191	211.3759	222.9423	199.8932	197.7983	183.0424	175.3686	195.4949	197.6539	210.2715	218.9207	233.1622	(219)
Water heating fuel used												2485.0430	(219)
Annual totals kWh/year													
Space heating fuel - main system												3861.2795	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6832.6746	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3861.2795	0.2160	834.0364	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.0430	0.2160	536.7693	(264)
Space and water heating			1370.8057	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1623.2224	(272)
Emissions per m2 for space and water heating			14.6988	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6988 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.4100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3392	0.3325	0.3259	0.2926	0.2860	0.2527	0.2527	0.2461	0.2660	0.2860	0.2993	0.3126	(22b)
Effective ac	0.5575	0.5553	0.5531	0.5428	0.5409	0.5319	0.5319	0.5303	0.5354	0.5409	0.5448	0.5488	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3531	44.1754	44.0013	43.1833	43.0302	42.3178	42.3178	42.1859	42.5922	43.0302	43.3398	43.6635	(38)
Heat transfer coeff	107.8973	107.7196	107.5454	106.7275	106.5744	105.8620	105.8620	105.7301	106.1364	106.5744	106.8840	107.2077	(39)
Average = Sum(39)m / 12 =												106.7267	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1550	1.1532	1.1444	1.1428	1.1351	1.1351	1.1337	1.1381	1.1428	1.1461	1.1496	(40)
HLP (average)												1.1444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106 (71)

Water heating gains (Table 5)

	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206 (72)

Total internal gains

	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104 (83)
Total gains	529.6028	633.0985	710.4630	768.6356	796.8050	772.6230	741.8527	707.1332	674.0577	603.7625	527.9311	496.3287 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0237	60.1227	60.2200	60.6815	60.7687	61.1776	61.1776	61.2540	61.0195	60.7687	60.5927	60.4097	
alpha	5.0016	5.0082	5.0147	5.0454	5.0512	5.0785	5.0785	5.0836	5.0680	5.0512	5.0395	5.0273	
util living area	0.9985	0.9959	0.9893	0.9691	0.9112	0.7762	0.6045	0.6521	0.8678	0.9783	0.9965	0.9989	(86)
MIT	19.7196	19.8895	20.1380	20.4491	20.7327	20.9214	20.9825	20.9745	20.8512	20.4779	20.0329	19.6854	(87)
Th 2	19.9546	19.9561	19.9576	19.9647	19.9661	19.9722	19.9722	19.9734	19.9699	19.9661	19.9634	19.9606	(88)
util rest of house	0.9979	0.9945	0.9854	0.9568	0.8737	0.6876	0.4751	0.5238	0.8006	0.9673	0.9950	0.9985	(89)
MIT 2	18.7873	18.9578	19.2056	19.5156	19.7797	19.9344	19.9676	19.9659	19.8858	19.5484	19.1072	18.7580	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0284	19.1988	19.4468	19.7571	20.0262	20.1897	20.2301	20.2267	20.1355	19.7888	19.3466	18.9979	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0284	19.1988	19.4468	19.7571	20.0262	20.1897	20.2301	20.2267	20.1355	19.7888	19.3466	18.9979	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9931	0.9829	0.9537	0.8762	0.7082	0.5090	0.5573	0.8132	0.9648	0.9938	0.9980	(94)
Useful gains	528.1518	628.7346	698.3341	733.0395	698.1761	547.1789	377.6073	394.1201	548.1569	582.5048	524.6743	495.3375	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1589.1573	1540.2604	1392.3649	1158.7473	887.3564	591.7341	384.2911	404.6024	640.5836	979.2930	1308.9696	1586.4443	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	789.3880	612.5453	516.3589	306.5096	140.7501	0.0000	0.0000	0.0000	0.0000	295.2104	564.6926	811.7835	(98)
Space heating												4037.2385	(98)
Space heating per m2											(98) / (4) =	43.2901	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	995.1029	783.3789	803.5486	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8395	0.9097	0.8895	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	835.3958	712.6026	714.7651	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.7918	966.7232	928.1025	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	121.9652	189.0657	158.7230	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												469.7539 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.4913	47.2664	39.6808	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												117.4385 (107)
Space cooling per m2												1.2593 (108)
Energy for space heating												43.2901 (99)
Energy for space cooling												1.2593 (108)
Total												44.5494 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.6300	0.7000	0.7700	13.2913	(74)
East	1.5300	19.6403	0.6300	0.7000	0.7700	9.1835	(76)
South	7.7900	46.7521	0.6300	0.7000	0.7700	111.3038	(78)

Solar gains	133.7787	225.6523	304.9484	374.9151	419.7487	417.2951	402.0259	368.0497	328.8650	248.1663	159.7803	114.8091	(83)
Total gains	510.4916	600.8624	666.8990	715.0763	736.8409	713.0094	684.4204	654.5547	627.0770	568.3101	505.1053	479.9274	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9987	0.9967	0.9916	0.9751	0.9251	0.7971	0.6247	0.6711	0.8826	0.9819	0.9971	0.9991	(86)
MIT	19.7564	19.9135	20.1483	20.4500	20.7274	20.9198	20.9824	20.9746	20.8505	20.4874	20.0630	19.7295	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9983	0.9956	0.9884	0.9650	0.8922	0.7129	0.4974	0.5458	0.8209	0.9727	0.9959	0.9988	(89)
MIT 2	18.8512	19.0096	19.2448	19.5494	19.8110	19.9742	20.0091	20.0079	19.9238	19.5904	19.1676	18.8312	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0853	19.2434	19.4785	19.7823	20.0480	20.2188	20.2609	20.2579	20.1635	19.8224	19.3992	19.0636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9864	0.9621	0.8939	0.7323	0.5308	0.5786	0.8321	0.9704	0.9949	0.9983	(94)
Useful gains	509.3266	597.5293	657.7963	688.0021	658.6550	522.1432	363.2936	378.7215	521.7814	551.5142	502.5234	479.1283	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1537.7811	1488.1705	1343.3186	1113.6134	852.4468	568.0200	370.0895	389.2800	615.3619	941.7262	1261.3650	1531.2435	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	765.1701	598.5109	510.0286	306.4401	144.1811	0.0000	0.0000	0.0000	0.0000	290.3178	546.3660	782.7738	(98)
Space heating												3943.7883	(98)
Space heating per m2											(98) / (4) =	42.2881	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8337	0.9070	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	792.2430	678.5531	680.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.1136	899.5945	866.6471	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	102.8669	164.4548	138.4792	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												405.8010	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   25.7167   41.1137   34.6198    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.4502 (107)
Space cooling per m2                                                                                                   1.0878 (108)
Energy for space heating                                                                                              42.2881 (99)
Energy for space cooling                                                                                               1.0878 (108)
Total                                                                                                                 43.3759 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2793	0.2594	0.2660	0.2527	0.2527	0.2461	0.2394	0.2328	0.2261	0.2461	0.2328	0.2461	(22b)
Effective ac	0.5390	0.5336	0.5354	0.5319	0.5319	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8807	42.4533	42.5922	42.3178	42.3178	42.1859	42.0575	41.9326	41.8112	42.1859	41.9326	42.1859	(38)
Heat transfer coeff	106.4249	105.9975	106.1364	105.8620	105.8620	105.7301	105.6017	105.4768	105.3554	105.7301	105.4768	105.7301	(39)
Average = Sum(39)m / 12 =												105.7820	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1412	1.1366	1.1381	1.1351	1.1351	1.1337	1.1323	1.1310	1.1297	1.1337	1.1310	1.1337	(40)
HLP (average)												1.1343	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8541	61.0995	61.0195	61.1776	61.1776	61.2540	61.3285	61.4011	61.4718	61.2540	61.4011	61.2540	
alpha	5.0569	5.0733	5.0680	5.0785	5.0785	5.0836	5.0886	5.0934	5.0981	5.0836	5.0934	5.0836	
util living area													
	0.9888	0.9817	0.9604	0.9056	0.7904	0.5819	0.4259	0.4366	0.6880	0.9041	0.9751	0.9910	(86)
MIT	20.0657	20.1847	20.4183	20.6856	20.8862	20.9809	20.9968	20.9964	20.9561	20.7407	20.3760	20.0422	(87)
Th 2	19.9674	19.9711	19.9699	19.9722	19.9722	19.9734	19.9745	19.9756	19.9767	19.9734	19.9756	19.9734	(88)
util rest of house													
	0.9852	0.9759	0.9477	0.8752	0.7270	0.4856	0.3157	0.3240	0.5954	0.8663	0.9658	0.9881	(89)
MIT 2	18.7571	18.9308	19.2617	19.6277	19.8730	19.9631	19.9736	19.9746	19.9484	19.7072	19.2108	18.7279	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8728	0.7380	0.5101	0.3444	0.3533	0.6177	0.8664	0.9603	0.9845	(94)
Useful gains	781.0489	846.9494	891.5588	873.2012	734.8632	511.7532	330.4325	329.9916	556.9109	726.5972	752.6646	738.5024	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1510.7613	1479.2067	1333.1606	1101.1008	808.2644	520.8645	331.4044	331.0790	580.4014	906.5856	1224.8111	1487.3895	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	542.9060	424.8769	328.5517	164.0877	54.6104	0.0000	0.0000	0.0000	0.0000	133.9113	339.9455	557.1720	(98)
Space heating												2546.0617	(98)
RHI space heating demand												2546	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3392	0.3325	0.3259	0.2926	0.2860	0.2527	0.2527	0.2461	0.2660	0.2860	0.2993	0.3126	(22b)
Effective ac	0.5575	0.5553	0.5531	0.5428	0.5409	0.5319	0.5319	0.5303	0.5354	0.5409	0.5448	0.5488	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3531	44.1754	44.0013	43.1833	43.0302	42.3178	42.3178	42.1859	42.5922	43.0302	43.3398	43.6635	(38)
Heat transfer coeff	107.8973	107.7196	107.5454	106.7275	106.5744	105.8620	105.8620	105.7301	106.1364	106.5744	106.8840	107.2077	(39)
Average = Sum(39)m / 12 =												106.7267	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1550	1.1532	1.1444	1.1428	1.1351	1.1351	1.1337	1.1381	1.1428	1.1461	1.1496	(40)
HLP (average)												1.1444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0237	60.1227	60.2200	60.6815	60.7687	61.1776	61.1776	61.2540	61.0195	60.7687	60.5927	60.4097	
alpha	5.0016	5.0082	5.0147	5.0454	5.0512	5.0785	5.0785	5.0836	5.0680	5.0512	5.0395	5.0273	
util living area													
	0.9922	0.9846	0.9685	0.9282	0.8373	0.6719	0.5026	0.5392	0.7625	0.9368	0.9845	0.9939	(86)
MIT	19.9480	20.1089	20.3357	20.6073	20.8322	20.9593	20.9923	20.9890	20.9216	20.6413	20.2406	19.9102	(87)
Th 2	19.9546	19.9561	19.9576	19.9647	19.9661	19.9722	19.9722	19.9734	19.9699	19.9661	19.9634	19.9606	(88)
util rest of house													
	0.9897	0.9798	0.9584	0.9044	0.7849	0.5809	0.3896	0.4251	0.6800	0.9108	0.9787	0.9919	(89)
MIT 2	18.5771	18.8106	19.1361	19.5185	19.8068	19.9460	19.9695	19.9691	19.9118	19.5727	19.0083	18.5267	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9317	19.1464	19.4463	19.8001	20.0720	20.2081	20.2340	20.2329	20.1730	19.8491	19.3270	18.8845	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9317	19.1464	19.4463	19.8001	20.0720	20.2081	20.2340	20.2329	20.1730	19.8491	19.3270	18.8845	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9748	0.9521	0.8999	0.7909	0.6029	0.4190	0.4547	0.6977	0.9073	0.9740	0.9891	(94)
Useful gains	751.4199	840.1909	884.1385	874.3171	779.0317	571.8523	381.9077	401.0044	598.9749	728.9320	724.2803	715.5014	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1578.7169	1534.6143	1392.3201	1163.3418	892.2444	593.6832	384.7040	405.2487	644.5642	985.7126	1306.8697	1574.2910	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.5090	466.6525	378.0871	208.0978	84.2303	0.0000	0.0000	0.0000	0.0000	191.0447	419.4644	638.9394	(98)
Space heating												3002.0252	(98)
Space heating per m2											(98) / (4) =	32.1898	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3217.6048	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	615.5090	466.6525	378.0871	208.0978	84.2303	0.0000	0.0000	0.0000	0.0000	191.0447	419.4644	638.9394	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	659.7096	500.1635	405.2380	223.0415	90.2790	0.0000	0.0000	0.0000	0.0000	204.7639	449.5867	684.8225	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4921	89.3975	89.2206	88.8380	88.0682	86.7000	86.7000	86.7000	86.7000	88.7303	89.3071	89.5334	(217)
Fuel for water heating, kWh/month													
	191.0905	167.6749	174.2452	153.7989	149.7876	132.6794	124.3201	140.7076	141.8108	159.8363	171.7496	185.3819	(219)
Water heating fuel used												1893.0828	(219)
Annual totals kWh/year													
Space heating fuel - main system												3217.6048	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												4897.5077	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.6048	3.4800	111.9726	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1893.0828	3.4800	65.8793	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			269.7335	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8194	(257)
SAP value		88.5696	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.6048	0.2160	695.0026	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.0828	0.2160	408.9059	(264)
Space and water heating			1103.9085	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total kg/year			993.2682	(272)
CO2 emissions per m2			10.6500	(273)
EI value			90.3734	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8828 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8828 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2793	0.2594	0.2660	0.2527	0.2527	0.2461	0.2394	0.2328	0.2261	0.2461	0.2328	0.2461	(22b)
Effective ac	0.5390	0.5336	0.5354	0.5319	0.5319	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8807	42.4533	42.5922	42.3178	42.3178	42.1859	42.0575	41.9326	41.8112	42.1859	41.9326	42.1859	(38)
Heat transfer coeff	106.4249	105.9975	106.1364	105.8620	105.8620	105.7301	105.6017	105.4768	105.3554	105.7301	105.4768	105.7301	(39)
Average = Sum(39)m / 12 =												105.7820	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1412	1.1366	1.1381	1.1351	1.1351	1.1337	1.1323	1.1310	1.1297	1.1337	1.1310	1.1337	(40)
HLP (average)												1.1343	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.8661	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8541	61.0995	61.0195	61.1776	61.1776	61.2540	61.3285	61.4011	61.4718	61.2540	61.4011	61.2540	
alpha	5.0569	5.0733	5.0680	5.0785	5.0785	5.0836	5.0886	5.0934	5.0981	5.0836	5.0934	5.0836	
util living area													
	0.9888	0.9817	0.9604	0.9056	0.7904	0.5819	0.4259	0.4366	0.6880	0.9041	0.9751	0.9910	(86)
MIT	20.0657	20.1847	20.4183	20.6856	20.8862	20.9809	20.9968	20.9964	20.9561	20.7407	20.3760	20.0422	(87)
Th 2	19.9674	19.9711	19.9699	19.9722	19.9722	19.9734	19.9745	19.9756	19.9767	19.9734	19.9756	19.9734	(88)
util rest of house													
	0.9852	0.9759	0.9477	0.8752	0.7270	0.4856	0.3157	0.3240	0.5954	0.8663	0.9658	0.9881	(89)
MIT 2	18.7571	18.9308	19.2617	19.6277	19.8730	19.9631	19.9736	19.9746	19.9484	19.7072	19.2108	18.7279	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8728	0.7380	0.5101	0.3444	0.3533	0.6177	0.8664	0.9603	0.9845	(94)
Useful gains	781.0489	846.9494	891.5588	873.2012	734.8632	511.7532	330.4325	329.9916	556.9109	726.5972	752.6646	738.5024	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1510.7613	1479.2067	1333.1606	1101.1008	808.2644	520.8645	331.4044	331.0790	580.4014	906.5856	1224.8111	1487.3895	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	542.9060	424.8769	328.5517	164.0877	54.6104	0.0000	0.0000	0.0000	0.0000	133.9113	339.9455	557.1720	(98)
Space heating												2546.0617	(98)
Space heating per m2											(98) / (4) =	27.3007	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2728.8978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	542.9060	424.8769	328.5517	164.0877	54.6104	0.0000	0.0000	0.0000	0.0000	133.9113	339.9455	557.1720	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	581.8929	455.3879	352.1455	175.8711	58.5321	0.0000	0.0000	0.0000	0.0000	143.5277	364.3574	597.1833	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4107	89.3326	89.1115	88.6280	87.7239	86.7000	86.7000	86.7000	86.7000	88.4118	89.1491	89.4475	(217)
Fuel for water heating, kWh/month													
	191.2644	167.7967	174.4584	154.1633	150.3755	132.6794	124.3201	140.7076	141.8108	160.4121	172.0540	185.5599	(219)
Water heating fuel used												1895.6021	(219)
Annual totals kWh/year													
Space heating fuel - main system												2728.8978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												4327.9701	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2728.8978	7.3800	201.3927	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1895.6021	7.3800	139.8954	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			363.3026	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2728.8978	0.2160	589.4419	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.6021	0.2160	409.4500	(264)
Space and water heating			998.8920	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			844.9930	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2728.8978	1.2200	3329.2553	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1895.6021	1.2200	2312.6345	(264)
Space and water heating			5641.8899	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			4731.5433	(272)
Primary energy kWh/m2/year			50.7350	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-191 kg (22.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 90	A 92
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£448	£374	£74
Space heating	£330	£330	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£363	£304	£60
Total cost of uses	£364	£304	£60
Delivered energy	46 kWh/m²	36 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	39 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3392	0.3325	0.3259	0.2926	0.2860	0.2527	0.2527	0.2461	0.2660	0.2860	0.2993	0.3126	(22b)
Effective ac	0.5575	0.5553	0.5531	0.5428	0.5409	0.5319	0.5319	0.5303	0.5354	0.5409	0.5448	0.5488	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.3531	44.1754	44.0013	43.1833	43.0302	42.3178	42.3178	42.1859	42.5922	43.0302	43.3398	43.6635	(38)
Heat transfer coeff	107.8973	107.7196	107.5454	106.7275	106.5744	105.8620	105.8620	105.7301	106.1364	106.5744	106.8840	107.2077	(39)
Average = Sum(39)m / 12 =												106.7267	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1550	1.1532	1.1444	1.1428	1.1351	1.1351	1.1337	1.1381	1.1428	1.1461	1.1496	(40)
HLP (average)												1.1444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547 (61)
Total heat required for water heating calculated for each month												
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1815 (H8)
Utilisation factor												0.5710 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-862.7264 (H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435 (64)
								Total per year (kWh/year) = Sum(64)m =				818.2658 (64)
Heat gains from water heating, kWh/month												
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	10.6334	0.7200	0.7000	0.7700	15.1900	(74)
East	1.5300	19.6403	0.7200	0.7000	0.7700	10.4955	(76)
South	7.7900	46.7521	0.7200	0.7000	0.7700	127.2044	(78)

Solar gains	152.8899	257.8883	348.5124	428.4744	479.7128	476.9087	459.4582	420.6283	375.8458	283.6187	182.6061	131.2104	(83)
Total gains	761.8569	861.8811	928.5989	971.6145	984.9815	948.4963	911.5829	881.8157	858.5087	803.4508	743.6173	723.4171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0237	60.1227	60.2200	60.6815	60.7687	61.1776	61.1776	61.2540	61.0195	60.7687	60.5927	60.4097	
alpha	5.0016	5.0082	5.0147	5.0454	5.0512	5.0785	5.0785	5.0836	5.0680	5.0512	5.0395	5.0273	
util living area													
	0.9922	0.9846	0.9685	0.9282	0.8373	0.6719	0.5026	0.5392	0.7625	0.9368	0.9845	0.9939	(86)
MIT	19.9480	20.1089	20.3357	20.6073	20.8322	20.9593	20.9923	20.9890	20.9216	20.6413	20.2406	19.9102	(87)
Th 2	19.9546	19.9561	19.9576	19.9647	19.9661	19.9722	19.9722	19.9734	19.9699	19.9661	19.9634	19.9606	(88)
util rest of house													
	0.9897	0.9798	0.9584	0.9044	0.7849	0.5809	0.3896	0.4251	0.6800	0.9108	0.9787	0.9919	(89)
MIT 2	18.5771	18.8106	19.1361	19.5185	19.8068	19.9460	19.9695	19.9691	19.9118	19.5727	19.0083	18.5267	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.9317	19.1464	19.4463	19.8001	20.0720	20.2081	20.2340	20.2329	20.1730	19.8491	19.3270	18.8845	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9317	19.1464	19.4463	19.8001	20.0720	20.2081	20.2340	20.2329	20.1730	19.8491	19.3270	18.8845	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9748	0.9521	0.8999	0.7909	0.6029	0.4190	0.4547	0.6977	0.9073	0.9740	0.9891	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	751.4199	840.1909	884.1385	874.3171	779.0317	571.8523	381.9077	401.0044	598.9749	728.9320	724.2803	715.5014	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1578.7169	1534.6143	1392.3201	1163.3418	892.2444	593.6832	384.7040	405.2487	644.5642	985.7126	1306.8697	1574.2910	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	615.5090	466.6525	378.0871	208.0978	84.2303	0.0000	0.0000	0.0000	0.0000	191.0447	419.4644	638.9394	(98)
Space heating												3002.0252	(98)
Space heating per m2											(98) / (4) =	32.1898	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3217.6048	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	615.5090	466.6525	378.0871	208.0978	84.2303	0.0000	0.0000	0.0000	0.0000	191.0447	419.4644	638.9394	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	659.7096	500.1635	405.2380	223.0415	90.2790	0.0000	0.0000	0.0000	0.0000	204.7639	449.5867	684.8225	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9935	108.1504	84.3631	41.3445	14.1958	0.0000	0.0000	22.2098	44.7993	88.4555	123.7104	145.0435	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5868	89.6000	89.6211	89.6828	89.7624	86.7000	86.7000	86.7000	86.7000	89.1288	89.4540	89.6116	(217)
Fuel for water heating, kWh/month	162.9631	120.7036	94.1330	46.1008	15.8148	0.0000	0.0000	25.6169	51.6716	99.2446	138.2949	161.8579	(219)
Water heating fuel used												916.4013	(219)
Annual totals kWh/year													
Space heating fuel - main system												3217.6048	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												3970.8262	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3217.6048	3.4800	111.9726	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	916.4013	3.4800	31.8908	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			242.3400	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7362	(257)
SAP value		89.7304	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3217.6048	0.2160	695.0026	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	916.4013	0.2160	197.9427	(264)
Space and water heating			892.9453	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			808.2549 (272)
CO2 emissions per m2			8.6700 (273)
EI value			92.1665
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.7700	
Infiltration rate		0.3129	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2660	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2793	0.2594	0.2660	0.2527	0.2527	0.2461	0.2394	0.2328	0.2261	0.2461	0.2328	0.2461	(22b)
Effective ac	0.5390	0.5336	0.5354	0.5319	0.5319	0.5303	0.5287	0.5271	0.5256	0.5303	0.5271	0.5303	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8807	42.4533	42.5922	42.3178	42.3178	42.1859	42.0575	41.9326	41.8112	42.1859	41.9326	42.1859	(38)
Heat transfer coeff	106.4249	105.9975	106.1364	105.8620	105.8620	105.7301	105.6017	105.4768	105.3554	105.7301	105.4768	105.7301	(39)
Average = Sum(39)m / 12 =												105.7820	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1412	1.1366	1.1381	1.1351	1.1351	1.1337	1.1323	1.1310	1.1297	1.1337	1.1310	1.1337	(40)
HLP (average)												1.1343	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8653	10.7075	11.8312	11.4105	11.7625	11.3503	11.7082	11.7434	11.3831	11.8028	11.4571	11.8547	(61)
Total heat required for water heating calculated for each month													
	171.0109	149.8972	155.4626	136.6318	131.9153	115.0330	107.7855	121.9935	122.9499	141.8232	153.3846	165.9787	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3223	(H8)
Utilisation factor												0.5306	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-897.1283	(H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656	(63)
								Solar input (sum of months) = Sum(63)m =				-897.1283	(63)
Output from w/h													
	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
								Total per year (kWh/year) = Sum(64)m =				793.5279	(64)
Heat gains from water heating, kWh/month													
	55.8822	48.9575	50.7152	44.4887	42.8914	37.3121	34.8728	39.5940	39.9417	46.1825	50.0552	54.2099	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.1105	72.8534	68.1656	61.7899	57.6498	51.8223	46.8720	53.2178	55.4747	62.0732	69.5211	72.8628	(72)
Total internal gains													
	608.9670	603.9928	580.0864	543.1400	505.2687	471.5876	452.1246	461.1874	482.6630	519.8322	561.0113	592.2066	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0900	13.4839	0.7200	0.7000	0.7700	19.2620	(74)
East	1.5300	25.1925	0.7200	0.7000	0.7700	13.4625	(76)
South	7.7900	56.7559	0.7200	0.7000	0.7700	154.4230	(78)

Solar gains	187.1476	268.5866	366.8954	457.3503	490.5373	531.6808	507.4087	472.8488	418.9691	318.8530	222.7444	157.9335	(83)
Total gains	796.1146	872.5794	946.9819	1000.4904	995.8060	1003.2684	959.5333	934.0362	901.6321	838.6851	783.7557	750.1402	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8541	61.0995	61.0195	61.1776	61.1776	61.2540	61.3285	61.4011	61.4718	61.2540	61.4011	61.2540	
alpha	5.0569	5.0733	5.0680	5.0785	5.0785	5.0836	5.0886	5.0934	5.0981	5.0836	5.0934	5.0836	
util living area													
	0.9888	0.9817	0.9604	0.9056	0.7904	0.5819	0.4259	0.4366	0.6880	0.9041	0.9751	0.9910	(86)
MIT	20.0657	20.1847	20.4183	20.6856	20.8862	20.9809	20.9968	20.9964	20.9561	20.7407	20.3760	20.0422	(87)
Th 2	19.9674	19.9711	19.9699	19.9722	19.9722	19.9734	19.9745	19.9756	19.9767	19.9734	19.9756	19.9734	(88)
util rest of house													
	0.9852	0.9759	0.9477	0.8752	0.7270	0.4856	0.3157	0.3240	0.5954	0.8663	0.9658	0.9881	(89)
MIT 2	18.7571	18.9308	19.2617	19.6277	19.8730	19.9631	19.9736	19.9746	19.9484	19.7072	19.2108	18.7279	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0956	19.2551	19.5608	19.9013	20.1351	20.2264	20.2382	20.2389	20.2090	19.9745	19.5121	19.0678	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9706	0.9415	0.8728	0.7380	0.5101	0.3444	0.3533	0.6177	0.8664	0.9603	0.9845	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	781.0489	846.9494	891.5588	873.2012	734.8632	511.7532	330.4325	329.9916	556.9109	726.5972	752.6646	738.5024	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1510.7613	1479.2067	1333.1606	1101.1008	808.2644	520.8645	331.4044	331.0790	580.4014	906.5856	1224.8111	1487.3895	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	542.9060	424.8769	328.5517	164.0877	54.6104	0.0000	0.0000	0.0000	0.0000	133.9113	339.9455	557.1720	(98)
Space heating												2546.0617	(98)
Space heating per m2											(98) / (4) =	27.3007	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2728.8978	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	542.9060	424.8769	328.5517	164.0877	54.6104	0.0000	0.0000	0.0000	0.0000	133.9113	339.9455	557.1720	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	581.8929	455.3879	352.1455	175.8711	58.5321	0.0000	0.0000	0.0000	0.0000	143.5277	364.3574	597.1833	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.7444	108.2821	83.9362	40.1262	18.5636	0.0000	0.0000	15.9045	39.8896	84.3981	118.7700	141.9132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5304	89.5449	89.5434	89.5692	89.3587	86.7000	86.7000	86.7000	86.7000	88.8734	89.3395	89.5452	(217)
Fuel for water heating, kWh/month	158.3199	120.9250	93.7380	44.7991	20.7743	0.0000	0.0000	18.3443	46.0088	94.9644	132.9423	158.4821	(219)
Water heating fuel used												889.2982	(219)
Annual totals kWh/year													
Space heating fuel - main system												2728.8978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												3371.6662	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2728.8978	7.3800	201.3927	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	889.2982	7.3800	65.6302	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-782.8819	28.6600	-224.3739	(252)
Total energy cost			303.3674	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2728.8978	0.2160	589.4419	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2982	0.2160	192.0884	(264)
Space and water heating			781.5303	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	0.5190	-406.3157	(269)
Total kg/year			653.5814	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2728.8978	1.2200	3329.2553	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	889.2982	1.2200	1084.9438	(264)
Space and water heating			4414.1991	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-782.8819	3.0700	-2403.4473	(269)
Primary energy kWh/year			3657.3526	(272)
Primary energy kWh/m2/year			39.2167	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0900	87.1704	0.7200	0.7000	0.7650	123.7163
East	1.5300	125.2818	0.7200	0.7000	0.7650	66.5141
South	7.7900	118.5567	0.7200	0.7000	0.7650	320.4778
total:						510.7082

	Jun	Jul	Aug	
Solar gains	544	511	474	(P3)
Internal gains	469	449	458	
Total summer gains	1013	960	932	(P5)
Summer gain/loss ratio	1.45	1.37	1.33	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.10	18.92	18.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 421 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 421	**Prop Type Ref**	
Property	15 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	12.50	**TER**	17.41
Environmental	90 B	**% DER<TER**	28.18		
CO_2 Emissions (t/year)	0.84	**DFEE**	44.55	**TFEE**	49.88
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.41	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.50	$kgCO_2/m^2$	Pass
	-4.91 (-28.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.88	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.55	$kWh/m^2/yr$	
	-5.4 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.77 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	4.09 m², No overhang 1.53 m², No overhang 7.79 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.77 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 422 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 422	**Prop Type Ref**	
Property	16 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.06	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.04	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.33		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.39 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9968	0.9920	0.9801	0.9471	0.8662	0.7111	0.5424	0.5870	0.8146	0.9622	0.9930	0.9977	(86)
MIT	19.6953	19.8891	20.1616	20.4915	20.7704	20.9375	20.9863	20.9802	20.8753	20.5067	20.0322	19.6582	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9276	0.8169	0.6155	0.4156	0.4594	0.7342	0.9442	0.9902	0.9969	(89)
MIT 2	18.1606	18.4439	18.8388	19.3109	19.6778	19.8674	19.9036	19.9021	19.8091	19.3418	18.6605	18.1121	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5460	18.8068	19.1710	19.6074	19.9521	20.1361	20.1755	20.1728	20.0769	19.6343	19.0050	18.5003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5460	18.8068	19.1710	19.6074	19.9521	20.1361	20.1755	20.1728	20.0769	19.6343	19.0050	18.5003	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9212	0.8196	0.6369	0.4477	0.4915	0.7484	0.9386	0.9869	0.9954	(94)
Useful gains	532.0561	635.2714	704.7391	730.9512	677.2538	510.7743	344.4953	360.7809	521.2454	580.8642	529.4809	498.8387	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.4100	1386.6409	1260.8435	1055.2448	811.8051	540.0196	348.7698	367.4406	584.9251	888.7487	1175.4441	1417.3467	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	663.1673	504.9203	413.7417	233.4914	100.1061	0.0000	0.0000	0.0000	0.0000	229.0661	465.0935	683.3700	(98)
Space heating												3292.9563	(98)
Space heating per m2											(98) / (4) =	40.9980	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3529.4280	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	663.1673	504.9203	413.7417	233.4914	100.1061	0.0000	0.0000	0.0000	0.0000	229.0661	465.0935	683.3700	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	710.7903	541.1793	443.4530	250.2587	107.2949	0.0000	0.0000	0.0000	0.0000	245.5156	498.4925	732.4437	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5652	89.4794	89.3205	88.9751	88.2573	86.7000	86.7000	86.7000	86.7000	88.9276	89.4107	89.5995	(217)
Fuel for water heating, kWh/month													
	182.3144	159.9702	166.2338	146.7219	142.8513	126.8692	118.9361	134.5284	135.5568	152.3747	163.8448	176.9002	(219)
Water heating fuel used												1807.1018	(219)
Annual totals kWh/year													
Space heating fuel - main system												3529.4280	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5136.7542	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3529.4280	0.2160	762.3565	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1018	0.2160	390.3340	(264)
Space and water heating			1152.6904	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1049.0069	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0600	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5183	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5183	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8770	0.7259	0.5563	0.6037	0.8297	0.9678	0.9945	0.9982	(86)
MIT	19.6597	19.8552	20.1312	20.4674	20.7550	20.9317	20.9848	20.9777	20.8639	20.4807	19.9993	19.6233	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9352	0.8299	0.6306	0.4272	0.4739	0.7518	0.9521	0.9922	0.9976	(89)
MIT 2	18.6723	18.8682	19.1425	19.4753	19.7365	19.8774	19.9047	19.9038	19.8324	19.4950	19.0202	18.6423	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9202	19.1161	19.3908	19.7244	19.9922	20.1421	20.1759	20.1735	20.0914	19.7425	19.2661	18.8886	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9202	19.1161	19.3908	19.7244	19.9922	20.1421	20.1759	20.1735	20.0914	19.7425	19.2661	18.8886	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9734	0.9317	0.8345	0.6527	0.4600	0.5068	0.7669	0.9492	0.9905	0.9968	(94)
Useful gains	501.7871	607.2619	681.0794	714.3349	668.3826	508.1456	344.0163	359.9248	515.2144	561.8793	502.1793	469.0401	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1460.8004	1417.4755	1282.7179	1066.7852	815.7494	540.6074	348.8148	367.5069	586.3507	899.3929	1201.2246	1455.8309	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.5060	544.4635	447.6191	253.7642	109.6409	0.0000	0.0000	0.0000	0.0000	251.1101	503.3126	734.1724	(98)
Space heating												3557.5888	(98)
Space heating per m2											(98) / (4) =	44.2927	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.9221	721.8323	740.1730	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8626	0.9234	0.9052	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.9330	666.5480	669.9743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.1490	221.6750	187.5656	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												561.3896 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0373	55.4187	46.8914	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												140.3474 (107)
Space cooling per m2												1.7474 (108)
Energy for space heating												44.2927 (99)
Energy for space cooling												1.7474 (108)
Total												46.0400 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9849	0.9748	0.9463	0.8776	0.7499	0.5411	0.3945	0.4057	0.6490	0.8809	0.9671	0.9878	(86)
MIT	20.0299	20.1674	20.4218	20.7009	20.8953	20.9826	20.9969	20.9965	20.9591	20.7460	20.3634	20.0044	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6810	0.4445	0.2859	0.2944	0.5533	0.8365	0.9550	0.9839	(89)
MIT 2	18.6573	18.8572	19.2138	19.5895	19.8205	19.9010	19.9107	19.9120	19.8890	19.6567	19.1440	18.6268	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9226	0.8394	0.6934	0.4684	0.3133	0.3225	0.5759	0.8375	0.9484	0.9792	(94)
Useful gains	732.8090	801.2611	847.5920	825.3738	682.8902	467.5296	299.0673	298.6094	510.6648	679.9941	707.7237	691.0124	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.8263	1356.7218	1224.9879	1011.4045	740.4051	474.5473	299.8394	299.4793	529.1533	830.7711	1121.4828	1360.8244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.1009	373.2696	280.7825	133.9421	42.7911	0.0000	0.0000	0.0000	0.0000	112.1781	297.9066	498.3401	(98)
Space heating												2224.3110	(98)
RHI space heating demand												2224	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9894	0.9789	0.9571	0.9053	0.8004	0.6299	0.4680	0.5044	0.7266	0.9198	0.9794	0.9917	(86)
MIT	19.8958	20.0798	20.3297	20.6191	20.8434	20.9627	20.9927	20.9895	20.9254	20.6413	20.2125	19.8561	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8757	0.7414	0.5364	0.3556	0.3901	0.6386	0.8881	0.9718	0.9890	(89)
MIT 2	18.4512	18.7172	19.0732	19.4762	19.7566	19.8854	19.9060	19.9061	19.8523	19.5163	18.9182	18.3996	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8140	19.0594	19.3887	19.7632	20.0295	20.1559	20.1789	20.1781	20.1218	19.7988	19.2432	18.7653	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8140	19.0594	19.3887	19.7632	20.0295	20.1559	20.1789	20.1781	20.1218	19.7988	19.2432	18.7653	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8714	0.7491	0.5586	0.3839	0.4189	0.6574	0.8846	0.9658	0.9852	(94)
Useful gains	702.4741	794.6482	841.4375	829.8386	729.1337	525.0407	346.8854	364.5801	552.5941	684.9718	679.6684	667.4631	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1450.1808	1411.8200	1282.5090	1070.6004	819.4180	541.9521	349.0996	367.9584	589.3194	904.9355	1198.9664	1443.6108	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	556.2938	414.7395	328.1572	173.3485	67.1715	0.0000	0.0000	0.0000	0.0000	163.6530	373.8946	577.4539	(98)
Space heating												2654.7120	(98)
Space heating per m2											(98) / (4) =	33.0517	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2845.3505	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	556.2938	414.7395	328.1572	173.3485	67.1715	0.0000	0.0000	0.0000	0.0000	163.6530	373.8946	577.4539	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	596.2420	444.5225	351.7226	185.7968	71.9952	0.0000	0.0000	0.0000	0.0000	175.4052	400.7445	618.9217	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4571	89.3481	89.1469	88.7175	87.9183	86.7000	86.7000	86.7000	86.7000	88.6330	89.2567	89.4996	(217)
Fuel for water heating, kWh/month													
	182.5348	160.2052	166.5576	147.1479	143.4021	126.8692	118.9361	134.5284	135.5568	152.8811	164.1276	177.0977	(219)
Water heating fuel used												1809.8443	(219)
Annual totals kWh/year													
Space heating fuel - main system												2845.3505	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4455.4192	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2845.3505	3.4800	99.0182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8443	3.4800	62.9826	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.6504	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8568	(257)
SAP value		88.0478	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2845.3505	0.2160	614.5957	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8443	0.2160	390.9264	(264)
Space and water heating			1005.5221	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			901.8385	(272)
CO2 emissions per m2			11.2300	(273)
EI value			90.3570	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9849	0.9748	0.9463	0.8776	0.7499	0.5411	0.3945	0.4057	0.6490	0.8809	0.9671	0.9878	(86)
MIT	20.0299	20.1674	20.4218	20.7009	20.8953	20.9826	20.9969	20.9965	20.9591	20.7460	20.3634	20.0044	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6810	0.4445	0.2859	0.2944	0.5533	0.8365	0.9550	0.9839	(89)
MIT 2	18.6573	18.8572	19.2138	19.5895	19.8205	19.9010	19.9107	19.9120	19.8890	19.6567	19.1440	18.6268	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9226	0.8394	0.6934	0.4684	0.3133	0.3225	0.5759	0.8375	0.9484	0.9792	(94)
Useful gains	732.8090	801.2611	847.5920	825.3738	682.8902	467.5296	299.0673	298.6094	510.6648	679.9941	707.7237	691.0124	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1384.8263	1356.7218	1224.9879	1011.4045	740.4051	474.5473	299.8394	299.4793	529.1533	830.7711	1121.4828	1360.8244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.1009	373.2696	280.7825	133.9421	42.7911	0.0000	0.0000	0.0000	0.0000	112.1781	297.9066	498.3401	(98)
Space heating												2224.3110	(98)
Space heating per m2											(98) / (4) =	27.6931	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2384.0418	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.1009	373.2696	280.7825	133.9421	42.7911	0.0000	0.0000	0.0000	0.0000	112.1781	297.9066	498.3401	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	519.9366	400.0746	300.9459	143.5607	45.8640	0.0000	0.0000	0.0000	0.0000	120.2338	319.2996	534.1266	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3655	89.2725	89.0214	88.4865	87.5848	86.7000	86.7000	86.7000	86.7000	88.2943	89.0807	89.4042	(217)
Fuel for water heating, kWh/month													
	182.7219	160.3408	166.7923	147.5321	143.9481	126.8692	118.9361	134.5284	135.5568	153.4676	164.4518	177.2868	(219)
Water heating fuel used												1812.4319	(219)
Annual totals kWh/year													
Space heating fuel - main system												2384.0418	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3921.5803	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2384.0418	7.3800	175.9423	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4319	7.3800	133.7575	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			337.9153	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2384.0418	0.2160	514.9530	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4319	0.2160	391.4853	(264)
Space and water heating			906.4383	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			763.7686	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2384.0418	1.2200	2908.5310	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4319	1.2200	2211.1669	(264)
Space and water heating			5119.6980	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4275.7751	(272)
Primary energy kWh/m2/year			53.2343	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£344	£72
Space heating	£304	£304	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£280	£58
Total cost of uses	£338	£280	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.3900	
Infiltration rate		0.3640	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3945	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3481	0.3635	(22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.5894	39.3824	39.1795	38.2265	38.0482	37.2181	37.2181	37.0644	37.5378	38.0482	38.4089	38.7860	(38)
Heat transfer coeff	99.9163	99.7093	99.5064	98.5533	98.3750	97.5449	97.5449	97.3912	97.8646	98.3750	98.7357	99.1128	(39)
Average = Sum(39)m / 12 =												98.5524	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2440	1.2414	1.2389	1.2270	1.2248	1.2145	1.2145	1.2125	1.2184	1.2248	1.2293	1.2340	(40)
HLP (average)												1.2270	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8245	55.9404	56.0545	56.5966	56.6991	57.1816	57.1816	57.2719	56.9948	56.6991	56.4920	56.2770	
alpha	4.7216	4.7294	4.7370	4.7731	4.7799	4.8121	4.8121	4.8181	4.7997	4.7799	4.7661	4.7518	
util living area													
	0.9894	0.9789	0.9571	0.9053	0.8004	0.6299	0.4680	0.5044	0.7266	0.9198	0.9794	0.9917	(86)
MIT	19.8958	20.0798	20.3297	20.6191	20.8434	20.9627	20.9927	20.9895	20.9254	20.6413	20.2125	19.8561	(87)
Th 2	19.8850	19.8870	19.8890	19.8985	19.9002	19.9085	19.9085	19.9100	19.9053	19.9002	19.8966	19.8929	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8757	0.7414	0.5364	0.3556	0.3901	0.6386	0.8881	0.9718	0.9890	(89)
MIT 2	18.4512	18.7172	19.0732	19.4762	19.7566	19.8854	19.9060	19.9061	19.8523	19.5163	18.9182	18.3996	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8140	19.0594	19.3887	19.7632	20.0295	20.1559	20.1789	20.1781	20.1218	19.7988	19.2432	18.7653	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8140	19.0594	19.3887	19.7632	20.0295	20.1559	20.1789	20.1781	20.1218	19.7988	19.2432	18.7653	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8714	0.7491	0.5586	0.3839	0.4189	0.6574	0.8846	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4741	794.6482	841.4375	829.8386	729.1337	525.0407	346.8854	364.5801	552.5941	684.9718	679.6684	667.4631	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1450.1808	1411.8200	1282.5090	1070.6004	819.4180	541.9521	349.0996	367.9584	589.3194	904.9355	1198.9664	1443.6108	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	556.2938	414.7395	328.1572	173.3485	67.1715	0.0000	0.0000	0.0000	0.0000	163.6530	373.8946	577.4539	(98)

Space heating 2654.7120 (98)
Space heating per m2 (98) / (4) = 33.0517 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 93.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2845.3505 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.2938	414.7395	328.1572	173.3485	67.1715	0.0000	0.0000	0.0000	0.0000	163.6530	373.8946	577.4539	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	596.2420	444.5225	351.7226	185.7968	71.9952	0.0000	0.0000	0.0000	0.0000	175.4052	400.7445	618.9217	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5574	89.5643	89.5791	89.6411	89.7811	86.7000	86.7000	86.7000	86.7000	89.0530	89.4125	89.5825	(217)
Fuel for water heating, kWh/month	154.9901	114.1991	88.0718	41.5944	12.0977	0.0000	0.0000	21.8860	47.3352	93.5069	131.3595	154.0613	(219)

Water heating fuel used 859.1021 (219)
Annual totals kWh/year
Space heating fuel - main system 2845.3505 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) = -630.4424 -630.4424 (233)
Total delivered energy for all uses 3554.6769 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2845.3505	3.4800	99.0182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.1021	3.4800	29.8968	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.1595	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7680 (257)
SAP value 89.2863
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2845.3505	0.2160	614.5957	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.1021	0.2160	185.5660	(264)
Space and water heating			800.1618	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			722.4282 (272)
CO2 emissions per m2			8.9900 (273)
EI value			92.2753
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.3900	
Infiltration rate			0.3640	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3094	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3249	0.3017	0.3094	0.2939	0.2939	0.2862	0.2785	0.2707	0.2630	0.2862	0.2707	0.2862	(22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5366	0.5346	0.5410	0.5366	0.5410	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8739	37.3759	37.5378	37.2181	37.2181	37.0644	36.9147	36.7692	36.6278	37.0644	36.7692	37.0644	(38)
Heat transfer coeff	98.2008	97.7027	97.8646	97.5449	97.5449	97.3912	97.2416	97.0960	96.9546	97.3912	97.0960	97.3912	(39)
Average = Sum(39)m / 12 =												97.4517	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2226	1.2164	1.2184	1.2145	1.2145	1.2125	1.2107	1.2089	1.2071	1.2125	1.2089	1.2125	(40)
HLP (average)												1.2133	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7997	57.0893	56.9948	57.1816	57.1816	57.2719	57.3600	57.4460	57.5298	57.2719	57.4460	57.2719	
alpha	4.7866	4.8060	4.7997	4.8121	4.8121	4.8181	4.8240	4.8297	4.8353	4.8181	4.8297	4.8181	
util living area													
	0.9849	0.9748	0.9463	0.8776	0.7499	0.5411	0.3945	0.4057	0.6490	0.8809	0.9671	0.9878	(86)
MIT	20.0299	20.1674	20.4218	20.7009	20.8953	20.9826	20.9969	20.9965	20.9591	20.7460	20.3634	20.0044	(87)
Th 2	19.9019	19.9069	19.9053	19.9085	19.9085	19.9100	19.9115	19.9129	19.9143	19.9100	19.9129	19.9100	(88)
util rest of house													
	0.9800	0.9671	0.9297	0.8409	0.6810	0.4445	0.2859	0.2944	0.5533	0.8365	0.9550	0.9839	(89)
MIT 2	18.6573	18.8572	19.2138	19.5895	19.8205	19.9010	19.9107	19.9120	19.8890	19.6567	19.1440	18.6268	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0020	19.1862	19.5172	19.8686	20.0904	20.1726	20.1834	20.1844	20.1577	19.9302	19.4502	18.9728	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9604	0.9226	0.8394	0.6934	0.4684	0.3133	0.3225	0.5759	0.8375	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8090	801.2611	847.5920	825.3738	682.8902	467.5296	299.0673	298.6094	510.6648	679.9941	707.7237	691.0124 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1384.8263	1356.7218	1224.9879	1011.4045	740.4051	474.5473	299.8394	299.4793	529.1533	830.7711	1121.4828	1360.8244 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	485.1009	373.2696	280.7825	133.9421	42.7911	0.0000	0.0000	0.0000	0.0000	112.1781	297.9066	498.3401 (98)
Space heating												2224.3110 (98)
Space heating per m2											(98) / (4) =	27.6931 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2384.0418 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.1009	373.2696	280.7825	133.9421	42.7911	0.0000	0.0000	0.0000	0.0000	112.1781	297.9066	498.3401	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	519.9366	400.0746	300.9459	143.5607	45.8640	0.0000	0.0000	0.0000	0.0000	120.2338	319.2996	534.1266	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4925	89.4995	89.4874	89.5084	89.3224	86.7000	86.7000	86.7000	86.7000	88.7724	89.2827	89.5079	(217)
Fuel for water heating, kWh/month													
	150.5075	114.4996	87.8221	40.4952	17.1474	0.0000	0.0000	14.9625	41.9449	89.4319	126.1965	150.8095	(219)
Water heating fuel used												833.8171	(219)
Annual totals kWh/year													
Space heating fuel - main system												2384.0418	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2992.9655	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2384.0418	7.3800	175.9423	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8171	7.3800	61.5357	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			280.0235	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2384.0418	0.2160	514.9530	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8171	0.2160	180.1045	(264)
Space and water heating			695.0575	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			578.3378	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2384.0418	1.2200	2908.5310	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8171	1.2200	1017.2569	(264)
Space and water heating			3925.7880	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3235.3651	(272)
Primary energy kWh/m2/year			40.2809	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 422 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 422	**Prop Type Ref**	
Property	16 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.06	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.47		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.04	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.33		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.06	$kgCO_2/m^2$	Pass
	-5.20 (-28.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.04	$kWh/m^2/yr$	
	-5.3 (-10.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	3.61 m², No overhang 7.97 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.39 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 423 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 423	**Prop Type Ref**	
Property	17 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.08	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.37		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.13	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.08 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.49 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9968	0.9920	0.9802	0.9472	0.8665	0.7114	0.5427	0.5873	0.8148	0.9623	0.9930	0.9977	(86)
MIT	19.6929	19.8868	20.1596	20.4902	20.7695	20.9373	20.9862	20.9801	20.8748	20.5056	20.0306	19.6562	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9277	0.8172	0.6158	0.4159	0.4596	0.7345	0.9443	0.9902	0.9969	(89)
MIT 2	18.1561	18.4397	18.8350	19.3082	19.6759	19.8664	19.9027	19.9013	19.8079	19.3395	18.6574	18.1082	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5420	18.8031	19.1676	19.6050	19.9505	20.1353	20.1748	20.1722	20.0758	19.6323	19.0022	18.4969	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5420	18.8031	19.1676	19.6050	19.9505	20.1353	20.1748	20.1722	20.0758	19.6323	19.0022	18.4969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9213	0.8198	0.6372	0.4479	0.4918	0.7487	0.9386	0.9869	0.9954	(94)
Useful gains	532.0546	635.2752	704.7646	731.0335	677.4587	511.0179	344.6995	360.9771	521.4370	580.9069	529.4827	498.8373	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1425.1123	1388.2355	1262.2335	1056.1925	812.5115	540.3935	348.9992	367.6718	585.3626	889.4993	1176.5417	1418.8007	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	664.4349	505.9893	414.7569	234.1145	100.4793	0.0000	0.0000	0.0000	0.0000	229.5927	465.8825	684.4528	(98)
Space heating												3299.7028	(98)
Space heating per m2											(98) / (4) =	41.0820	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3536.6590	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	664.4349	505.9893	414.7569	234.1145	100.4793	0.0000	0.0000	0.0000	0.0000	229.5927	465.8825	684.4528	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	712.1489	542.3250	444.5411	250.9266	107.6948	0.0000	0.0000	0.0000	0.0000	246.0801	499.3382	733.6043	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5663	89.4807	89.3223	88.9774	88.2606	86.7000	86.7000	86.7000	86.7000	88.9295	89.4119	89.6004	(217)
Fuel for water heating, kWh/month													
	182.3122	159.9678	166.2306	146.7182	142.8460	126.8692	118.9361	134.5284	135.5568	152.3713	163.8427	176.8984	(219)
Water heating fuel used												1807.0777	(219)
Annual totals kWh/year													
Space heating fuel - main system												3536.6590	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5143.9611	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3536.6590	0.2160	763.9183	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0777	0.2160	390.3288	(264)
Space and water heating			1154.2471	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1050.5636	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0800	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5383	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5383	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss	(33) + (36) = 60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9975	0.9934	0.9831	0.9531	0.8773	0.7263	0.5567	0.6040	0.8300	0.9679	0.9945	0.9982	(86)
MIT	19.6573	19.8529	20.1292	20.4661	20.7541	20.9314	20.9847	20.9776	20.8634	20.4796	19.9977	19.6213	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9353	0.8302	0.6309	0.4274	0.4741	0.7521	0.9521	0.9923	0.9976	(89)
MIT 2	18.6688	18.8649	19.1395	19.4732	19.7348	19.8764	19.9039	19.9030	19.8313	19.4931	19.0177	18.6393	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9170	19.1130	19.3880	19.7225	19.9908	20.1414	20.1753	20.1729	20.0904	19.7408	19.2638	18.8859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9170	19.1130	19.3880	19.7225	19.9908	20.1414	20.1753	20.1729	20.0904	19.7408	19.2638	18.8859	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8347	0.6530	0.4603	0.5071	0.7672	0.9492	0.9905	0.9968	(94)
Useful gains	501.7858	607.2643	681.0996	714.4070	668.5736	508.3817	344.2183	360.1176	515.3938	561.9140	502.1802	469.0389	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1462.6318	1419.1829	1284.1966	1067.7810	816.4774	540.9850	349.0445	367.7385	586.7965	900.1836	1202.3990	1457.3960	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.8694	545.6093	448.7042	254.4293	110.0405	0.0000	0.0000	0.0000	0.0000	251.6726	504.1576	735.3377	(98)
Space heating												3564.8204	(98)
Space heating per m2											(98) / (4) =	44.3827	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.6917	722.4381	740.7629	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8622	0.9231	0.9048	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.2277	666.8975	670.2754	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	151.9369	221.4149	187.3416	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											560.6935	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	37.9842	55.3537	46.8354	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											140.1734	(107)
Space cooling per m2											1.7452	(108)
Energy for space heating											44.3827	(99)
Energy for space cooling											1.7452	(108)
Total											46.1279	(109)
Dwelling Fabric Energy Efficiency (DFEE)											46.1	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5415	0.3948	0.4060	0.6493	0.8811	0.9671	0.9879	(86)
MIT	20.0283	20.1660	20.4205	20.7001	20.8949	20.9825	20.9969	20.9965	20.9589	20.7454	20.3624	20.0032	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6813	0.4448	0.2861	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6542	18.8546	19.2114	19.5878	19.8193	19.9002	19.9099	19.9113	19.8883	19.6552	19.1422	18.6245	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6937	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8222	801.2885	847.6723	825.5518	683.1813	467.8061	299.2348	298.7673	510.8892	680.1323	707.7528	691.0192	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.9715	1357.6959	1225.9138	1012.1075	740.9308	474.8633	300.0119	299.6424	529.4525	831.3112	1122.1305	1361.7056	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.9431	373.9058	281.4117	134.3201	42.9656	0.0000	0.0000	0.0000	0.0000	112.4771	298.3520	498.9906	(98)
Space heating												2228.3660	(98)
RHI space heating demand												2228	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1445	(8)
Pressure test				Yes	
Measured/design AP50				4.4900	
Infiltration rate				0.3690	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689	(42)
Average daily hot water use (litres/day)	92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9894	0.9789	0.9572	0.9055	0.8008	0.6303	0.4683	0.5047	0.7269	0.9199	0.9794	0.9917	(86)
MIT	19.8933	20.0775	20.3277	20.6178	20.8427	20.9625	20.9926	20.9895	20.9251	20.6403	20.2109	19.8540	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8759	0.7418	0.5368	0.3558	0.3903	0.6390	0.8883	0.9718	0.9890	(89)
MIT 2	18.4466	18.7129	19.0694	19.4737	19.7549	19.8845	19.9051	19.9053	19.8511	19.5141	18.9150	18.3956	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8099	19.0556	19.3854	19.7610	20.0281	20.1552	20.1782	20.1775	20.1208	19.7969	19.2404	18.7619	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8099	19.0556	19.3854	19.7610	20.0281	20.1552	20.1782	20.1775	20.1208	19.7969	19.2404	18.7619	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9363	0.8716	0.7494	0.5590	0.3842	0.4192	0.6578	0.8848	0.9659	0.9852	(94)
Useful gains	702.4827	794.6804	841.5246	830.0176	729.4553	525.3358	347.1022	364.7940	552.8731	685.0924	679.6911	667.4672	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.9156	1413.4471	1283.9326	1071.5781	820.1493	542.3344	349.3309	368.1922	589.7729	905.7129	1200.0888	1445.0916	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.5781	415.8113	329.1516	173.9235	67.4763	0.0000	0.0000	0.0000	0.0000	164.1417	374.6863	578.5526	(98)
Space heating												2661.3214	(98)
Space heating per m2											(98) / (4) =	33.1340	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2852.4345	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	557.5781	415.8113	329.1516	173.9235	67.4763	0.0000	0.0000	0.0000	0.0000	164.1417	374.6863	578.5526	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	597.6185	445.6712	352.7884	186.4132	72.3219	0.0000	0.0000	0.0000	0.0000	175.9289	401.5931	620.0992	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4586	89.3499	89.1493	88.7205	87.9220	86.7000	86.7000	86.7000	86.7000	88.6357	89.2582	89.5008	(217)
Fuel for water heating, kWh/month													
	182.5317	160.2020	166.5531	147.1430	143.3961	126.8692	118.9361	134.5284	135.5568	152.8765	164.1247	177.0953	(219)
Water heating fuel used												1809.8130	(219)
Annual totals kWh/year													
Space heating fuel - main system												2852.4345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4462.4719	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2852.4345	3.4800	99.2647	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8130	3.4800	62.9815	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.8958	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8576	(257)
SAP value		88.0363	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2852.4345	0.2160	616.1258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8130	0.2160	390.9196	(264)
Space and water heating			1007.0455	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			903.3619	(272)
CO2 emissions per m2			11.2500	(273)
EI value			90.3407	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4900	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5415	0.3948	0.4060	0.6493	0.8811	0.9671	0.9879	(86)
MIT	20.0283	20.1660	20.4205	20.7001	20.8949	20.9825	20.9969	20.9965	20.9589	20.7454	20.3624	20.0032	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6813	0.4448	0.2861	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6542	18.8546	19.2114	19.5878	19.8193	19.9002	19.9099	19.9113	19.8883	19.6552	19.1422	18.6245	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6937	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)
Useful gains	732.8222	801.2885	847.6723	825.5518	683.1813	467.8061	299.2348	298.7673	510.8892	680.1323	707.7528	691.0192	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.9715	1357.6959	1225.9138	1012.1075	740.9308	474.8633	300.0119	299.6424	529.4525	831.3112	1122.1305	1361.7056	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.9431	373.9058	281.4117	134.3201	42.9656	0.0000	0.0000	0.0000	0.0000	112.4771	298.3520	498.9906	(98)
Space heating												2228.3660	(98)
Space heating per m2											(98) / (4) =	27.7436	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2388.3880	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.9431	373.9058	281.4117	134.3201	42.9656	0.0000	0.0000	0.0000	0.0000	112.4771	298.3520	498.9906	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	520.8393	400.7565	301.6202	143.9658	46.0511	0.0000	0.0000	0.0000	0.0000	120.5543	319.7771	534.8238	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3667	89.2738	89.0233	88.4890	87.5875	86.7000	86.7000	86.7000	86.7000	88.2966	89.0819	89.4051	(217)
Fuel for water heating, kWh/month													
	182.7194	160.3386	166.7888	147.5279	143.9437	126.8692	118.9361	134.5284	135.5568	153.4635	164.4496	177.2850	(219)
Water heating fuel used												1812.4070	(219)
Annual totals kWh/year													
Space heating fuel - main system												2388.3880	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3925.9015	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2388.3880	7.3800	176.2630	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4070	7.3800	133.7556	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			338.2342	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2388.3880	0.2160	515.8918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4070	0.2160	391.4799	(264)
Space and water heating			907.3717	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			764.7020	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2388.3880	1.2200	2913.8334	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4070	1.2200	2211.1365	(264)
Space and water heating			5124.9699	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4281.0470	(272)
Primary energy kWh/m2/year			53.2999	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£345	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£281	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3999	0.3921	0.3842	0.3450	0.3372	0.2980	0.2980	0.2901	0.3136	0.3372	0.3528	0.3685	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5568	0.5444	0.5444	0.5421	0.5492	0.5568	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.7369	39.5242	39.3156	38.3362	38.1530	37.2999	37.2999	37.1420	37.6285	38.1530	38.5237	38.9112	(38)
Heat transfer coeff	100.0637	99.8510	99.6425	98.6631	98.4798	97.6268	97.6268	97.4688	97.9554	98.4798	98.8505	99.2381	(39)
Average = Sum(39)m / 12 =												98.6622	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2458	1.2432	1.2406	1.2284	1.2261	1.2155	1.2155	1.2135	1.2196	1.2261	1.2307	1.2355	(40)
HLP (average)												1.2284	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7423	55.8610	55.9779	56.5336	56.6388	57.1337	57.1337	57.2263	56.9420	56.6388	56.4264	56.2060	
alpha	4.7162	4.7241	4.7319	4.7689	4.7759	4.8089	4.8089	4.8151	4.7961	4.7759	4.7618	4.7471	
util living area													
	0.9894	0.9789	0.9572	0.9055	0.8008	0.6303	0.4683	0.5047	0.7269	0.9199	0.9794	0.9917	(86)
MIT	19.8933	20.0775	20.3277	20.6178	20.8427	20.9625	20.9926	20.9895	20.9251	20.6403	20.2109	19.8540	(87)
Th 2	19.8835	19.8856	19.8877	19.8974	19.8992	19.9076	19.9076	19.9092	19.9044	19.8992	19.8955	19.8917	(88)
util rest of house													
	0.9861	0.9724	0.9438	0.8759	0.7418	0.5368	0.3558	0.3903	0.6390	0.8883	0.9718	0.9890	(89)
MIT 2	18.4466	18.7129	19.0694	19.4737	19.7549	19.8845	19.9051	19.9053	19.8511	19.5141	18.9150	18.3956	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8099	19.0556	19.3854	19.7610	20.0281	20.1552	20.1782	20.1775	20.1208	19.7969	19.2404	18.7619	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8099	19.0556	19.3854	19.7610	20.0281	20.1552	20.1782	20.1775	20.1208	19.7969	19.2404	18.7619	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9661	0.9363	0.8716	0.7494	0.5590	0.3842	0.4192	0.6578	0.8848	0.9659	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4827	794.6804	841.5246	830.0176	729.4553	525.3358	347.1022	364.7940	552.8731	685.0924	679.6911	667.4672	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1451.9156	1413.4471	1283.9326	1071.5781	820.1493	542.3344	349.3309	368.1922	589.7729	905.7129	1200.0888	1445.0916	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	557.5781	415.8113	329.1516	173.9235	67.4763	0.0000	0.0000	0.0000	0.0000	164.1417	374.6863	578.5526	(98)
Space heating												2661.3214	(98)
Space heating per m2											(98) / (4) =	33.1340	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2852.4345	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	557.5781	415.8113	329.1516	173.9235	67.4763	0.0000	0.0000	0.0000	0.0000	164.1417	374.6863	578.5526	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	597.6185	445.6712	352.7884	186.4132	72.3219	0.0000	0.0000	0.0000	0.0000	175.9289	401.5931	620.0992	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5588	89.5658	89.5808	89.6429	89.7831	86.7000	86.7000	86.7000	86.7000	89.0554	89.4139	89.5836	(217)
Fuel for water heating, kWh/month	154.9878	114.1972	88.0701	41.5936	12.0975	0.0000	0.0000	21.8860	47.3352	93.5044	131.3575	154.0594	(219)
Water heating fuel used												859.0885	(219)
Annual totals kWh/year													
Space heating fuel - main system												2852.4345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3561.7473	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2852.4345	3.4800	99.2647	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.0885	3.4800	29.8963	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.4056	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7688	(257)
SAP value		89.2748	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2852.4345	0.2160	616.1258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.0885	0.2160	185.5631	(264)
Space and water heating			801.6890	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			723.9554 (272)
CO2 emissions per m2			9.0100 (273)
EI value			92.2590
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4900	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3136	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3293	0.3058	0.3136	0.2980	0.2980	0.2901	0.2823	0.2744	0.2666	0.2901	0.2744	0.2901	(22b)
Effective ac	0.5542	0.5468	0.5492	0.5444	0.5444	0.5421	0.5398	0.5377	0.5355	0.5421	0.5377	0.5421	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9740	37.4621	37.6285	37.2999	37.2999	37.1420	36.9882	36.8387	36.6933	37.1420	36.8387	37.1420	(38)
Heat transfer coeff	98.3008	97.7890	97.9554	97.6268	97.6268	97.4688	97.3150	97.1655	97.0202	97.4688	97.1655	97.4688	(39)
Average = Sum(39)m / 12 =												97.5309	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2239	1.2175	1.2196	1.2155	1.2155	1.2135	1.2116	1.2097	1.2079	1.2135	1.2097	1.2135	(40)
HLP (average)												1.2143	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
								Total per year (kWh/year) = Sum(64)m =				743.7098	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7419	57.0389	56.9420	57.1337	57.1337	57.2263	57.3167	57.4049	57.4909	57.2263	57.4049	57.2263	
alpha	4.7828	4.8026	4.7961	4.8089	4.8089	4.8151	4.8211	4.8270	4.8327	4.8151	4.8270	4.8151	
util living area													
	0.9849	0.9749	0.9464	0.8778	0.7502	0.5415	0.3948	0.4060	0.6493	0.8811	0.9671	0.9879	(86)
MIT	20.0283	20.1660	20.4205	20.7001	20.8949	20.9825	20.9969	20.9965	20.9589	20.7454	20.3624	20.0032	(87)
Th 2	19.9010	19.9060	19.9044	19.9076	19.9076	19.9092	19.9107	19.9122	19.9137	19.9092	19.9122	19.9092	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8411	0.6813	0.4448	0.2861	0.2945	0.5535	0.8367	0.9551	0.9839	(89)
MIT 2	18.6542	18.8546	19.2114	19.5878	19.8193	19.9002	19.9099	19.9113	19.8883	19.6552	19.1422	18.6245	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9993	19.1839	19.5150	19.8671	20.0894	20.1720	20.1829	20.1838	20.1571	19.9290	19.4487	18.9707	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8396	0.6937	0.4687	0.3135	0.3226	0.5761	0.8376	0.9485	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8222	801.2885	847.6723	825.5518	683.1813	467.8061	299.2348	298.7673	510.8892	680.1323	707.7528	691.0192	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1385.9715	1357.6959	1225.9138	1012.1075	740.9308	474.8633	300.0119	299.6424	529.4525	831.3112	1122.1305	1361.7056	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	485.9431	373.9058	281.4117	134.3201	42.9656	0.0000	0.0000	0.0000	0.0000	112.4771	298.3520	498.9906	(98)
Space heating												2228.3660	(98)
Space heating per m2											(98) / (4) =	27.7436	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2388.3880	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.9431	373.9058	281.4117	134.3201	42.9656	0.0000	0.0000	0.0000	0.0000	112.4771	298.3520	498.9906	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	520.8393	400.7565	301.6202	143.9658	46.0511	0.0000	0.0000	0.0000	0.0000	120.5543	319.7771	534.8238	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4935	89.5006	89.4888	89.5102	89.3253	86.7000	86.7000	86.7000	86.7000	88.7748	89.2837	89.5087	(217)
Fuel for water heating, kWh/month	150.5057	114.4983	87.8207	40.4944	17.1468	0.0000	0.0000	14.9625	41.9449	89.4295	126.1950	150.8082	(219)
Water heating fuel used												833.8060	(219)
Annual totals kWh/year													
Space heating fuel - main system												2388.3880	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2997.3005	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2388.3880	7.3800	176.2630	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8060	7.3800	61.5349	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			280.3435	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2388.3880	0.2160	515.8918	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8060	0.2160	180.1021	(264)
Space and water heating			695.9939	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			579.2742	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2388.3880	1.2200	2913.8334	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8060	1.2200	1017.2433	(264)
Space and water heating			3931.0767	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3240.6538	(272)
Primary energy kWh/m2/year			40.3468	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 423 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 423	**Prop Type Ref**	
Property	17 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.08	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.37		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.13	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.16		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.08	$kgCO_2/m^2$	Pass
	-5.18 (-28.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.13	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.49 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 424 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 424	**Prop Type Ref**	
Property	18 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.43 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing South: 7.97 m², No overhang
Windows facing West: 2.46 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3966	0.3889	0.3811	0.3422	0.3344	0.2955	0.2955	0.2878	0.3111	0.3344	0.3500	0.3655	(22b)
Effective ac	0.5787	0.5756	0.5726	0.5586	0.5559	0.5437	0.5437	0.5414	0.5484	0.5559	0.5612	0.5668	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6482	39.4389	39.2338	38.2702	38.0899	37.2507	37.2507	37.0953	37.5739	38.0899	38.4546	38.8359	(38)
Heat transfer coeff	99.9750	99.7657	99.5606	98.5970	98.4167	97.5775	97.5775	97.4221	97.9008	98.4167	98.7814	99.1627	(39)
Average = Sum(39)m / 12 =												98.5962	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2447	1.2421	1.2395	1.2276	1.2253	1.2149	1.2149	1.2129	1.2189	1.2253	1.2298	1.2346	(40)
HLP (average)												1.2275	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7917	55.9088	56.0240	56.5715	56.6751	57.1625	57.1625	57.2537	56.9738	56.6751	56.4658	56.2487	
alpha	4.7194	4.7273	4.7349	4.7714	4.7783	4.8108	4.8108	4.8169	4.7983	4.7783	4.7644	4.7499	
util living area													
	0.9968	0.9920	0.9802	0.9471	0.8663	0.7112	0.5425	0.5871	0.8147	0.9622	0.9930	0.9977	(86)
MIT	19.6943	19.8882	20.1608	20.4910	20.7700	20.9374	20.9863	20.9801	20.8751	20.5063	20.0315	19.6574	(87)
Th 2	19.8844	19.8865	19.8885	19.8980	19.8998	19.9081	19.9081	19.9097	19.9049	19.8998	19.8962	19.8924	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9276	0.8170	0.6156	0.4157	0.4595	0.7343	0.9443	0.9902	0.9969	(89)
MIT 2	18.1589	18.4422	18.8373	19.3098	19.6770	19.8670	19.9032	19.9018	19.8086	19.3408	18.6593	18.1105	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5444	18.8053	19.1696	19.6064	19.9515	20.1358	20.1752	20.1726	20.0765	19.6335	19.0039	18.4990	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5444	18.8053	19.1696	19.6064	19.9515	20.1358	20.1752	20.1726	20.0765	19.6335	19.0039	18.4990	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9212	0.8197	0.6371	0.4478	0.4916	0.7486	0.9386	0.9869	0.9954	(94)
Useful gains	532.0555	635.2729	704.7493	730.9840	677.3355	510.8714	344.5767	360.8591	521.3218	580.8812	529.4816	498.8381	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.0882	1387.2762	1261.3973	1055.6224	812.0865	540.1685	348.8612	367.5327	585.0994	889.0478	1175.8814	1417.9260	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	663.6724	505.3462	414.1461	233.7396	100.2547	0.0000	0.0000	0.0000	0.0000	229.2759	465.4078	683.8014	(98)
Space heating												3295.6442	(98)
Space heating per m2											(98) / (4) =	41.0314	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3532.3088	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	663.6724	505.3462	414.1461	233.7396	100.2547	0.0000	0.0000	0.0000	0.0000	229.2759	465.4078	683.8014	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	711.3316	541.6358	443.8865	250.5248	107.4542	0.0000	0.0000	0.0000	0.0000	245.7405	498.8294	732.9061	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5657	89.4799	89.3212	88.9760	88.2586	86.7000	86.7000	86.7000	86.7000	88.9284	89.4112	89.5999	(217)
Fuel for water heating, kWh/month													
	182.3135	159.9693	166.2325	146.7204	142.8492	126.8692	118.9361	134.5284	135.5568	152.3733	163.8439	176.8995	(219)
Water heating fuel used												1807.0922	(219)
Annual totals kWh/year													
Space heating fuel - main system												3532.3088	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5139.6254	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3532.3088	0.2160	762.9787	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0922	0.2160	390.3319	(264)
Space and water heating			1153.3106	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1049.6271	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0700	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5283	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3966	0.3889	0.3811	0.3422	0.3344	0.2955	0.2955	0.2878	0.3111	0.3344	0.3500	0.3655	(22b)
Effective ac	0.5787	0.5756	0.5726	0.5586	0.5559	0.5437	0.5437	0.5414	0.5484	0.5559	0.5612	0.5668	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6482	39.4389	39.2338	38.2702	38.0899	37.2507	37.2507	37.0953	37.5739	38.0899	38.4546	38.8359	(38)
Heat transfer coeff	99.9750	99.7657	99.5606	98.5970	98.4167	97.5775	97.5775	97.4221	97.9008	98.4167	98.7814	99.1627	(39)
Average = Sum(39)m / 12 =												98.5962	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2447	1.2421	1.2395	1.2276	1.2253	1.2149	1.2149	1.2129	1.2189	1.2253	1.2298	1.2346	(40)
HLP (average)												1.2275	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7917	55.9088	56.0240	56.5715	56.6751	57.1625	57.1625	57.2537	56.9738	56.6751	56.4658	56.2487	
alpha	4.7194	4.7273	4.7349	4.7714	4.7783	4.8108	4.8108	4.8169	4.7983	4.7783	4.7644	4.7499	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8771	0.7261	0.5565	0.6038	0.8298	0.9678	0.9945	0.9982	(86)
MIT	19.6588	19.8543	20.1304	20.4669	20.7547	20.9316	20.9848	20.9777	20.8637	20.4802	19.9987	19.6225	(87)
Th 2	19.8844	19.8865	19.8885	19.8980	19.8998	19.9081	19.9081	19.9097	19.9049	19.8998	19.8962	19.8924	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9352	0.8300	0.6307	0.4273	0.4740	0.7519	0.9521	0.9922	0.9976	(89)
MIT 2	18.6709	18.8669	19.1413	19.4745	19.7358	19.8770	19.9044	19.9035	19.8320	19.4942	19.0192	18.6411	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9190	19.1149	19.3897	19.7237	19.9917	20.1418	20.1757	20.1733	20.0910	19.7418	19.2652	18.8875	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9190	19.1149	19.3897	19.7237	19.9917	20.1418	20.1757	20.1733	20.0910	19.7418	19.2652	18.8875	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8345	0.6528	0.4601	0.5069	0.7670	0.9492	0.9905	0.9968	(94)
Useful gains	501.7866	607.2629	681.0875	714.3637	668.4588	508.2397	344.0968	360.0016	515.2859	561.8932	502.1797	469.0396	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1461.5301	1418.1557	1283.3070	1067.1819	816.0395	540.7579	348.9064	367.5992	586.5283	899.7079	1201.6925	1456.4545	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.0492	544.9200	448.0514	254.0291	109.8000	0.0000	0.0000	0.0000	0.0000	251.3342	503.6492	734.6367	(98)
Space heating												3560.4698	(98)
Space heating per m2											(98) / (4) =	44.3286	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.2287	722.0736	740.4080	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8624	0.9233	0.9050	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.0505	666.6873	670.0943	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0645	221.5713	187.4763	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                561.1121 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   38.0161   55.3928   46.8691    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                140.2780 (107)
Space cooling per m2                                                                                           1.7465 (108)
Energy for space heating                                                                                      44.3286 (99)
Energy for space cooling                                                                                       1.7465 (108)
Total                                                                                                         46.0750 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                        46.1 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)
West	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(80)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3266	0.3033	0.3111	0.2955	0.2955	0.2878	0.2800	0.2722	0.2644	0.2878	0.2722	0.2878	(22b)
Effective ac	0.5533	0.5460	0.5484	0.5437	0.5437	0.5414	0.5392	0.5370	0.5350	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9138	37.4102	37.5739	37.2507	37.2507	37.0953	36.9440	36.7969	36.6539	37.0953	36.7969	37.0953	(38)
Heat transfer coeff	98.2406	97.7371	97.9008	97.5775	97.5775	97.4221	97.2708	97.1237	96.9807	97.4221	97.1237	97.4221	(39)
Average = Sum(39)m / 12 =												97.4832	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2231	1.2168	1.2189	1.2149	1.2149	1.2129	1.2110	1.2092	1.2074	1.2129	1.2092	1.2129	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7767	57.0692	56.9738	57.1625	57.1625	57.2537	57.3428	57.4296	57.5143	57.2537	57.4296	57.2537	
alpha	4.7851	4.8046	4.7983	4.8108	4.8108	4.8169	4.8229	4.8286	4.8343	4.8169	4.8286	4.8169	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7500	0.5412	0.3946	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0293	20.1669	20.4213	20.7005	20.8952	20.9825	20.9969	20.9965	20.9590	20.7458	20.3630	20.0039	(87)
Th 2	19.9016	19.9065	19.9049	19.9081	19.9081	19.9097	19.9112	19.9126	19.9141	19.9097	19.9126	19.9097	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4446	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6561	18.8562	19.2129	19.5888	19.8200	19.9007	19.9104	19.9117	19.8887	19.6561	19.1433	18.6259	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)
Useful gains	732.8143	801.2720	847.6240	825.4448	683.0062	467.6398	299.1340	298.6723	510.7542	680.0492	707.7353	691.0152	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.2826	1357.1099	1225.3568	1011.6846	740.6146	474.6732	299.9082	299.5443	529.2725	830.9863	1121.7409	1361.1755	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.4364	373.5230	281.0332	134.0927	42.8606	0.0000	0.0000	0.0000	0.0000	112.2972	298.0840	498.5993	(98)
Space heating												2225.9264	(98)
RHI space heating demand												2226	(98)

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3966	0.3889	0.3811	0.3422	0.3344	0.2955	0.2955	0.2878	0.3111	0.3344	0.3500	0.3655	(22b)
Effective ac	0.5787	0.5756	0.5726	0.5586	0.5559	0.5437	0.5437	0.5414	0.5484	0.5559	0.5612	0.5668	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6482	39.4389	39.2338	38.2702	38.0899	37.2507	37.2507	37.0953	37.5739	38.0899	38.4546	38.8359	(38)
Heat transfer coeff	99.9750	99.7657	99.5606	98.5970	98.4167	97.5775	97.5775	97.4221	97.9008	98.4167	98.7814	99.1627	(39)
Average = Sum(39)m / 12 =												98.5962	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2447	1.2421	1.2395	1.2276	1.2253	1.2149	1.2149	1.2129	1.2189	1.2253	1.2298	1.2346	(40)
HLP (average)												1.2275	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7917	55.9088	56.0240	56.5715	56.6751	57.1625	57.1625	57.2537	56.9738	56.6751	56.4658	56.2487	
alpha	4.7194	4.7273	4.7349	4.7714	4.7783	4.8108	4.8108	4.8169	4.7983	4.7783	4.7644	4.7499	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8005	0.6301	0.4681	0.5045	0.7267	0.9198	0.9794	0.9917	(86)
MIT	19.8948	20.0789	20.3289	20.6186	20.8431	20.9626	20.9926	20.9895	20.9253	20.6409	20.2119	19.8553	(87)
Th 2	19.8844	19.8865	19.8885	19.8980	19.8998	19.9081	19.9081	19.9097	19.9049	19.8998	19.8962	19.8924	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8757	0.7416	0.5366	0.3556	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4494	18.7155	19.0717	19.4752	19.7560	19.8850	19.9056	19.9058	19.8518	19.5155	18.9169	18.3980	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8123	19.0579	19.3874	19.7623	20.0290	20.1556	20.1786	20.1779	20.1214	19.7981	19.2421	18.7639	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8123	19.0579	19.3874	19.7623	20.0290	20.1556	20.1786	20.1779	20.1214	19.7981	19.2421	18.7639	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)
Useful gains	702.4775	794.6610	841.4723	829.9100	729.2619	525.1583	346.9718	364.6653	552.7053	685.0199	679.6774	667.4647	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1450.8720	1412.4683	1283.0762	1070.9899	819.7093	542.1044	349.1918	368.0516	589.5001	905.2452	1199.4136	1444.2008	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	556.8055	415.1665	328.5534	173.5775	67.2929	0.0000	0.0000	0.0000	0.0000	163.8477	374.2100	577.8916	(98)
Space heating												2657.3451	(98)
Space heating per m2											(98) / (4) =	33.0845	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.1726	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	556.8055	415.1665	328.5534	173.5775	67.2929	0.0000	0.0000	0.0000	0.0000	163.8477	374.2100	577.8916	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	596.7905	444.9802	352.1472	186.0424	72.1253	0.0000	0.0000	0.0000	0.0000	175.6138	401.0826	619.3908	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4577	89.3488	89.1478	88.7187	87.9198	86.7000	86.7000	86.7000	86.7000	88.6341	89.2573	89.5001	(217)
Fuel for water heating, kWh/month													
	182.5336	160.2039	166.5558	147.1459	143.3997	126.8692	118.9361	134.5284	135.5568	152.8792	164.1264	177.0968	(219)
Water heating fuel used												1809.8318	(219)
Annual totals kWh/year													
Space heating fuel - main system												2848.1726	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4458.2289	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.1726	3.4800	99.1164	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8318	3.4800	62.9821	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.7482	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8571	(257)
SAP value		88.0432	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.1726	0.2160	615.2053	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8318	0.2160	390.9237	(264)
Space and water heating			1006.1290	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			902.4454	(272)
CO2 emissions per m2			11.2400	(273)
EI value			90.3505	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4300	
Infiltration rate			0.3660	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3266	0.3033	0.3111	0.2955	0.2955	0.2878	0.2800	0.2722	0.2644	0.2878	0.2722	0.2878	(22b)
Effective ac	0.5533	0.5460	0.5484	0.5437	0.5437	0.5414	0.5392	0.5370	0.5350	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9138	37.4102	37.5739	37.2507	37.2507	37.0953	36.9440	36.7969	36.6539	37.0953	36.7969	37.0953	(38)
Heat transfer coeff	98.2406	97.7371	97.9008	97.5775	97.5775	97.4221	97.2708	97.1237	96.9807	97.4221	97.1237	97.4221	(39)
Average = Sum(39)m / 12 =												97.4832	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2231	1.2168	1.2189	1.2149	1.2149	1.2129	1.2110	1.2092	1.2074	1.2129	1.2092	1.2129	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7767	57.0692	56.9738	57.1625	57.1625	57.2537	57.3428	57.4296	57.5143	57.2537	57.4296	57.2537	
alpha	4.7851	4.8046	4.7983	4.8108	4.8108	4.8169	4.8229	4.8286	4.8343	4.8169	4.8286	4.8169	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7500	0.5412	0.3946	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0293	20.1669	20.4213	20.7005	20.8952	20.9825	20.9969	20.9965	20.9590	20.7458	20.3630	20.0039	(87)
Th 2	19.9016	19.9065	19.9049	19.9081	19.9081	19.9097	19.9112	19.9126	19.9141	19.9097	19.9126	19.9097	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4446	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6561	18.8562	19.2129	19.5888	19.8200	19.9007	19.9104	19.9117	19.8887	19.6561	19.1433	18.6259	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)
Useful gains	732.8143	801.2720	847.6240	825.4448	683.0062	467.6398	299.1340	298.6723	510.7542	680.0492	707.7353	691.0152	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.2826	1357.1099	1225.3568	1011.6846	740.6146	474.6732	299.9082	299.5443	529.2725	830.9863	1121.7409	1361.1755	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.4364	373.5230	281.0332	134.0927	42.8606	0.0000	0.0000	0.0000	0.0000	112.2972	298.0840	498.5993	(98)
Space heating												2225.9264	(98)
Space heating per m2											(98) / (4) =	27.7132	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2385.7732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.4364	373.5230	281.0332	134.0927	42.8606	0.0000	0.0000	0.0000	0.0000	112.2972	298.0840	498.5993	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	520.2963	400.3462	301.2145	143.7220	45.9385	0.0000	0.0000	0.0000	0.0000	120.3614	319.4898	534.4044	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3660	89.2730	89.0222	88.4875	87.5859	86.7000	86.7000	86.7000	86.7000	88.2952	89.0812	89.4045	(217)
Fuel for water heating, kWh/month													
	182.7209	160.3399	166.7909	147.5304	143.9464	126.8692	118.9361	134.5284	135.5568	153.4660	164.4509	177.2861	(219)
Water heating fuel used												1812.4220	(219)
Annual totals kWh/year													
Space heating fuel - main system												2385.7732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3923.3017	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2385.7732	7.3800	176.0701	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4220	7.3800	133.7567	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			338.0423	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2385.7732	0.2160	515.3270	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4220	0.2160	391.4831	(264)
Space and water heating			906.8102	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			764.1405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2385.7732	1.2200	2910.6433	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4220	1.2200	2211.1548	(264)
Space and water heating			5121.7981	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4277.8752	(272)
Primary energy kWh/m2/year			53.2604	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£345	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£281	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3966	0.3889	0.3811	0.3422	0.3344	0.2955	0.2955	0.2878	0.3111	0.3344	0.3500	0.3655	(22b)
Effective ac	0.5787	0.5756	0.5726	0.5586	0.5559	0.5437	0.5437	0.5414	0.5484	0.5559	0.5612	0.5668	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6482	39.4389	39.2338	38.2702	38.0899	37.2507	37.2507	37.0953	37.5739	38.0899	38.4546	38.8359	(38)
Heat transfer coeff	99.9750	99.7657	99.5606	98.5970	98.4167	97.5775	97.5775	97.4221	97.9008	98.4167	98.7814	99.1627	(39)
Average = Sum(39)m / 12 =												98.5962	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2447	1.2421	1.2395	1.2276	1.2253	1.2149	1.2149	1.2129	1.2189	1.2253	1.2298	1.2346	(40)
HLP (average)												1.2275	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)
West	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(80)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7917	55.9088	56.0240	56.5715	56.6751	57.1625	57.1625	57.2537	56.9738	56.6751	56.4658	56.2487	
alpha	4.7194	4.7273	4.7349	4.7714	4.7783	4.8108	4.8108	4.8169	4.7983	4.7783	4.7644	4.7499	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8005	0.6301	0.4681	0.5045	0.7267	0.9198	0.9794	0.9917	(86)
MIT	19.8948	20.0789	20.3289	20.6186	20.8431	20.9626	20.9926	20.9895	20.9253	20.6409	20.2119	19.8553	(87)
Th 2	19.8844	19.8865	19.8885	19.8980	19.8998	19.9081	19.9081	19.9097	19.9049	19.8998	19.8962	19.8924	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8757	0.7416	0.5366	0.3556	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4494	18.7155	19.0717	19.4752	19.7560	19.8850	19.9056	19.9058	19.8518	19.5155	18.9169	18.3980	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8123	19.0579	19.3874	19.7623	20.0290	20.1556	20.1786	20.1779	20.1214	19.7981	19.2421	18.7639	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8123	19.0579	19.3874	19.7623	20.0290	20.1556	20.1786	20.1779	20.1214	19.7981	19.2421	18.7639	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4775	794.6610	841.4723	829.9100	729.2619	525.1583	346.9718	364.6653	552.7053	685.0199	679.6774	667.4647	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1450.8720	1412.4683	1283.0762	1070.9899	819.7093	542.1044	349.1918	368.0516	589.5001	905.2452	1199.4136	1444.2008	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	556.8055	415.1665	328.5534	173.5775	67.2929	0.0000	0.0000	0.0000	0.0000	163.8477	374.2100	577.8916	(98)
Space heating												2657.3451	(98)
Space heating per m2											(98) / (4) =	33.0845	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.1726	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.8055	415.1665	328.5534	173.5775	67.2929	0.0000	0.0000	0.0000	0.0000	163.8477	374.2100	577.8916	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	596.7905	444.9802	352.1472	186.0424	72.1253	0.0000	0.0000	0.0000	0.0000	175.6138	401.0826	619.3908	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5580	89.5649	89.5798	89.6418	89.7819	86.7000	86.7000	86.7000	86.7000	89.0540	89.4131	89.5829	(217)
Fuel for water heating, kWh/month	154.9892	114.1984	88.0711	41.5941	12.0976	0.0000	0.0000	21.8860	47.3352	93.5059	131.3587	154.0605	(219)
Water heating fuel used												859.0966	(219)

Annual totals kWh/year		
Space heating fuel - main system	2848.1726	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =	-630.4424	(233)
Total delivered energy for all uses	3557.4937	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.1726	3.4800	99.1164	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.0966	3.4800	29.8966	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.2576	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7683	(257)
SAP value	89.2817	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.1726	0.2160	615.2053	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.0966	0.2160	185.5649	(264)
Space and water heating			800.7702	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			723.0366 (272)
CO2 emissions per m2			9.0000 (273)
EI value			92.2688
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4300	
Infiltration rate		0.3660	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3111	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3266	0.3033	0.3111	0.2955	0.2955	0.2878	0.2800	0.2722	0.2644	0.2878	0.2722	0.2878	(22b)
Effective ac	0.5533	0.5460	0.5484	0.5437	0.5437	0.5414	0.5392	0.5370	0.5350	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9138	37.4102	37.5739	37.2507	37.2507	37.0953	36.9440	36.7969	36.6539	37.0953	36.7969	37.0953	(38)
Heat transfer coeff	98.2406	97.7371	97.9008	97.5775	97.5775	97.4221	97.2708	97.1237	96.9807	97.4221	97.1237	97.4221	(39)
Average = Sum(39)m / 12 =												97.4832	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2231	1.2168	1.2189	1.2149	1.2149	1.2129	1.2110	1.2092	1.2074	1.2129	1.2092	1.2129	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3896	(H8)
Utilisation factor												0.5131	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-876.6189	(H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154	(63)
								Solar input (sum of months) = Sum(63)m =				-876.6189	(63)
Output from w/h													
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
								Total per year (kWh/year) = Sum(64)m =				743.7098	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)
West	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(80)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7767	57.0692	56.9738	57.1625	57.1625	57.2537	57.3428	57.4296	57.5143	57.2537	57.4296	57.2537	
alpha	4.7851	4.8046	4.7983	4.8108	4.8108	4.8169	4.8229	4.8286	4.8343	4.8169	4.8286	4.8169	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7500	0.5412	0.3946	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0293	20.1669	20.4213	20.7005	20.8952	20.9825	20.9969	20.9965	20.9590	20.7458	20.3630	20.0039	(87)
Th 2	19.9016	19.9065	19.9049	19.9081	19.9081	19.9097	19.9112	19.9126	19.9141	19.9097	19.9126	19.9097	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4446	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6561	18.8562	19.2129	19.5888	19.8200	19.9007	19.9104	19.9117	19.8887	19.6561	19.1433	18.6259	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0009	19.1853	19.5163	19.8680	20.0900	20.1723	20.1832	20.1842	20.1575	19.9298	19.4496	18.9719	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8143	801.2720	847.6240	825.4448	683.0062	467.6398	299.1340	298.6723	510.7542	680.0492	707.7353	691.0152	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1385.2826	1357.1099	1225.3568	1011.6846	740.6146	474.6732	299.9082	299.5443	529.2725	830.9863	1121.7409	1361.1755	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	485.4364	373.5230	281.0332	134.0927	42.8606	0.0000	0.0000	0.0000	0.0000	112.2972	298.0840	498.5993	(98)
Space heating												2225.9264	(98)
Space heating per m2											(98) / (4) =	27.7132	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2385.7732	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.4364	373.5230	281.0332	134.0927	42.8606	0.0000	0.0000	0.0000	0.0000	112.2972	298.0840	498.5993	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	520.2963	400.3462	301.2145	143.7220	45.9385	0.0000	0.0000	0.0000	0.0000	120.3614	319.4898	534.4044	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4929	89.4999	89.4880	89.5091	89.3235	86.7000	86.7000	86.7000	86.7000	88.7733	89.2831	89.5082	(217)
Fuel for water heating, kWh/month	150.5068	114.4991	87.8215	40.4949	17.1471	0.0000	0.0000	14.9625	41.9449	89.4309	126.1959	150.8090	(219)
Water heating fuel used												833.8127	(219)
Annual totals kWh/year													
Space heating fuel - main system												2385.7732	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2994.6924	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2385.7732	7.3800	176.0701	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8127	7.3800	61.5354	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			280.1510	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2385.7732	0.2160	515.3270	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8127	0.2160	180.1035	(264)
Space and water heating			695.4305	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			578.7109	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2385.7732	1.2200	2910.6433	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8127	1.2200	1017.2515	(264)
Space and water heating			3927.8948	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3237.4719	(272)
Primary energy kWh/m2/year			40.3072	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
West	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 424 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 424	**Prop Type Ref**	
Property	18 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.26		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.07	$kgCO_2/m^2$	Pass
	-5.19 (-28.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.08	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.43 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	3.61 m², No overhang 7.97 m², No overhang 2.46 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.43 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 425 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 425	**Prop Type Ref**	
Property	19 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.61 m², No overhang
Windows facing East: 2.46 m², No overhang
Windows facing South: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	374.9429	372.8256	359.2657	337.4120	315.2247	293.8604	279.9980	286.0037	297.2472	319.3129	344.6509	363.6519	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103 (83)
Total gains	535.3689	644.6007	728.6735	793.4928	826.3683	801.9144	769.5286	734.0468	696.4416	618.8767	536.4964	501.1623 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9968	0.9920	0.9802	0.9471	0.8663	0.7113	0.5426	0.5871	0.8147	0.9622	0.9930	0.9977	(86)
MIT	19.6941	19.8880	20.1606	20.4908	20.7699	20.9374	20.9863	20.9801	20.8751	20.5062	20.0314	19.6572	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9957	0.9893	0.9732	0.9276	0.8170	0.6156	0.4157	0.4595	0.7343	0.9443	0.9902	0.9969	(89)
MIT 2	18.1584	18.4418	18.8369	19.3096	19.6768	19.8669	19.9032	19.9017	19.8085	19.3406	18.6589	18.1102	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5440	18.8050	19.1693	19.6062	19.9513	20.1357	20.1752	20.1725	20.0763	19.6333	19.0036	18.4986	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5440	18.8050	19.1693	19.6062	19.9513	20.1357	20.1752	20.1725	20.0763	19.6333	19.0036	18.4986	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9938	0.9855	0.9672	0.9212	0.8197	0.6371	0.4478	0.4916	0.7486	0.9386	0.9869	0.9954	(94)
Useful gains	532.0553	635.2733	704.7518	730.9923	677.3560	510.8958	344.5971	360.8787	521.3410	580.8855	529.4818	498.8380	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1424.2583	1387.4355	1261.5362	1055.7171	812.1571	540.2059	348.8841	367.5558	585.1431	889.1228	1175.9911	1418.0713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	663.7990	505.4530	414.2476	233.8019	100.2920	0.0000	0.0000	0.0000	0.0000	229.3285	465.4867	683.9096	(98)
Space heating												3296.3183	(98)
Space heating per m2											(98) / (4) =	41.0398	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3533.0315	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	663.7990	505.4530	414.2476	233.8019	100.2920	0.0000	0.0000	0.0000	0.0000	229.3285	465.4867	683.9096	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	711.4674	541.7503	443.9953	250.5915	107.4941	0.0000	0.0000	0.0000	0.0000	245.7969	498.9139	733.0221	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5658	89.4800	89.3214	88.9763	88.2589	86.7000	86.7000	86.7000	86.7000	88.9285	89.4113	89.6000	(217)
Fuel for water heating, kWh/month													
	182.3133	159.9690	166.2322	146.7200	142.8487	126.8692	118.9361	134.5284	135.5568	152.3730	163.8437	176.8993	(219)
Water heating fuel used												1807.0898	(219)
Annual totals kWh/year													
Space heating fuel - main system												3533.0315	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5140.3456	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3533.0315	0.2160	763.1348	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.0898	0.2160	390.3314	(264)
Space and water heating			1153.4662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1049.7826	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0700	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		31.5283	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5283	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	528.4574	623.5028	694.7461	748.1077	773.4731	748.7799	718.7157	689.0450	658.1759	593.6884	525.3946	497.1186	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9970	0.9928	0.9826	0.9534	0.8786	0.7258	0.5543	0.5970	0.8239	0.9650	0.9934	0.9978	(86)
MIT	19.7550	19.9325	20.1875	20.5032	20.7734	20.9394	20.9872	20.9817	20.8808	20.5286	20.0800	19.7237	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9960	0.9904	0.9765	0.9360	0.8329	0.6333	0.4302	0.4727	0.7471	0.9485	0.9908	0.9970	(89)
MIT 2	18.2762	18.5363	18.9067	19.3620	19.7209	19.9130	19.9489	19.9480	19.8565	19.4061	18.7604	18.2373	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6475	18.8869	19.2283	19.6486	19.9852	20.1707	20.2097	20.2076	20.1137	19.6880	19.0918	18.6105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9871	0.9711	0.9300	0.8349	0.6540	0.4616	0.5040	0.7607	0.9432	0.9878	0.9956	(94)
Useful gains	525.3861	615.4293	674.6835	695.7504	645.7972	489.7077	331.7453	347.2868	500.6462	559.9955	518.9755	494.9316	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1374.5897	1336.6371	1213.3310	1012.5753	778.7739	518.1954	335.7768	353.4956	561.6613	854.2338	1132.2652	1367.0263	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating												3153.5819	(98)
Space heating per m2											(98) / (4) =	39.2627	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3376.4260	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	631.8075	484.6517	400.7538	228.1139	98.9347	0.0000	0.0000	0.0000	0.0000	218.9133	441.5686	648.8385	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	676.4534	518.8990	429.0725	244.2333	105.9258	0.0000	0.0000	0.0000	0.0000	234.3825	472.7715	694.6879	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7230	87.4485	86.9469	85.8817	83.8981	80.3000	80.3000	80.3000	80.3000	85.6597	87.1799	87.8211	(217)
Fuel for water heating, kWh/month													
	230.7265	203.2573	212.6961	190.9906	189.2845	174.1812	166.8789	186.0308	188.0853	200.7719	210.5829	225.0275	(219)
Water heating fuel used												2378.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3376.4260	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6185.6062	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3376.4260	0.2160	729.3080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2378.5135	0.2160	513.7589	(264)
Space and water heating			1243.0669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1466.5830	(272)
Emissions per m2 for space and water heating			15.4764	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4764 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	503.9614	613.9721	699.6627	766.6792	800.9819	778.5357	747.8539	710.1861	671.8022	591.9635	507.0154	470.5288	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9975	0.9934	0.9830	0.9530	0.8772	0.7261	0.5565	0.6038	0.8298	0.9678	0.9945	0.9982	(86)
MIT	19.6585	19.8541	20.1302	20.4668	20.7546	20.9315	20.9847	20.9776	20.8636	20.4801	19.9985	19.6223	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9967	0.9912	0.9770	0.9352	0.8300	0.6307	0.4273	0.4740	0.7519	0.9521	0.9922	0.9976	(89)
MIT 2	18.6705	18.8666	19.1410	19.4742	19.7357	19.8769	19.9043	19.9034	19.8318	19.4940	19.0190	18.6408	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9186	19.1146	19.3894	19.7235	19.9915	20.1418	20.1756	20.1732	20.0909	19.7416	19.2649	18.8872	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9186	19.1146	19.3894	19.7235	19.9915	20.1418	20.1756	20.1732	20.0909	19.7416	19.2649	18.8872	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9891	0.9735	0.9318	0.8346	0.6528	0.4601	0.5069	0.7670	0.9492	0.9905	0.9968	(94)
Useful gains	501.7864	607.2631	681.0895	714.3709	668.4778	508.2633	344.1170	360.0209	515.3039	561.8966	502.1798	469.0395	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1461.7131	1418.3264	1283.4548	1067.2815	816.1122	540.7956	348.9293	367.6223	586.5728	899.7869	1201.8099	1456.6109	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	714.1854	545.0345	448.1598	254.0956	109.8400	0.0000	0.0000	0.0000	0.0000	251.3904	503.7337	734.7531	(98)
Space heating												3561.1925	(98)
Space heating per m2											(98) / (4) =	44.3376	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	917.3056	722.1342	740.4670	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8624	0.9233	0.9050	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.0799	666.7222	670.1244	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.2512	964.4982	922.0787	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0433	221.5453	187.4540	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												561.0426 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.0108	55.3863	46.8635	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												140.2606 (107)
Space cooling per m2												1.7463 (108)
Energy for space heating												44.3376 (99)
Energy for space cooling												1.7463 (108)
Total												46.0838 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.6300	0.7000	0.7700	11.7314	(74)
East	2.4600	19.6403	0.6300	0.7000	0.7700	14.7657	(76)
South	7.9700	46.7521	0.6300	0.7000	0.7700	113.8757	(78)

Solar gains	140.3728	237.8032	323.2319	399.0707	447.2507	444.5473	428.3393	392.0377	349.2951	262.1183	167.8648	120.3216	(83)
Total gains	483.9081	580.0003	653.4867	709.6691	737.0889	715.0290	686.6626	654.1807	621.9029	554.5180	483.0347	453.3400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9980	0.9947	0.9864	0.9615	0.8944	0.7489	0.5771	0.6238	0.8473	0.9730	0.9954	0.9985	(86)
MIT	19.7040	19.8837	20.1433	20.4672	20.7497	20.9301	20.9848	20.9778	20.8629	20.4897	20.0321	19.6733	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9973	0.9929	0.9815	0.9466	0.8522	0.6573	0.4495	0.4963	0.7747	0.9597	0.9936	0.9980	(89)
MIT 2	18.7487	18.9295	19.1885	19.5127	19.7729	19.9210	19.9498	19.9491	19.8745	19.5406	19.0872	18.7257	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9886	19.1691	19.4283	19.7524	20.0182	20.1744	20.2097	20.2074	20.1227	19.7790	19.3245	18.9637	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9912	0.9785	0.9433	0.8557	0.6784	0.4819	0.5287	0.7884	0.9570	0.9921	0.9974	(94)
Useful gains	482.1721	574.8743	639.4505	669.4177	630.6969	485.0585	330.9029	345.8356	490.3251	530.6491	479.2085	452.1460	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1407.2676	1363.6085	1232.3915	1022.3609	781.8788	518.5360	335.7756	353.4858	562.5044	862.7874	1154.2377	1400.5246	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	688.2710	530.0293	441.1481	254.1191	112.4793	0.0000	0.0000	0.0000	0.0000	247.1109	486.0210	705.5937	(98)
Space heating												3464.7724	(98)
Space heating per m2											(98) / (4) =	43.1371	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8570	0.9210	0.9029	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.3990	633.9793	637.1016	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	928.0225	892.9759	856.6178	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6089	192.6935	163.3201	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												484.6224	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    32.1522    48.1734    40.8300     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                    121.1556 (107)
Space cooling per m2                                                                                                               1.5084 (108)
Energy for space heating                                                                                                          43.1371 (99)
Energy for space cooling                                                                                                           1.5084 (108)
Total                                                                                                                             44.6455 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                               51.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

```
If cylinder contains dedicated solar storage
              0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss   11.8491   10.6889   11.8029   11.3868   11.7406   11.3322   11.6915   11.7233   11.3619   11.7771   11.4382   11.8391 (61)
Total heat required for water heating calculated for each month
             163.2903  143.1403  148.4809  130.5460  126.0767  109.9956  103.1176  116.6361  117.5277  135.5031  146.4948  158.5018 (62)
Solar input   0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             163.2903  143.1403  148.4809  130.5460  126.0767  109.9956  103.1176  116.6361  117.5277  135.5031  146.4948  158.5018 (64)
                                                                              Total per year (kWh/year) = Sum(64)m =   1599.3110 (64)
RHI water heating demand                                                                                                1599 (64)
Heat gains from water heating, kWh/month
              53.3165   46.7123   48.3962   42.4671   40.9519   35.6386   33.3221   37.8143   38.1406   44.0832   47.7659   51.7251 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m        148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343  148.1343 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              50.3483   44.7189   36.3679   27.5328   20.5811   17.3754   18.7748   24.4042   32.7552   41.5903   48.5420   51.7476 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             328.5195  331.9285  323.3379  305.0496  281.9638  260.2665  245.7713  242.3623  250.9529  269.2413  292.3270  314.0243 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823   52.2823 (69)
Pumps, fans    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562  -98.7562 (71)
Water heating gains (Table 5)
              71.6619   69.5124   65.0486   58.9821   55.0429   49.4981   44.7877   50.8257   52.9731   59.2516   66.3415   69.5230 (72)
Total internal gains
             555.1901  550.8202  529.4148  496.2249  462.2482  431.8005  413.9943  422.2527  441.3416  474.7435  511.8709  539.9554 (73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

```
Solar gains  196.6383  283.4397  389.3343  487.0583  522.6411  566.2454  540.5150  503.7882  445.4034  337.2274  234.3363  165.7361 (83)
Total gains  751.8284  834.2599  918.7491  983.2832  984.8894  998.0458  954.5092  926.0408  886.7450  811.9709  746.2072  705.6915 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                             21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau          56.7709   57.0642   56.9685   57.1577   57.1577   57.2492   57.3384   57.4255   57.5104   57.2492   57.4255   57.2492
alpha         4.7847    4.8043    4.7979    4.8105    4.8105    4.8166    4.8226    4.8284    4.8340    4.8166    4.8284    4.8166
util living area
              0.9849    0.9749    0.9464    0.8777    0.7501    0.5413    0.3947    0.4058    0.6491    0.8810    0.9671    0.9878 (86)

MIT          20.0291   20.1667   20.4212   20.7005   20.8951   20.9825   20.9969   20.9965   20.9590   20.7457   20.3629   20.0038 (87)
Th 2         19.9015   19.9065   19.9048   19.9080   19.9080   19.9096   19.9111   19.9126   19.9140   19.9096   19.9126   19.9096 (88)
util rest of house
              0.9800    0.9671    0.9298    0.8410    0.6811    0.4447    0.2860    0.2944    0.5534    0.8366    0.9550    0.9839 (89)
MIT 2        18.6558   18.8559   19.2126   19.5887   19.8199   19.9006   19.9103   19.9117   19.8887   19.6560   19.1431   18.6256 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.2511 (91)
MIT          19.0006   19.1851   19.5161   19.8679   20.0899   20.1723   20.1832   20.1841   20.1574   19.9296   19.4494   18.9717 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT 19.0006   19.1851   19.5161   19.8679   20.0899   20.1723   20.1832   20.1841   20.1574   19.9296   19.4494   18.9717 (93)
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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation   0.9747    0.9605    0.9226    0.8395    0.6935    0.4686    0.3134    0.3225    0.5760    0.8375    0.9484    0.9792 (94)
Useful gains 732.8156  801.2748  847.6321  825.4626  683.0353  467.6674  299.1508  298.6881  510.7767  680.0630  707.7382  691.0158 (95)
Ext temp.     4.9000    5.3000    7.0000    9.5000   12.5000   15.3000   17.1000   17.1000   14.7000   11.4000    7.9000    5.0000 (96)
Heat loss rate W
             1385.3970 1357.2072 1225.4493 1011.7548  740.6671  474.7048  299.9254  299.5606  529.3024  831.0403 1121.8056 1361.2635 (97)
Month fracti  1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             485.5206  373.5866  281.0960  134.1304   42.8780    0.0000    0.0000    0.0000    0.0000  112.3271  298.1285  498.6643 (98)
Space heating                                                                                                          2226.3316 (98)
RHI space heating demand                                                                                                  2226 (98)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8006	0.6301	0.4682	0.5045	0.7268	0.9198	0.9794	0.9917	(86)
MIT	19.8945	20.0787	20.3287	20.6184	20.8430	20.9626	20.9926	20.9895	20.9253	20.6408	20.2117	19.8551	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8758	0.7416	0.5366	0.3557	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4489	18.7150	19.0713	19.4749	19.7558	19.8849	19.9056	19.9057	19.8517	19.5152	18.9166	18.3976	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)
Useful gains	702.4784	794.6642	841.4810	829.9279	729.2941	525.1878	346.9935	364.6867	552.7332	685.0319	679.6797	667.4651	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1451.0453	1412.6309	1283.2185	1071.0876	819.7824	542.1426	349.2149	368.0749	589.5454	905.3229	1199.5258	1444.3488	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating												2658.0056	(98)
Space heating per m2											(98) / (4) =	33.0927	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.8806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	596.9280	445.0950	352.2537	186.1040	72.1579	0.0000	0.0000	0.0000	0.0000	175.6661	401.1674	619.5085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4578	89.3490	89.1481	88.7190	87.9201	86.7000	86.7000	86.7000	86.7000	88.6344	89.2575	89.5002	(217)
Fuel for water heating, kWh/month													
	182.5333	160.2036	166.5554	147.1455	143.3991	126.8692	118.9361	134.5284	135.5568	152.8788	164.1261	177.0965	(219)
Water heating fuel used												1809.8287	(219)
Annual totals kWh/year													
Space heating fuel - main system												2848.8806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4458.9336	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.8806	3.4800	99.1410	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1809.8287	3.4800	62.9820	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			255.7727	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8572	(257)
SAP value		88.0420	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.8806	0.2160	615.3582	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1809.8287	0.2160	390.9230	(264)
Space and water heating			1006.2812	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			902.5977	(272)
CO2 emissions per m2			11.2400	(273)
EI value			90.3489	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.3110 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361	(83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7709	57.0642	56.9685	57.1577	57.1577	57.2492	57.3384	57.4255	57.5104	57.2492	57.4255	57.2492	
alpha	4.7847	4.8043	4.7979	4.8105	4.8105	4.8166	4.8226	4.8284	4.8340	4.8166	4.8284	4.8166	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0291	20.1667	20.4212	20.7005	20.8951	20.9825	20.9969	20.9965	20.9590	20.7457	20.3629	20.0038	(87)
Th 2	19.9015	19.9065	19.9048	19.9080	19.9080	19.9096	19.9111	19.9126	19.9140	19.9096	19.9126	19.9096	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4447	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6558	18.8559	19.2126	19.5887	19.8199	19.9006	19.9103	19.9117	19.8887	19.6560	19.1431	18.6256	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)
Useful gains	732.8156	801.2748	847.6321	825.4626	683.0353	467.6674	299.1508	298.6881	510.7767	680.0630	707.7382	691.0158	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1385.3970	1357.2072	1225.4493	1011.7548	740.6671	474.7048	299.9254	299.5606	529.3024	831.0403	1121.8056	1361.2635	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating												2226.3316	(98)
Space heating per m2											(98) / (4) =	27.7183	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2386.2075	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	520.3865	400.4144	301.2819	143.7625	45.9572	0.0000	0.0000	0.0000	0.0000	120.3934	319.5375	534.4741	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3661	89.2732	89.0223	88.4878	87.5862	86.7000	86.7000	86.7000	86.7000	88.2955	89.0813	89.4046	(217)
Fuel for water heating, kWh/month													
	182.7206	160.3397	166.7906	147.5300	143.9459	126.8692	118.9361	134.5284	135.5568	153.4656	164.4507	177.2859	(219)
Water heating fuel used												1812.4195	(219)
Annual totals kWh/year													
Space heating fuel - main system												2386.2075	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3923.7335	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2386.2075	7.3800	176.1021	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4195	7.3800	133.7566	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			338.0742	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2386.2075	0.2160	515.4208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4195	0.2160	391.4826	(264)
Space and water heating			906.9034	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			764.2337	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2386.2075	1.2200	2911.1732	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4195	1.2200	2211.1518	(264)
Space and water heating			5122.3249	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4278.4020	(272)
Primary energy kWh/m2/year			53.2670	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (24.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£417	£345	£72
Space heating	£305	£305	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£338	£281	£58
Total cost of uses	£339	£281	£58
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	40 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3665	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3972	0.3894	0.3816	0.3427	0.3349	0.2959	0.2959	0.2882	0.3115	0.3349	0.3505	0.3660	(22b)
Effective ac	0.5789	0.5758	0.5728	0.5587	0.5561	0.5438	0.5438	0.5415	0.5485	0.5561	0.5614	0.5670	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6629	39.4531	39.2474	38.2812	38.1004	37.2589	37.2589	37.1030	37.5830	38.1004	38.4661	38.8484	(38)
Heat transfer coeff	99.9897	99.7799	99.5742	98.6080	98.4272	97.5857	97.5857	97.4299	97.9098	98.4272	98.7929	99.1752	(39)
Average = Sum(39)m / 12 =												98.6071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2423	1.2397	1.2277	1.2254	1.2150	1.2150	1.2130	1.2190	1.2254	1.2300	1.2348	(40)
HLP (average)												1.2277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391	(61)
Total heat required for water heating calculated for each month													
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
								Total per year (kWh/year) = Sum(64)m =				766.8771	(64)
Heat gains from water heating, kWh/month													
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	10.6334	0.7200	0.7000	0.7700	13.4073	(74)
East	2.4600	19.6403	0.7200	0.7000	0.7700	16.8751	(76)
South	7.9700	46.7521	0.7200	0.7000	0.7700	130.1436	(78)

Solar gains	160.4261	271.7751	369.4078	456.0808	511.1436	508.0540	489.5307	448.0431	399.1944	299.5638	191.8455	137.5103	(83)
Total gains	715.6162	822.5953	898.8226	952.3057	973.3919	939.8545	903.5249	870.2957	840.5360	774.3073	703.7164	677.4657	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7835	55.9008	56.0163	56.5652	56.6691	57.1577	57.1577	57.2492	56.9685	56.6691	56.4593	56.2416	
alpha	4.7189	4.7267	4.7344	4.7710	4.7779	4.8105	4.8105	4.8166	4.7979	4.7779	4.7640	4.7494	
util living area													
	0.9894	0.9789	0.9571	0.9054	0.8006	0.6301	0.4682	0.5045	0.7268	0.9198	0.9794	0.9917	(86)
MIT	19.8945	20.0787	20.3287	20.6184	20.8430	20.9626	20.9926	20.9895	20.9253	20.6408	20.2117	19.8551	(87)
Th 2	19.8843	19.8863	19.8884	19.8979	19.8997	19.9080	19.9080	19.9096	19.9048	19.8997	19.8961	19.8923	(88)
util rest of house													
	0.9861	0.9724	0.9437	0.8758	0.7416	0.5366	0.3557	0.3902	0.6388	0.8882	0.9718	0.9890	(89)
MIT 2	18.4489	18.7150	19.0713	19.4749	19.7558	19.8849	19.9056	19.9057	19.8517	19.5152	18.9166	18.3976	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8119	19.0575	19.3871	19.7621	20.0288	20.1556	20.1785	20.1778	20.1213	19.7979	19.2418	18.7636	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9660	0.9362	0.8715	0.7492	0.5588	0.3840	0.4190	0.6576	0.8847	0.9658	0.9852	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	702.4784	794.6642	841.4810	829.9279	729.2941	525.1878	346.9935	364.6867	552.7332	685.0319	679.6797	667.4651	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1451.0453	1412.6309	1283.2185	1071.0876	819.7824	542.1426	349.2149	368.0749	589.5454	905.3229	1199.5258	1444.3488	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating												2658.0056	(98)
Space heating per m2											(98) / (4) =	33.0927	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2848.8806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.9338	415.2736	328.6527	173.6350	67.3233	0.0000	0.0000	0.0000	0.0000	163.8965	374.2892	578.0014	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	596.9280	445.0950	352.2537	186.1040	72.1579	0.0000	0.0000	0.0000	0.0000	175.6661	401.1674	619.5085	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.8052	102.2817	78.8939	37.2857	10.8615	0.0000	0.0000	18.9752	41.0396	83.2707	117.4519	138.0119	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5581	89.5650	89.5800	89.6420	89.7821	86.7000	86.7000	86.7000	86.7000	89.0542	89.4132	89.5830	(217)
Fuel for water heating, kWh/month	154.9890	114.1982	88.0709	41.5940	12.0976	0.0000	0.0000	21.8860	47.3352	93.5056	131.3585	154.0603	(219)
Water heating fuel used												859.0953	(219)
Annual totals kWh/year													
Space heating fuel - main system												2848.8806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3558.2002	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2848.8806	3.4800	99.1410	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	859.0953	3.4800	29.8965	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			229.2822	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7684	(257)
SAP value		89.2805	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2848.8806	0.2160	615.3582	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	859.0953	0.2160	185.5646	(264)
Space and water heating			800.9228	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			723.1892 (272)
CO2 emissions per m2			9.0000 (273)
EI value			92.2672
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4400	
Infiltration rate			0.3665	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3115	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3271	0.3037	0.3115	0.2959	0.2959	0.2882	0.2804	0.2726	0.2648	0.2882	0.2726	0.2882	(22b)
Effective ac	0.5535	0.5461	0.5485	0.5438	0.5438	0.5415	0.5393	0.5371	0.5351	0.5415	0.5371	0.5415	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.9238	37.4189	37.5830	37.2589	37.2589	37.1030	36.9514	36.8038	36.6605	37.1030	36.8038	37.1030	(38)
Heat transfer coeff	98.2506	97.7457	97.9098	97.5857	97.5857	97.4299	97.2782	97.1307	96.9873	97.4299	97.1307	97.4299	(39)
Average = Sum(39)m / 12 =												97.4912	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2232	1.2170	1.2190	1.2150	1.2150	1.2130	1.2111	1.2093	1.2075	1.2130	1.2093	1.2130	(40)
HLP (average)												1.2138	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8491	10.6889	11.8029	11.3868	11.7406	11.3322	11.6915	11.7233	11.3619	11.7771	11.4382	11.8391 (61)
Total heat required for water heating calculated for each month												
	163.2903	143.1403	148.4809	130.5460	126.0767	109.9956	103.1176	116.6361	117.5277	135.5031	146.4948	158.5018 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3896 (H8)
Utilisation factor	0.5131 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.8365 (H14)
Volume ratio Veff/V	0.8079 (H15)
Solar storage volume factor	0.9573 (H16)
Solar input	-876.6189 (H17)

Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864 (64)
								Total per year (kWh/year) = Sum(64)m =				743.7098 (64)
Heat gains from water heating, kWh/month												
	53.3165	46.7123	48.3962	42.4671	40.9519	35.6386	33.3221	37.8143	38.1406	44.0832	47.7659	51.7251 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6619	69.5124	65.0486	58.9821	55.0429	49.4981	44.7877	50.8257	52.9731	59.2516	66.3415	69.5230	(72)
Total internal gains													
	555.1901	550.8202	529.4148	496.2249	462.2482	431.8005	413.9943	422.2527	441.3416	474.7435	511.8709	539.9554	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.6100	13.4839	0.7200	0.7000	0.7700	17.0015	(74)
East	2.4600	25.1925	0.7200	0.7000	0.7700	21.6457	(76)
South	7.9700	56.7559	0.7200	0.7000	0.7700	157.9912	(78)

Solar gains	196.6383	283.4397	389.3343	487.0583	522.6411	566.2454	540.5150	503.7882	445.4034	337.2274	234.3363	165.7361 (83)
Total gains	751.8284	834.2599	918.7491	983.2832	984.8894	998.0458	954.5092	926.0408	886.7450	811.9709	746.2072	705.6915 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7709	57.0642	56.9685	57.1577	57.1577	57.2492	57.3384	57.4255	57.5104	57.2492	57.4255	57.2492	
alpha	4.7847	4.8043	4.7979	4.8105	4.8105	4.8166	4.8226	4.8284	4.8340	4.8166	4.8284	4.8166	
util living area													
	0.9849	0.9749	0.9464	0.8777	0.7501	0.5413	0.3947	0.4058	0.6491	0.8810	0.9671	0.9878	(86)
MIT	20.0291	20.1667	20.4212	20.7005	20.8951	20.9825	20.9969	20.9965	20.9590	20.7457	20.3629	20.0038	(87)
Th 2	19.9015	19.9065	19.9048	19.9080	19.9080	19.9096	19.9111	19.9126	19.9140	19.9096	19.9126	19.9096	(88)
util rest of house													
	0.9800	0.9671	0.9298	0.8410	0.6811	0.4447	0.2860	0.2944	0.5534	0.8366	0.9550	0.9839	(89)
MIT 2	18.6558	18.8559	19.2126	19.5887	19.8199	19.9006	19.9103	19.9117	19.8887	19.6560	19.1431	18.6256	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0006	19.1851	19.5161	19.8679	20.0899	20.1723	20.1832	20.1841	20.1574	19.9296	19.4494	18.9717	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9747	0.9605	0.9226	0.8395	0.6935	0.4686	0.3134	0.3225	0.5760	0.8375	0.9484	0.9792	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.8156	801.2748	847.6321	825.4626	683.0353	467.6674	299.1508	298.6881	510.7767	680.0630	707.7382	691.0158 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1385.3970	1357.2072	1225.4493	1011.7548	740.6671	474.7048	299.9254	299.5606	529.3024	831.0403	1121.8056	1361.2635 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643 (98)
Space heating												2226.3316 (98)
Space heating per m2											(98) / (4) =	27.7183 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2386.2075 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	485.5206	373.5866	281.0960	134.1304	42.8780	0.0000	0.0000	0.0000	0.0000	112.3271	298.1285	498.6643	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	520.3865	400.4144	301.2819	143.7625	45.9572	0.0000	0.0000	0.0000	0.0000	120.3934	319.5375	534.4741	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6929	102.4766	78.5897	36.2466	15.3164	0.0000	0.0000	12.9725	36.3662	79.3908	112.6716	134.9864	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4930	89.5000	89.4881	89.5093	89.3238	86.7000	86.7000	86.7000	86.7000	88.7736	89.2832	89.5083	(217)
Fuel for water heating, kWh/month	150.5066	114.4989	87.8214	40.4948	17.1471	0.0000	0.0000	14.9625	41.9449	89.4307	126.1957	150.8089	(219)
Water heating fuel used												833.8116	(219)
Annual totals kWh/year													
Space heating fuel - main system												2386.2075	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												2995.1256	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2386.2075	7.3800	176.1021	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	833.8116	7.3800	61.5353	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			280.1829	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2386.2075	0.2160	515.4208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8116	0.2160	180.1033	(264)
Space and water heating			695.5241	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			578.8044	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2386.2075	1.2200	2911.1732	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	833.8116	1.2200	1017.2501	(264)
Space and water heating			3928.4233	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3238.0004	(272)
Primary energy kWh/m2/year			40.3138	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.6100	87.1704	0.7200	0.7000	0.7650	109.1971
East	2.4600	125.2818	0.7200	0.7000	0.7650	106.9443
South	7.9700	118.5567	0.7200	0.7000	0.7650	327.8829
total:						544.0243

	Jun	Jul	Aug	
Solar gains	579	544	505	(P3)
Internal gains	429	411	419	
Total summer gains	1008	955	925	(P5)
Summer gain/loss ratio	1.66	1.57	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.12	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 425 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 425	**Prop Type Ref**	
Property	19 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	18.26
Environmental	90 B	**% DER<TER**	28.42		
CO_2 Emissions (t/year)	0.76	**DFEE**	46.08	**TFEE**	51.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.07	$kgCO_2/m^2$	Pass
	-5.19 (-28.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.34	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.08	$kWh/m^2/yr$	
	-5.2 (-10.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 426 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 426	**Prop Type Ref**	
Property	20 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.96	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.56		
CO_2 Emissions (t/year)	0.61	**DFEE**	50.92	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached Maisonette, total floor area 60 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.84 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.47 m², No overhang
Windows facing East: 1.30 m², No overhang
Windows facing South: 5.22 m², No overhang
Windows facing West: 1.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		3.8400	
Infiltration rate		0.3321	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2823	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3599	0.3528	0.3458	0.3105	0.3034	0.2682	0.2682	0.2611	0.2823	0.3034	0.3176	0.3317	(22b)
Effective ac	0.5648	0.5623	0.5598	0.5482	0.5460	0.5360	0.5360	0.5341	0.5398	0.5460	0.5504	0.5550	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.6071	26.4886	26.3724	25.8270	25.7249	25.2498	25.2498	25.1618	25.4328	25.7249	25.9314	26.1472	(38)
Heat transfer coeff	80.7887	80.6702	80.5541	80.0086	79.9065	79.4314	79.4314	79.3434	79.6144	79.9065	80.1130	80.3288	(39)
Average = Sum(39)m / 12 =												80.0081	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3407	1.3387	1.3368	1.3277	1.3260	1.3181	1.3181	1.3167	1.3212	1.3260	1.3295	1.3330	(40)
HLP (average)												1.3277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	308.2961	306.4753	295.4466	277.7386	259.9415	242.6260	231.2680	236.4967	245.4949	263.3889	283.9481	299.1929	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	429.2746	515.2394	588.8383	655.2357	696.2293	681.8683	652.1880	612.4972	567.7807	496.1499	429.3283	402.4252	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7984	51.8745	51.9492	52.3034	52.3702	52.6835	52.6835	52.7419	52.5624	52.3702	52.2353	52.0949	
alpha	4.4532	4.4583	4.4633	4.4869	4.4913	4.5122	4.5122	4.5161	4.5042	4.4913	4.4824	4.4730	
util living area													
	0.9958	0.9902	0.9761	0.9365	0.8435	0.6827	0.5205	0.5712	0.8046	0.9578	0.9914	0.9969	(86)
MIT	19.6118	19.8118	20.1058	20.4648	20.7646	20.9352	20.9848	20.9772	20.8602	20.4627	19.9618	19.5697	(87)
Th 2	19.8091	19.8106	19.8121	19.8192	19.8205	19.8266	19.8266	19.8278	19.8243	19.8205	19.8178	19.8150	(88)
util rest of house													
	0.9944	0.9868	0.9677	0.9134	0.7880	0.5817	0.3894	0.4377	0.7188	0.9376	0.9879	0.9958	(89)
MIT 2	17.9867	18.2782	18.7028	19.2108	19.5987	19.7857	19.8215	19.8191	19.7189	19.2198	18.5032	17.9294	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.6639	18.9172	19.2874	19.7333	20.0846	20.2646	20.3063	20.3017	20.1944	19.7377	19.1110	18.6129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6639	18.9172	19.2874	19.7333	20.0846	20.2646	20.3063	20.3017	20.1944	19.7377	19.1110	18.6129	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9834	0.9630	0.9114	0.8018	0.6216	0.4445	0.4937	0.7488	0.9358	0.9849	0.9942	(94)
Useful gains	426.0330	506.6895	567.0240	597.1495	558.2623	423.8603	289.8759	302.3794	425.1561	464.2944	422.8663	400.0932	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1160.4374	1130.7740	1030.0796	866.7591	669.9803	449.9506	294.3936	309.5716	485.2054	730.1610	962.2351	1157.7702	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.3969	419.3848	344.5133	194.1189	83.1182	0.0000	0.0000	0.0000	0.0000	197.8047	388.3455	563.7117	(98)
Space heating												2737.3939	(98)
Space heating per m2											(98) / (4) =	45.4264	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2946.6027	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	546.3969	419.3848	344.5133	194.1189	83.1182	0.0000	0.0000	0.0000	0.0000	197.8047	388.3455	563.7117	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	588.1560	451.4368	370.8432	208.9547	89.4706	0.0000	0.0000	0.0000	0.0000	212.9222	418.0253	606.7940	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2109	89.1362	88.9920	88.6766	88.0349	86.7000	86.7000	86.7000	86.7000	88.6627	89.0762	89.2431	(217)
Fuel for water heating, kWh/month													
	162.1012	142.2592	147.9148	130.6617	127.2214	112.8685	105.9690	119.6348	120.4782	135.6335	145.7630	157.3393	(219)
Water heating fuel used												1607.8447	(219)
Annual totals kWh/year													
Space heating fuel - main system												2946.6027	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4280.0554	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2946.6027	0.2160	636.4662	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1607.8447	0.2160	347.2944	(264)
Space and water heating			983.7606	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			841.3512	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9600	ZC1
Total Floor Area	TFA	60.2600	
Assumed number of occupants	N	1.9890	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0715	ZC2
CO2 emissions from cooking, equation (L16)		2.7669	ZC3
Total CO2 emissions		33.7985	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.7985	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1954	(36)
Total fabric heat loss	(33) + (36) = 49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890 (42)
Average daily hot water use (litres/day)	81.4382 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	45.6500	39.7329	42.3300	39.3581	39.0100	36.1452	37.3500	39.0100	39.3581	42.3300	42.5710	45.6500	(61)
Total heat required for water heating calculated for each month													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
								Total per year (kWh/year) = Sum(64)m =				1769.8350	(64)
Heat gains from water heating, kWh/month													
	55.5843	48.5662	50.4482	44.5954	43.1016	37.8141	36.0043	40.3531	40.8056	46.6704	50.0355	54.1905	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	74.7101	72.2711	67.8068	61.9381	57.9323	52.5195	48.3929	54.2380	56.6744	62.7291	69.4938	72.8367	(72)
Total internal gains													
	319.6824	317.3078	305.7271	287.4681	269.1179	251.2502	239.8956	245.6763	255.2290	273.6741	294.7833	310.5810	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	425.5386	499.9764	562.4448	617.7780	650.8697	635.5873	608.2007	574.6767	537.2292	477.3400	421.9910	400.9093	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9960	0.9910	0.9785	0.9425	0.8546	0.6936	0.5282	0.5766	0.8103	0.9599	0.9917	0.9969	(86)
MIT	19.6903	19.8732	20.1471	20.4886	20.7750	20.9402	20.9867	20.9802	20.8718	20.4978	20.0271	19.6555	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9946	0.9879	0.9710	0.9216	0.8025	0.5964	0.4015	0.4481	0.7282	0.9408	0.9883	0.9959	(89)
MIT 2	18.1361	18.4033	18.7999	19.2872	19.6610	19.8462	19.8802	19.8787	19.7834	19.3107	18.6359	18.0912	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9848	0.9667	0.9196	0.8154	0.6349	0.4547	0.5020	0.7571	0.9393	0.9857	0.9944	(94)
Useful gains	422.4614	492.3986	543.7382	568.1216	530.6913	403.5094	276.5414	288.4971	406.7427	448.3875	415.9368	398.6646	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1113.0485	1082.4655	984.2000	824.9901	637.2052	427.5177	280.5025	294.7483	461.6698	696.2112	919.7639	1108.3779	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating												2577.3801	(98)
Space heating per m2											(98) / (4) =	42.7710	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2759.5076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	550.1036	424.5449	350.8604	198.0143	84.8462	0.0000	0.0000	0.0000	0.0000	197.4099	388.3891	565.3391	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5604	87.3009	86.7856	85.6842	83.6904	80.3000	80.3000	80.3000	80.3000	85.5573	87.0343	87.6635	(217)
Fuel for water heating, kWh/month													
	203.8564	178.6033	186.9285	167.9272	166.4566	152.7955	146.3898	163.1903	164.9925	176.3323	185.0369	198.8350	(219)
Water heating fuel used												2091.3443	(219)
Annual totals kWh/year													
Space heating fuel - main system												2759.5076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Total delivered energy for all uses												5200.2131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2759.5076	0.2160	596.0536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2091.3443	0.2160	451.7304	(264)
Space and water heating			1047.7840	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Total CO2, kg/m2/year			1229.1025	(272)
Emissions per m2 for space and water heating			17.3877	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3630	(272b)
Emissions per m2 for pumps and fans			0.6460	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3877 * 1.00) + 2.3630 + 0.6460, rounded to 2 d.p.			20.4000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		3.8400	
Infiltration rate		0.3321	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2823	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3599	0.3528	0.3458	0.3105	0.3034	0.2682	0.2682	0.2611	0.2823	0.3034	0.3176	0.3317	(22b)
Effective ac	0.5648	0.5623	0.5598	0.5482	0.5460	0.5360	0.5360	0.5341	0.5398	0.5460	0.5504	0.5550	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.6071	26.4886	26.3724	25.8270	25.7249	25.2498	25.2498	25.1618	25.4328	25.7249	25.9314	26.1472	(38)
Heat transfer coeff	80.7887	80.6702	80.5541	80.0086	79.9065	79.4314	79.4314	79.3434	79.6144	79.9065	80.1130	80.3288	(39)
Average = Sum(39)m / 12 =												80.0081	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3407	1.3387	1.3368	1.3277	1.3260	1.3181	1.3181	1.3167	1.3212	1.3260	1.3295	1.3330	(40)
HLP (average)												1.3277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.9890 (42)
Average daily hot water use (litres/day)		81.4382 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	400.8945	487.5422	562.5567	630.8777	673.1204	660.5172	632.3296	590.7247	545.3271	471.7056	402.6362	374.7230	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7984	51.8745	51.9492	52.3034	52.3702	52.6835	52.6835	52.7419	52.5624	52.3702	52.2353	52.0949	
alpha	4.4532	4.4583	4.4633	4.4869	4.4913	4.5122	4.5122	4.5161	4.5042	4.4913	4.4824	4.4730	
util living area													
	0.9968	0.9920	0.9797	0.9436	0.8559	0.6984	0.5350	0.5890	0.8213	0.9644	0.9933	0.9977	(86)
MIT	19.5698	19.7718	20.0702	20.4372	20.7478	20.9289	20.9831	20.9742	20.8467	20.4321	19.9230	19.5284	(87)
Th 2	19.8091	19.8106	19.8121	19.8192	19.8205	19.8266	19.8266	19.8278	19.8243	19.8205	19.8178	19.8150	(88)
util rest of house													
	0.9957	0.9893	0.9725	0.9225	0.8026	0.5974	0.4012	0.4528	0.7382	0.9469	0.9905	0.9968	(89)
MIT 2	18.5232	18.7250	19.0204	19.3789	19.6564	19.7956	19.8227	19.8210	19.7439	19.3824	18.8821	18.4866	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9593	19.1612	19.4579	19.8199	20.1112	20.2678	20.3062	20.3015	20.2034	19.8198	19.3158	18.9207	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9593	19.1612	19.4579	19.8199	20.1112	20.2678	20.3062	20.3015	20.2034	19.8198	19.3158	18.9207	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9873	0.9698	0.9225	0.8173	0.6378	0.4575	0.5102	0.7682	0.9468	0.9889	0.9960	(94)
Useful gains	398.7575	481.3718	545.5423	582.0133	550.1281	421.2836	289.3189	301.3695	418.9270	446.6309	398.1779	373.2213	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1184.3039	1150.4555	1043.8094	873.6866	672.1098	450.2010	294.3904	309.5616	485.9213	736.7189	978.6454	1182.4990	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	584.4465	449.6243	370.7107	210.0047	90.7544	0.0000	0.0000	0.0000	0.0000	215.8254	417.9366	602.1025	(98)
Space heating												2941.4052	(98)
Space heating per m2											(98) / (4) =	48.8119	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	746.6551	587.7923	603.0100	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8659	0.9227	0.9009	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	646.4924	542.3621	543.2351	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.3257	811.9197	764.4492	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	143.8800	200.5509	164.5833	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												509.0142 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.9700	50.1377	41.1458	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												127.2535 (107)
Space cooling per m2												2.1117 (108)
Energy for space heating												48.8119 (99)
Energy for space cooling												2.1117 (108)
Total												50.9236 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	385.7722	461.4467	525.8828	583.6905	618.5844	605.6119	579.7146	543.7246	505.0413	442.6105	384.4636	361.8190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9973	0.9935	0.9834	0.9525	0.8727	0.7178	0.5512	0.6044	0.8359	0.9693	0.9943	0.9980	(86)
MIT	19.6307	19.8167	20.0964	20.4483	20.7499	20.9309	20.9842	20.9759	20.8516	20.4533	19.9718	19.5966	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9964	0.9912	0.9774	0.9344	0.8241	0.6208	0.4205	0.4721	0.7581	0.9541	0.9920	0.9973	(89)
MIT 2	18.6239	18.8105	19.0886	19.4369	19.7101	19.8537	19.8810	19.8798	19.8018	19.4491	18.9736	18.5964	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9896	0.9750	0.9341	0.8371	0.6595	0.4756	0.5278	0.7860	0.9539	0.9906	0.9966	(94)
Useful gains	384.0342	456.6256	512.7279	545.2031	517.7941	399.4181	275.6838	286.9784	396.9810	422.2205	380.8568	360.5938	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1133.0054	1098.8740	995.4685	830.3348	638.5804	427.5523	280.4571	294.6670	461.8437	700.9114	932.9704	1128.9672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.2346	431.5909	359.1590	205.2948	89.8650	0.0000	0.0000	0.0000	0.0000	207.3461	397.5218	571.6698	(98)
Space heating												2819.6819	(98)
Space heating per m2											(98) / (4) =	46.7919	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	704.7684	554.8177	568.8901	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8653	0.9238	0.9028	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.8029	512.5501	513.5980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	782.1507	750.4217	709.5141	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.0904	176.9765	145.7615	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                446.8284 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0226   44.2441   36.4404    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                111.7071 (107)
Space cooling per m2                                                                                           1.8538 (108)
Energy for space heating                                                                                      46.7919 (99)
Energy for space cooling                                                                                       1.8538 (108)
Total                                                                                                         48.6457 (109)
Target Fabric Energy Efficiency (TFEE)                                                                           55.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		3.8400	
Infiltration rate		0.3321	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2823	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2964	0.2752	0.2823	0.2682	0.2682	0.2611	0.2541	0.2470	0.2399	0.2611	0.2470	0.2611	(22b)
Effective ac	0.5439	0.5379	0.5398	0.5360	0.5360	0.5341	0.5323	0.5305	0.5288	0.5341	0.5305	0.5341	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.6252	25.3401	25.4328	25.2498	25.2498	25.1618	25.0762	24.9929	24.9119	25.1618	24.9929	25.1618	(38)
Heat transfer coeff	79.8068	79.5217	79.6144	79.4314	79.4314	79.3434	79.2578	79.1745	79.0935	79.3434	79.1745	79.3434	(39)
Average = Sum(39)m / 12 =												79.3780	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3244	1.3196	1.3212	1.3181	1.3181	1.3167	1.3153	1.3139	1.3125	1.3167	1.3139	1.3167	(40)
HLP (average)												1.3173	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
RHI water heating demand												1419	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4357	52.6236	52.5624	52.6835	52.6835	52.7419	52.7989	52.8544	52.9085	52.7419	52.8544	52.7419	
alpha	4.4957	4.5082	4.5042	4.5122	4.5122	4.5161	4.5199	4.5236	4.5272	4.5161	4.5236	4.5161	
util living area													
	0.9821	0.9713	0.9396	0.8630	0.7265	0.5188	0.3795	0.3956	0.6425	0.8758	0.9634	0.9854	(86)
MIT	19.9523	20.0943	20.3722	20.6790	20.8890	20.9807	20.9962	20.9956	20.9505	20.7124	20.3007	19.9231	(87)
Th 2	19.8218	19.8255	19.8243	19.8266	19.8266	19.8278	19.8289	19.8300	19.8310	19.8278	19.8300	19.8278	(88)
util rest of house													
	0.9764	0.9623	0.9209	0.8225	0.6531	0.4190	0.2672	0.2789	0.5414	0.8285	0.9498	0.9806	(89)
MIT 2	18.4877	18.6926	19.0812	19.4899	19.7357	19.8182	19.8280	19.8289	19.8011	19.5443	18.9932	18.4505	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0980	19.2767	19.6191	19.9854	20.2162	20.3026	20.3148	20.3150	20.2801	20.0310	19.5380	19.0641	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0980	19.2767	19.6191	19.9854	20.2162	20.3026	20.3148	20.3150	20.2801	20.0310	19.5380	19.0641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9718	0.9571	0.9170	0.8286	0.6789	0.4603	0.3142	0.3278	0.5821	0.8379	0.9456	0.9765	(94)
Useful gains	585.0887	639.9523	682.4211	673.2114	562.3350	389.9397	253.8479	253.4249	421.8098	546.7919	564.5167	552.4831	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1133.0952	1111.4513	1004.6661	832.8723	612.9113	396.9215	254.7968	254.5487	441.3481	684.8135	921.4364	1115.8970	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	407.7169	316.8474	239.7503	114.9559	37.6288	0.0000	0.0000	0.0000	0.0000	102.6881	256.9822	419.1799	(98)
Space heating												1895.7494	(98)
RHI space heating demand												1896	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		3.8400	
Infiltration rate		0.3321	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2823	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3599	0.3528	0.3458	0.3105	0.3034	0.2682	0.2682	0.2611	0.2823	0.3034	0.3176	0.3317	(22b)
Effective ac	0.5648	0.5623	0.5598	0.5482	0.5460	0.5360	0.5360	0.5341	0.5398	0.5460	0.5504	0.5550	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.6071	26.4886	26.3724	25.8270	25.7249	25.2498	25.2498	25.1618	25.4328	25.7249	25.9314	26.1472	(38)
Heat transfer coeff	80.7887	80.6702	80.5541	80.0086	79.9065	79.4314	79.4314	79.3434	79.6144	79.9065	80.1130	80.3288	(39)
Average = Sum(39)m / 12 =												80.0081	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3407	1.3387	1.3368	1.3277	1.3260	1.3181	1.3181	1.3167	1.3212	1.3260	1.3295	1.3330	(40)
HLP (average)												1.3277	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	573.9511	658.1976	725.6954	783.2436	815.0111	793.5191	760.7137	722.7411	684.1258	621.3441	563.7487	543.9766	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7984	51.8745	51.9492	52.3034	52.3702	52.6835	52.6835	52.7419	52.5624	52.3702	52.2353	52.0949	
alpha	4.4532	4.4583	4.4633	4.4869	4.4913	4.5122	4.5122	4.5161	4.5042	4.4913	4.4824	4.4730	
util living area													
	0.9871	0.9756	0.9511	0.8926	0.7782	0.6069	0.4519	0.4933	0.7190	0.9143	0.9761	0.9897	(86)
MIT	19.8212	20.0106	20.2798	20.5940	20.8356	20.9595	20.9913	20.9872	20.9132	20.6029	20.1499	19.7766	(87)
Th 2	19.8091	19.8106	19.8121	19.8192	19.8205	19.8266	19.8266	19.8278	19.8243	19.8205	19.8178	19.8150	(88)
util rest of house													
	0.9830	0.9680	0.9358	0.8594	0.7145	0.5094	0.3353	0.3735	0.6262	0.8801	0.9673	0.9864	(89)
MIT 2	18.2897	18.5622	18.9441	19.3758	19.6733	19.8024	19.8239	19.8232	19.7638	19.4004	18.7710	18.2295	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9279	19.1658	19.5007	19.8834	20.1576	20.2845	20.3103	20.3082	20.2427	19.9015	19.3456	18.8741	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9279	19.1658	19.5007	19.8834	20.1576	20.2845	20.3103	20.3082	20.2427	19.9015	19.3456	18.8741	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9628	0.9310	0.8615	0.7342	0.5489	0.3841	0.4236	0.6615	0.8828	0.9627	0.9828	(94)
Useful gains	561.8764	633.6998	675.5932	674.7267	598.3442	435.5323	292.2017	306.1802	452.5501	548.5421	542.7234	534.6246	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1181.7648	1150.8214	1047.2558	878.7681	675.8206	451.5311	294.7176	310.0937	489.0486	743.2482	981.0299	1178.7557	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	461.1970	347.5057	276.5170	146.9098	57.6425	0.0000	0.0000	0.0000	0.0000	144.8613	315.5806	479.2336	(98)
Space heating												2229.4475	(98)
Space heating per m2											(98) / (4) =	36.9971	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2399.8358	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	461.1970	347.5057	276.5170	146.9098	57.6425	0.0000	0.0000	0.0000	0.0000	144.8613	315.5806	479.2336	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	496.4445	374.0643	297.6501	158.1376	62.0479	0.0000	0.0000	0.0000	0.0000	155.9325	339.6993	515.8596	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1149	89.0216	88.8425	88.4604	87.7615	86.7000	86.7000	86.7000	86.7000	88.4197	88.9431	89.1543	(217)
Fuel for water heating, kWh/month													
	162.2759	142.4424	148.1637	130.9811	127.6178	112.8685	105.9690	119.6348	120.4782	136.0062	145.9812	157.4960	(219)
Water heating fuel used												1609.9150	(219)
Annual totals kWh/year													
Space heating fuel - main system												2399.8358	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3735.3588	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2399.8358	3.4800	83.5143	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1609.9150	3.4800	56.0250	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	274.3612	13.1900	36.1882	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			223.3470	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8912	(257)
SAP value		87.5680	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2399.8358	0.2160	518.3645	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1609.9150	0.2160	347.7416	(264)
Space and water heating			866.1062	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			723.6967	(272)
CO2 emissions per m2			12.0100	(273)
EI value			90.7871	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8804 = 3.953, stars = 4
Water heating environmental impact	0.216 / 0.8804 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		3.8400	
Infiltration rate		0.3321	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2823	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2964	0.2752	0.2823	0.2682	0.2682	0.2611	0.2541	0.2470	0.2399	0.2611	0.2470	0.2611	(22b)
Effective ac	0.5439	0.5379	0.5398	0.5360	0.5360	0.5341	0.5323	0.5305	0.5288	0.5341	0.5305	0.5341	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.6252	25.3401	25.4328	25.2498	25.2498	25.1618	25.0762	24.9929	24.9119	25.1618	24.9929	25.1618	(38)
Heat transfer coeff	79.8068	79.5217	79.6144	79.4314	79.4314	79.3434	79.2578	79.1745	79.0935	79.3434	79.1745	79.3434	(39)
Average = Sum(39)m / 12 =												79.3780	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3244	1.3196	1.3212	1.3181	1.3181	1.3167	1.3153	1.3139	1.3125	1.3167	1.3139	1.3167	(40)
HLP (average)												1.3173	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7645	10.6152	11.7353	11.3373	11.7011	11.3074	11.6741	11.6916	11.3237	11.7212	11.3656	11.7588	(61)
Total heat required for water heating calculated for each month													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3355	(64)
Heat gains from water heating, kWh/month													
	47.1129	41.2867	42.7996	37.5902	36.2744	31.6046	29.5854	33.5235	33.7970	39.0182	42.2342	45.7177	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3238	61.4386	57.5263	52.2087	48.7559	43.8953	39.7653	45.0584	46.9402	52.4439	58.6586	61.4486	(72)
Total internal gains													
	452.9726	449.4336	432.3038	405.7465	378.7232	354.2767	339.7936	346.7406	361.8399	388.5831	418.3685	440.7443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0509	668.6509	744.1941	812.4922	828.2460	847.1128	807.8760	773.1354	724.6789	652.6043	596.9739	565.7782	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4357	52.6236	52.5624	52.6835	52.6835	52.7419	52.7989	52.8544	52.9085	52.7419	52.8544	52.7419	
alpha	4.4957	4.5082	4.5042	4.5122	4.5122	4.5161	4.5199	4.5236	4.5272	4.5161	4.5236	4.5161	
util living area													
	0.9821	0.9713	0.9396	0.8630	0.7265	0.5188	0.3795	0.3956	0.6425	0.8758	0.9634	0.9854	(86)
MIT	19.9523	20.0943	20.3722	20.6790	20.8890	20.9807	20.9962	20.9956	20.9505	20.7124	20.3007	19.9231	(87)
Th 2	19.8218	19.8255	19.8243	19.8266	19.8266	19.8278	19.8289	19.8300	19.8310	19.8278	19.8300	19.8278	(88)
util rest of house													
	0.9764	0.9623	0.9209	0.8225	0.6531	0.4190	0.2672	0.2789	0.5414	0.8285	0.9498	0.9806	(89)
MIT 2	18.4877	18.6926	19.0812	19.4899	19.7357	19.8182	19.8280	19.8289	19.8011	19.5443	18.9932	18.4505	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0980	19.2767	19.6191	19.9854	20.2162	20.3026	20.3148	20.3150	20.2801	20.0310	19.5380	19.0641	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0980	19.2767	19.6191	19.9854	20.2162	20.3026	20.3148	20.3150	20.2801	20.0310	19.5380	19.0641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9718	0.9571	0.9170	0.8286	0.6789	0.4603	0.3142	0.3278	0.5821	0.8379	0.9456	0.9765	(94)
Useful gains	585.0887	639.9523	682.4211	673.2114	562.3350	389.9397	253.8479	253.4249	421.8098	546.7919	564.5167	552.4831	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1133.0952	1111.4513	1004.6661	832.8723	612.9113	396.9215	254.7968	254.5487	441.3481	684.8135	921.4364	1115.8970	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	407.7169	316.8474	239.7503	114.9559	37.6288	0.0000	0.0000	0.0000	0.0000	102.6881	256.9822	419.1799	(98)
Space heating												1895.7494	(98)
Space heating per m2											(98) / (4) =	31.4595	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2040.6344	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	407.7169	316.8474	239.7503	114.9559	37.6288	0.0000	0.0000	0.0000	0.0000	102.6881	256.9822	419.1799	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	438.8771	341.0628	258.0735	123.7416	40.5046	0.0000	0.0000	0.0000	0.0000	110.5361	276.6224	451.2163	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6120	126.8045	131.6323	115.8664	111.9992	97.8570	91.8751	103.7234	104.4546	120.2563	129.8402	140.4145	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0396	88.9615	88.7391	88.2647	87.4831	86.7000	86.7000	86.7000	86.7000	88.1451	88.7999	89.0751	(217)
Fuel for water heating, kWh/month													
	162.4132	142.5385	148.3362	131.2715	128.0238	112.8685	105.9690	119.6348	120.4782	136.4299	146.2166	157.6362	(219)
Water heating fuel used												1611.8166	(219)
Annual totals kWh/year													
Space heating fuel - main system												2040.6344	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3308.8740	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2040.6344	7.3800	150.5988	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1611.8166	7.3800	118.9521	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	274.3612	28.6600	78.6319	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			278.0817	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2040.6344	0.2160	440.7770	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.8166	0.2160	348.1524	(264)
Space and water heating			788.9294	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			610.6129	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2040.6344	1.2200	2489.5740	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1611.8166	1.2200	1966.4162	(264)
Space and water heating			4455.9902	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	274.3612	3.0700	842.2889	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3401.2088	(272)
Primary energy kWh/m2/year			56.4422	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£100	£100	£0
Mains gas	£377	£377	£0
Space heating	£279	£279	£0
Water heating	£119	£119	£0
Lighting	£79	£79	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£278	£278	£0
Total cost of uses	£278	£278	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	376.89 (P1)
Transmission heat loss coefficient	54.18 (37)
Summer heat loss coefficient	431.07 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.4700	87.1704	0.7200	0.7000	0.7650	135.2108
East	1.3000	125.2818	0.7200	0.7000	0.7650	56.5153
South	5.2200	118.5567	0.7200	0.7000	0.7650	214.7489
West	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
total:						471.2501

	Jun	Jul	Aug	
Solar gains	504	471	428	(P3)
Internal gains	351	337	344	
Total summer gains	856	808	772	(P5)
Summer gain/loss ratio	1.98	1.87	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.63	19.42	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 426 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 426	**Prop Type Ref**	
Property	20 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.96	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.56		
CO_2 Emissions (t/year)	0.61	**DFEE**	50.92	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.97		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.40	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.96	$kgCO_2/m^2$	Pass
	-6.44 (-31.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	50.92	$kWh/m^2/yr$	
	-5.0 (-8.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.84 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	4.47 m², No overhang		
Windows facing East	1.30 m², No overhang		
Windows facing South	5.22 m², No overhang		
Windows facing West	1.49 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.84 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 427 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 427	**Prop Type Ref**	
Property	21 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.14	**TER**	20.84
Environmental	92 A	**% DER<TER**	36.95		
CO_2 Emissions (t/year)	0.47	**DFEE**	48.29	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.21 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.07 m², No overhang
Windows facing East: 1.49 m², No overhang
Windows facing South: 3.80 m², No overhang
Windows facing West: 0.71 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4110	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8565	22.7282	22.6025	22.0119	21.9014	21.3870	21.3870	21.2917	21.5851	21.9014	22.1249	22.3586	(38)
Heat transfer coeff	65.7541	65.6258	65.5000	64.9095	64.7990	64.2846	64.2846	64.1893	64.4827	64.7990	65.0225	65.2562	(39)
Average = Sum(39)m / 12 =												64.9089	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2818	1.2793	1.2768	1.2653	1.2631	1.2531	1.2531	1.2513	1.2570	1.2631	1.2675	1.2721	(40)
HLP (average)												1.2653	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	274.8889	273.1952	263.3948	247.7199	232.0754	216.7746	206.6900	211.5326	219.4569	235.3038	253.5002	266.8876	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	367.1472	433.2278	490.5501	543.7793	577.6475	566.1574	540.8941	507.7218	470.2461	414.3310	364.5163	345.5171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1792	54.2851	54.3893	54.8841	54.9777	55.4176	55.4176	55.4999	55.2474	54.9777	54.7887	54.5925	
alpha	4.6119	4.6190	4.6260	4.6589	4.6652	4.6945	4.6945	4.7000	4.6832	4.6652	4.6526	4.6395	
util living area													
	0.9957	0.9903	0.9767	0.9366	0.8405	0.6737	0.5107	0.5616	0.8005	0.9575	0.9912	0.9968	(86)
MIT	19.6904	19.8776	20.1578	20.5049	20.7899	20.9461	20.9881	20.9818	20.8770	20.5028	20.0276	19.6534	(87)
Th 2	19.8552	19.8571	19.8590	19.8681	19.8698	19.8777	19.8777	19.8792	19.8747	19.8698	19.8664	19.8628	(88)
util rest of house													
	0.9943	0.9871	0.9686	0.9140	0.7858	0.5763	0.3867	0.4346	0.7166	0.9375	0.9877	0.9957	(89)
MIT 2	18.1328	18.4060	18.8110	19.3036	19.6715	19.8436	19.8737	19.8722	19.7817	19.3122	18.6324	18.0842	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.8448	19.0787	19.4267	19.8528	20.1827	20.3475	20.3831	20.3794	20.2824	19.8565	19.2702	18.8015	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8448	19.0787	19.4267	19.8528	20.1827	20.3475	20.3831	20.3794	20.2824	19.8565	19.2702	18.8015	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9841	0.9647	0.9136	0.8024	0.6191	0.4438	0.4930	0.7499	0.9372	0.9852	0.9942	(94)
Useful gains	364.3998	426.3561	473.2258	496.7952	463.5294	350.4985	240.0229	250.3065	352.6592	388.3247	359.1112	343.5202	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	956.3796	930.4864	846.6976	710.9382	549.6708	369.4788	243.1961	255.4360	398.6548	599.8087	791.3347	952.8379	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	440.4330	338.7756	277.8630	154.1830	64.0892	0.0000	0.0000	0.0000	0.0000	157.3441	311.2009	453.3324	(98)
Space heating												2197.2211	(98)
Space heating per m2											(98) / (4) =	42.8308	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2365.1465	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	440.4330	338.7756	277.8630	154.1830	64.0892	0.0000	0.0000	0.0000	0.0000	157.3441	311.2009	453.3324	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	474.0936	364.6669	299.0990	165.9666	68.9873	0.0000	0.0000	0.0000	0.0000	169.3694	334.9848	487.9789	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1304	89.0512	88.8961	88.5543	87.8903	86.7000	86.7000	86.7000	86.7000	88.5412	88.9816	89.1639	(217)
Fuel for water heating, kWh/month													
	150.8926	132.4560	137.8012	121.8521	118.7402	105.2670	98.9250	111.5511	112.2971	126.4827	135.7756	146.4866	(219)
Water heating fuel used												1498.5272	(219)
Annual totals kWh/year													
Space heating fuel - main system												2365.1465	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3554.2074	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2365.1465	0.2160	510.8717	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1498.5272	0.2160	323.6819	(264)
Space and water heating			834.5535	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			673.9405	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.1400	ZC1
Total Floor Area	TFA	51.3000	
Assumed number of occupants	N	1.7284	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3973	ZC2
CO2 emissions from cooking, equation (L16)		3.1283	ZC3
Total CO2 emissions		33.6656	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.6656	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	42.1812	36.7137	39.1135	36.3674	36.0458	33.3986	34.5119	36.0458	36.3674	39.1135	39.3361	42.1812	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (64)
								Total per year (kWh/year) = Sum(64)m =				1635.3511 (64)
Heat gains from water heating, kWh/month												
	51.3606	44.8758	46.6148	41.2068	39.8265	34.9407	33.2685	37.2868	37.7049	43.1241	46.2335	50.0728 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	69.0331	66.7794	62.6544	57.2316	53.5302	48.5287	44.7157	50.1166	52.3679	57.9625	64.2132	67.3021	(72)
Total internal gains													
	285.1184	282.9126	272.6018	256.4172	240.2613	224.4500	214.3683	219.7213	228.1583	244.5148	263.2200	277.1187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	365.8443	422.9412	471.3626	515.4692	542.6370	530.1600	506.7969	478.8869	447.5989	401.1636	360.3591	345.9195	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9958	0.9910	0.9790	0.9432	0.8539	0.6892	0.5231	0.5715	0.8088	0.9596	0.9914	0.9967	(86)
MIT	19.7466	19.9180	20.1805	20.5130	20.7901	20.9468	20.9887	20.9829	20.8819	20.5242	20.0736	19.7157	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9944	0.9880	0.9717	0.9226	0.8025	0.5942	0.4008	0.4472	0.7280	0.9407	0.9880	0.9957	(89)
MIT 2	18.2391	18.4898	18.8702	19.3460	19.7073	19.8839	19.9143	19.9133	19.8239	19.3718	18.7257	18.2007	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9853	0.9681	0.9220	0.8178	0.6358	0.4571	0.5043	0.7600	0.9405	0.9856	0.9942	(94)
Useful gains	363.1533	416.7065	456.3210	475.2761	443.7621	337.0971	231.6373	241.5204	340.1922	377.2926	355.1631	343.9302	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	928.3313	901.6352	819.0285	685.4691	529.6690	355.8228	234.6796	246.3539	384.3176	579.2762	765.9678	923.5361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating												2108.7545	(98)
Space heating per m2											(98) / (4) =	41.1063	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2257.7671	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	450.2060	348.8994	288.9233	162.0331	68.4312	0.0000	0.0000	0.0000	0.0000	160.8948	316.6803	461.6989	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3062	87.0435	86.5140	85.3779	83.3912	80.3000	80.3000	80.3000	80.3000	85.2405	86.7480	87.4103	(217)
Fuel for water heating, kWh/month													
	188.9145	165.5197	173.2665	155.7237	154.3598	141.1851	135.2661	150.7900	152.4553	163.5389	171.5409	184.2584	(219)
Water heating fuel used												1936.8188	(219)
Annual totals kWh/year													
Space heating fuel - main system												2257.7671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Total delivered energy for all uses												4508.8727	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2257.7671	0.2160	487.6777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1936.8188	0.2160	418.3529	(264)
Space and water heating			906.0306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Total CO2, kg/m2/year			1069.1454	(272)
Emissions per m2 for space and water heating			17.6614	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4209	(272b)
Emissions per m2 for pumps and fans			0.7588	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6614 * 1.00) + 2.4209 + 0.7588, rounded to 2 d.p.			20.8400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4110	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8565	22.7282	22.6025	22.0119	21.9014	21.3870	21.3870	21.2917	21.5851	21.9014	22.1249	22.3586	(38)
Heat transfer coeff	65.7541	65.6258	65.5000	64.9095	64.7990	64.2846	64.2846	64.1893	64.4827	64.7990	65.0225	65.2562	(39)
Average = Sum(39)m / 12 =												64.9089	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2818	1.2793	1.2768	1.2653	1.2631	1.2531	1.2531	1.2513	1.2570	1.2631	1.2675	1.2721	(40)
HLP (average)												1.2653	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	340.4040	407.1154	465.7453	520.7514	555.7735	545.9073	522.0229	487.0824	448.9776	391.2236	339.3323	319.4003	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1792	54.2851	54.3893	54.8841	54.9777	55.4176	55.4176	55.4999	55.2474	54.9777	54.7887	54.5925	
alpha	4.6119	4.6190	4.6260	4.6589	4.6652	4.6945	4.6945	4.7000	4.6832	4.6652	4.6526	4.6395	
util living area													
	0.9969	0.9925	0.9808	0.9449	0.8551	0.6921	0.5274	0.5821	0.8203	0.9652	0.9934	0.9977	(86)
MIT	19.6435	19.8329	20.1179	20.4741	20.7715	20.9397	20.9865	20.9789	20.8624	20.4685	19.9842	19.6073	(87)
Th 2	19.8552	19.8571	19.8590	19.8681	19.8698	19.8777	19.8777	19.8792	19.8747	19.8698	19.8664	19.8628	(88)
util rest of house													
	0.9958	0.9899	0.9740	0.9246	0.8029	0.5945	0.4002	0.4521	0.7394	0.9483	0.9907	0.9969	(89)
MIT 2	18.6326	18.8223	19.1050	19.4549	19.7206	19.8512	19.8745	19.8736	19.8021	19.4578	18.9811	18.6025	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.0947	19.2842	19.5680	19.9208	20.2010	20.3488	20.3828	20.3788	20.2868	19.9198	19.4397	19.0618	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0947	19.2842	19.5680	19.9208	20.2010	20.3488	20.3828	20.3788	20.2868	19.9198	19.4397	19.0618	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9882	0.9718	0.9257	0.8198	0.6377	0.4589	0.5120	0.7721	0.9492	0.9894	0.9961	(94)
Useful gains	338.6543	402.3134	452.6011	482.0625	455.6251	348.1110	239.5314	249.4038	346.6673	371.3453	335.7319	318.1593	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	972.8106	943.9766	855.9553	715.3524	550.8554	369.5576	243.1769	255.3991	398.9405	603.9149	802.3554	969.8269	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	471.8123	363.9977	300.0955	167.9687	70.8513	0.0000	0.0000	0.0000	0.0000	173.0318	335.9689	484.8407	(98)
Space heating												2368.5669	(98)
Space heating per m2											(98) / (4) =	46.1709	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	604.2750	475.7059	487.8388	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8807	0.9336	0.9134	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	532.1864	444.1335	445.6019	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.4180	674.2629	634.4069	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	123.2868	171.2162	140.4710	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												434.9740	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   30.8217   42.8041   35.1177    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          108.7435 (107)
Space cooling per m2                                                                                                     2.1198 (108)
Energy for space heating                                                                                                46.1709 (99)
Energy for space cooling                                                                                                 2.1198 (108)
Total                                                                                                                   48.2907 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   48.3 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	328.8717	387.1113	437.3509	483.7440	512.5770	502.2344	480.2474	450.0588	417.6289	368.8452	325.4553	309.5716	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9973	0.9937	0.9843	0.9543	0.8745	0.7167	0.5490	0.6028	0.8379	0.9702	0.9944	0.9980	(86)
MIT	19.6812	19.8559	20.1246	20.4686	20.7627	20.9370	20.9861	20.9785	20.8600	20.4752	20.0128	19.6509	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9964	0.9916	0.9786	0.9370	0.8270	0.6218	0.4222	0.4742	0.7619	0.9556	0.9921	0.9973	(89)
MIT 2	18.6980	18.8736	19.1413	19.4834	19.7502	19.8898	19.9149	19.9142	19.8388	19.4970	19.0396	18.6753	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9902	0.9767	0.9375	0.8417	0.6636	0.4807	0.5335	0.7923	0.9561	0.9909	0.9966	(94)
Useful gains	327.4139	383.3033	427.1509	453.4944	431.4587	333.2823	230.8535	240.1229	330.9076	352.6689	322.4907	308.5312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.2408	913.0286	826.7081	688.8592	530.3395	355.7443	234.6264	246.2593	384.1998	582.1139	774.8944	937.8715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	457.4312	355.9754	297.2706	169.4627	73.5673	0.0000	0.0000	0.0000	0.0000	170.7070	325.7306	468.2292	(98)
Space heating												2318.3740	(98)
Space heating per m2											(98) / (4) =	45.1925	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	579.6997	456.3593	467.8108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8741	0.9304	0.9103	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	506.7211	424.5918	425.8391	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	652.3719	625.4344	591.1325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.8686	149.4268	122.9784	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												377.2738	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.2171   37.3567   30.7446    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              94.3184 (107)
Space cooling per m2                                                                                                        1.8386 (108)
Energy for space heating                                                                                                   45.1925 (99)
Energy for space cooling                                                                                                    1.8386 (108)
Total                                                                                                                      47.0310 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                      54.1 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3385	0.3143	0.3224	0.3063	0.3063	0.2982	0.2901	0.2821	0.2740	0.2982	0.2821	0.2982	(22b)
Effective ac	0.5573	0.5494	0.5520	0.5469	0.5469	0.5445	0.5421	0.5398	0.5375	0.5445	0.5398	0.5445	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.7934	21.4848	21.5851	21.3870	21.3870	21.2917	21.1990	21.1088	21.0212	21.2917	21.1088	21.2917	(38)
Heat transfer coeff	64.6910	64.3824	64.4827	64.2846	64.2846	64.1893	64.0966	64.0064	63.9188	64.1893	64.0064	64.1893	(39)
Average = Sum(39)m / 12 =												64.2268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2610	1.2550	1.2570	1.2531	1.2531	1.2513	1.2494	1.2477	1.2460	1.2513	1.2477	1.2513	(40)
HLP (average)												1.2520	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397 (64)
RHI water heating demand												1322 (64)
Heat gains from water heating, kWh/month												
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0695	55.3335	55.2474	55.4176	55.4176	55.4999	55.5802	55.6585	55.7348	55.4999	55.6585	55.4999	
alpha	4.6713	4.6889	4.6832	4.6945	4.6945	4.7000	4.7053	4.7106	4.7157	4.7000	4.7106	4.7000	
util living area	0.9807	0.9696	0.9369	0.8568	0.7143	0.5052	0.3681	0.3839	0.6292	0.8685	0.9604	0.9840	(86)
MIT	20.0391	20.1724	20.4320	20.7191	20.9085	20.9854	20.9973	20.9969	20.9607	20.7496	20.3702	20.0149	(87)
Th 2	19.8715	19.8762	19.8747	19.8777	19.8777	19.8792	19.8806	19.8820	19.8834	19.8792	19.8820	19.8792	(88)
util rest of house	0.9746	0.9604	0.9180	0.8162	0.6427	0.4111	0.2637	0.2753	0.5325	0.8209	0.9462	0.9789	(89)
MIT 2	18.6477	18.8407	19.2024	19.5834	19.8029	19.8719	19.8800	19.8813	19.8596	19.6331	19.1291	18.6192	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2837	19.4494	19.7645	20.1025	20.3083	20.3809	20.3908	20.3912	20.3629	20.1435	19.6964	19.2572	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2837	19.4494	19.7645	20.1025	20.3083	20.3809	20.3908	20.3912	20.3629	20.1435	19.6964	19.2572	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9706	0.9561	0.9158	0.8251	0.6715	0.4540	0.3116	0.3251	0.5756	0.8334	0.9434	0.9752	(94)
Useful gains	500.8233	542.4057	573.2334	561.3863	465.8596	321.4843	210.3166	209.9317	348.3612	457.6740	479.6582	474.7318	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	930.4975	910.9726	823.0896	681.5804	501.9538	326.1395	210.9260	210.6586	361.9658	561.2368	755.0455	915.1611	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	319.6777	247.6770	185.8930	86.5397	26.8541	0.0000	0.0000	0.0000	0.0000	77.0508	198.2788	327.6794	(98)
Space heating												1469.6505	(98)
RHI space heating demand												1470	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4110	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788	(22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.8565	22.7282	22.6025	22.0119	21.9014	21.3870	21.3870	21.2917	21.5851	21.9014	22.1249	22.3586	(38)
Heat transfer coeff	65.7541	65.6258	65.5000	64.9095	64.7990	64.2846	64.2846	64.1893	64.4827	64.7990	65.0225	65.2562	(39)
Average = Sum(39)m / 12 =												64.9089	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2818	1.2793	1.2768	1.2653	1.2631	1.2531	1.2531	1.2513	1.2570	1.2631	1.2675	1.2721	(40)
HLP (average)												1.2653	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	494.3932	558.9712	610.9826	656.5158	682.3650	664.6815	636.7099	605.0403	572.8755	524.6564	482.8607	470.0549	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1792	54.2851	54.3893	54.8841	54.9777	55.4176	55.4176	55.4999	55.2474	54.9777	54.7887	54.5925	
alpha	4.6119	4.6190	4.6260	4.6589	4.6652	4.6945	4.6945	4.7000	4.6832	4.6652	4.6526	4.6395	
util living area													
	0.9860	0.9744	0.9494	0.8883	0.7688	0.5924	0.4387	0.4793	0.7070	0.9091	0.9740	0.9887	(86)
MIT	19.9083	20.0844	20.3385	20.6374	20.8600	20.9683	20.9937	20.9905	20.9283	20.6467	20.2230	19.8689	(87)
Th 2	19.8552	19.8571	19.8590	19.8681	19.8698	19.8777	19.8777	19.8792	19.8747	19.8698	19.8664	19.8628	(88)
util rest of house													
	0.9816	0.9666	0.9340	0.8549	0.7060	0.4996	0.3297	0.3670	0.6169	0.8743	0.9647	0.9851	(89)
MIT 2	18.4477	18.7012	19.0613	19.4724	19.7447	19.8587	19.8757	19.8758	19.8248	19.4968	18.9101	18.3964	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1153	19.3335	19.6451	20.0050	20.2545	20.3659	20.3867	20.3853	20.3292	20.0225	19.5103	19.0695	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1153	19.3335	19.6451	20.0050	20.2545	20.3659	20.3867	20.3853	20.3292	20.0225	19.5103	19.0695	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9779	0.9622	0.9305	0.8594	0.7288	0.5412	0.3797	0.4185	0.6553	0.8797	0.9610	0.9818	(94)
Useful gains	483.4854	537.8336	568.5248	564.2395	497.3069	359.6973	241.7739	253.2139	375.4223	461.5336	464.0453	461.5158	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	974.1692	947.2077	861.0071	720.8174	554.3249	370.6605	243.4284	255.8162	401.6778	610.5650	806.9461	970.3276	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	365.0688	275.0994	217.6068	112.7361	42.4214	0.0000	0.0000	0.0000	0.0000	110.8794	246.8886	378.5560	(98)
Space heating												1749.2564	(98)
Space heating per m2											(98) / (4) =	34.0986	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1882.9456	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	365.0688	275.0994	217.6068	112.7361	42.4214	0.0000	0.0000	0.0000	0.0000	110.8794	246.8886	378.5560	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	392.9696	296.1242	234.2377	121.3521	45.6635	0.0000	0.0000	0.0000	0.0000	119.3535	265.7574	407.4876	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0155	88.9152	88.7206	88.3060	87.6012	86.7000	86.7000	86.7000	86.7000	88.2630	88.8228	89.0568	(217)
Fuel for water heating, kWh/month	151.0874	132.6586	138.0738	122.1947	119.1320	105.2670	98.9250	111.5511	112.2971	126.8813	136.0182	146.6627	(219)
Water heating fuel used												1500.7491	(219)
Annual totals kWh/year													
Space heating fuel - main system												1882.9456	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3074.2283	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1882.9456	3.4800	65.5265	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1500.7491	3.4800	52.2261	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	239.2868	13.1900	31.5619	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			196.9340	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8589	(257)
SAP value		88.0183	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1882.9456	0.2160	406.7162	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1500.7491	0.2160	324.1618	(264)
Space and water heating			730.8780	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			570.2650	(272)
CO2 emissions per m2			11.1200	(273)
EI value			92.0648	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8796 = 3.956, stars = 4
Water heating environmental impact	0.216 / 0.8796 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3793	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3224	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3385	0.3143	0.3224	0.3063	0.3063	0.2982	0.2901	0.2821	0.2740	0.2982	0.2821	0.2982	(22b)
Effective ac	0.5573	0.5494	0.5520	0.5469	0.5469	0.5445	0.5421	0.5398	0.5375	0.5445	0.5398	0.5445	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.7934	21.4848	21.5851	21.3870	21.3870	21.2917	21.1990	21.1088	21.0212	21.2917	21.1088	21.2917	(38)
Heat transfer coeff	64.6910	64.3824	64.4827	64.2846	64.2846	64.1893	64.0966	64.0064	63.9188	64.1893	64.0064	64.1893	(39)
Average = Sum(39)m / 12 =												64.2268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2610	1.2550	1.2570	1.2531	1.2531	1.2513	1.2494	1.2477	1.2460	1.2513	1.2477	1.2513	(40)
HLP (average)												1.2520	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7284	(42)
Average daily hot water use (litres/day)												75.2500	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0695	55.3335	55.2474	55.4176	55.4176	55.4999	55.5802	55.6585	55.7348	55.4999	55.6585	55.4999	
alpha	4.6713	4.6889	4.6832	4.6945	4.6945	4.7000	4.7053	4.7106	4.7157	4.7000	4.7106	4.7000	
util living area													
	0.9807	0.9696	0.9369	0.8568	0.7143	0.5052	0.3681	0.3839	0.6292	0.8685	0.9604	0.9840	(86)
MIT	20.0391	20.1724	20.4320	20.7191	20.9085	20.9854	20.9973	20.9969	20.9607	20.7496	20.3702	20.0149	(87)
Th 2	19.8715	19.8762	19.8747	19.8777	19.8777	19.8792	19.8806	19.8820	19.8834	19.8792	19.8820	19.8792	(88)
util rest of house													
	0.9746	0.9604	0.9180	0.8162	0.6427	0.4111	0.2637	0.2753	0.5325	0.8209	0.9462	0.9789	(89)
MIT 2	18.6477	18.8407	19.2024	19.5834	19.8029	19.8719	19.8800	19.8813	19.8596	19.6331	19.1291	18.6192	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2837	19.4494	19.7645	20.1025	20.3083	20.3809	20.3908	20.3912	20.3629	20.1435	19.6964	19.2572	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2837	19.4494	19.7645	20.1025	20.3083	20.3809	20.3908	20.3912	20.3629	20.1435	19.6964	19.2572	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9706	0.9561	0.9158	0.8251	0.6715	0.4540	0.3116	0.3251	0.5756	0.8334	0.9434	0.9752	(94)
Useful gains	500.8233	542.4057	573.2334	561.3863	465.8596	321.4843	210.3166	209.9317	348.3612	457.6740	479.6582	474.7318	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	930.4975	910.9726	823.0896	681.5804	501.9538	326.1395	210.9260	210.6586	361.9658	561.2368	755.0455	915.1611	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	319.6777	247.6770	185.8930	86.5397	26.8541	0.0000	0.0000	0.0000	0.0000	77.0508	198.2788	327.6794	(98)
Space heating												1469.6505	(98)
Space heating per m2											(98) / (4) =	28.6482	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1581.9704	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	319.6777	247.6770	185.8930	86.5397	26.8541	0.0000	0.0000	0.0000	0.0000	77.0508	198.2788	327.6794	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	344.1094	266.6060	200.1001	93.1536	28.9065	0.0000	0.0000	0.0000	0.0000	82.9395	213.4325	352.7227	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9280	88.8422	88.6010	88.0956	87.3362	86.7000	86.7000	86.7000	86.7000	87.9764	88.6610	88.9642	(217)
Fuel for water heating, kWh/month													
	151.2360	132.7676	138.2601	122.4866	119.4935	105.2670	98.9250	111.5511	112.2971	127.2948	136.2665	146.8154	(219)
Water heating fuel used												1502.6606	(219)
Annual totals kWh/year													
Space heating fuel - main system												1581.9704	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												2705.9796	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1581.9704	7.3800	116.7494	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.6606	7.3800	110.8964	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	239.2868	28.6600	68.5796	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			226.1243	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1581.9704	0.2160	341.7056	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6606	0.2160	324.5747	(264)
Space and water heating			666.2803	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			469.7602	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1581.9704	1.2200	1930.0038	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.6606	1.2200	1833.2460	(264)
Space and water heating			3763.2498	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	239.2868	3.0700	734.6105	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			2600.7900	(272)
Primary energy kWh/m2/year			50.6977	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£90	£90	£0
Mains gas	£335	£335	£0
Space heating	£245	£245	£0
Water heating	£111	£111	£0
Lighting	£69	£69	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£226	£226	£0
Total cost of uses	£226	£226	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	234.64 (P1)
Transmission heat loss coefficient	42.90 (37)
Summer heat loss coefficient	277.53 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0700	87.1704	0.7200	0.7000	0.7650	123.1114
East	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
South	3.8000	118.5567	0.7200	0.7000	0.7650	156.3306
West	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
total:						375.0832

	Jun	Jul	Aug	
Solar gains	402	375	338	(P3)
Internal gains	312	300	306	
Total summer gains	714	675	644	(P5)
Summer gain/loss ratio	2.57	2.43	2.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.22	19.98	19.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 427 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 427	**Prop Type Ref**	
Property	21 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.14	**TER**	20.84
Environmental	92 A	**% DER<TER**	36.95		
CO_2 Emissions (t/year)	0.47	**DFEE**	48.29	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.84	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.14	$kgCO_2/m^2$	Pass
	-7.70 (-36.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.09	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.29	$kWh/m^2/yr$	
	-5.8 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.07 m², No overhang
Windows facing East	1.49 m², No overhang
Windows facing South	3.80 m², No overhang
Windows facing West	0.71 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 428 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 428	**Prop Type Ref**	
Property	22 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.81	**TER**	18.42
Environmental	90 B	**% DER<TER**	25.04		
CO_2 Emissions (t/year)	0.79	**DFEE**	46.68	**TFEE**	51.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.81 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.37 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.75 m², No overhang
Windows facing South: 6.47 m², No overhang
Windows facing West: 0.50 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.4630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5018	0.4920	0.4821	0.4329	0.4231	0.3739	0.3739	0.3641	0.3936	0.4231	0.4428	0.4625	(22b)
Effective ac	0.6259	0.6210	0.6162	0.5937	0.5895	0.5699	0.5699	0.5663	0.5775	0.5895	0.5980	0.6069	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2338	41.9039	41.5805	40.0617	39.7775	38.4547	38.4547	38.2097	38.9642	39.7775	40.3524	40.9534	(38)
Heat transfer coeff	99.5695	99.2396	98.9162	97.3974	97.1132	95.7903	95.7903	95.5454	96.2999	97.1132	97.6881	98.2891	(39)
Average = Sum(39)m / 12 =												97.3960	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2588	1.2546	1.2505	1.2313	1.2277	1.2110	1.2110	1.2079	1.2174	1.2277	1.2350	1.2426	(40)
HLP (average)												1.2313	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	372.0331	369.8566	356.3243	334.5799	312.5409	291.3553	277.6472	283.6869	294.9179	316.8731	342.0423	360.8803	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	498.7541	583.3068	645.0673	691.8198	715.8320	694.0869	664.8711	635.5525	606.8871	551.5920	493.3128	469.6987	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1681	55.3515	55.5324	56.3984	56.5634	57.3446	57.3446	57.4916	57.0411	56.5634	56.2306	55.8867	
alpha	4.6779	4.6901	4.7022	4.7599	4.7709	4.8230	4.8230	4.8328	4.8027	4.7709	4.7487	4.7258	
util living area													
	0.9975	0.9944	0.9870	0.9657	0.9074	0.7732	0.6062	0.6509	0.8629	0.9739	0.9948	0.9981	(86)
MIT	19.6433	19.8142	20.0700	20.4028	20.7031	20.9103	20.9784	20.9697	20.8349	20.4465	19.9862	19.6194	(87)
Th 2	19.8733	19.8766	19.8798	19.8950	19.8979	19.9112	19.9112	19.9137	19.9061	19.8979	19.8921	19.8861	(88)
util rest of house													
	0.9966	0.9924	0.9822	0.9519	0.8676	0.6807	0.4699	0.5165	0.7921	0.9607	0.9926	0.9975	(89)
MIT 2	18.0768	18.3281	18.7017	19.1884	19.5976	19.8487	19.9031	19.9009	19.7714	19.2582	18.5907	18.0506	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3802	18.6159	18.9667	19.4236	19.8117	20.0543	20.1113	20.1079	19.9773	19.4883	18.8610	18.3545	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3802	18.6159	18.9667	19.4236	19.8117	20.0543	20.1113	20.1079	19.9773	19.4883	18.8610	18.3545	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9892	0.9768	0.9442	0.8638	0.6943	0.4964	0.5423	0.7976	0.9539	0.9896	0.9961	(94)
Useful gains	496.1924	576.9917	630.0806	653.1858	618.3253	481.8746	330.0187	344.6497	484.0398	526.1638	488.1924	467.8570	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1401.9541	1361.1649	1233.1601	1024.9721	787.7564	522.4727	336.3512	354.2727	565.9870	863.1751	1148.9065	1391.2302	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	673.8866	526.9644	448.6911	267.6861	126.0567	0.0000	0.0000	0.0000	0.0000	250.7364	475.7141	686.9896	(98)
Space heating												3456.7251	(98)
Space heating per m2											(98) / (4) =	43.7007	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3720.9097	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	673.8866	526.9644	448.6911	267.6861	126.0567	0.0000	0.0000	0.0000	0.0000	250.7364	475.7141	686.9896	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	725.3893	567.2383	482.9829	288.1444	135.6908	0.0000	0.0000	0.0000	0.0000	269.8992	512.0712	739.4937	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2604	89.1999	89.0859	88.8293	88.2753	86.7000	86.7000	86.7000	86.7000	88.7549	89.1289	89.2851	(217)
Fuel for water heating, kWh/month													
	181.8820	159.5499	165.7272	146.1462	142.0411	126.1921	118.3152	133.8039	134.8180	151.8189	163.4255	176.5037	(219)
Water heating fuel used												1800.2238	(219)
Annual totals kWh/year													
Space heating fuel - main system												3720.9097	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5328.7018	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3720.9097	0.2160	803.7165	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.2238	0.2160	388.8483	(264)
Space and water heating			1192.5648	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1092.6928	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.8100	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.3542	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.3542	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.6300	0.7000	0.7700	15.4361	(74)
South	6.4700	46.7521	0.6300	0.7000	0.7700	92.4436	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	110.8809	186.7689	252.6501	312.5849	352.8797	352.3901	338.8209	307.8824	272.9730	205.3790	132.3617	95.2161	(83)
Total gains	496.0682	569.4103	621.1346	658.7016	676.3314	654.0314	626.7585	602.4842	579.4338	534.4185	487.1923	469.2531	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9976	0.9947	0.9879	0.9676	0.9098	0.7729	0.6014	0.6442	0.8603	0.9740	0.9949	0.9982	(86)
MIT	19.7734	19.9274	20.1604	20.4627	20.7385	20.9250	20.9835	20.9767	20.8607	20.5081	20.0852	19.7472	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9967	0.9929	0.9835	0.9547	0.8720	0.6846	0.4734	0.5177	0.7917	0.9612	0.9928	0.9975	(89)
MIT 2	18.3231	18.5492	18.8892	19.3300	19.7057	19.9295	19.9759	19.9741	19.8641	19.4008	18.7886	18.2916	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6040	18.8162	19.1354	19.5494	19.9057	20.1223	20.1711	20.1683	20.0571	19.6153	19.0397	18.5735	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6040	18.8162	19.1354	19.5494	19.9057	20.1223	20.1711	20.1683	20.0571	19.6153	19.0397	18.5735	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9900	0.9787	0.9479	0.8690	0.6980	0.4983	0.5420	0.7979	0.9551	0.9900	0.9963	(94)
Useful gains	493.6578	563.7362	607.8880	624.3917	587.7594	456.5420	312.2861	326.5697	462.3414	510.4455	482.3327	467.5026	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1309.9778	1271.0922	1151.1127	958.3086	736.6962	490.4190	317.1379	333.9757	531.2642	809.3753	1076.9699	1302.8365	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	607.3420	475.3432	404.1592	240.4202	110.8090	0.0000	0.0000	0.0000	0.0000	222.4038	428.1388	621.4884	(98)
Space heating												3110.1045	(98)
Space heating per m2											(98) / (4) =	39.3186	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3329.8764	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.3420	475.3432	404.1592	240.4202	110.8090	0.0000	0.0000	0.0000	0.0000	222.4038	428.1388	621.4884	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	650.2591	508.9328	432.7186	257.4092	118.6392	0.0000	0.0000	0.0000	0.0000	238.1197	458.3927	665.4052	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6535	87.4205	86.9797	86.0273	84.1790	80.3000	80.3000	80.3000	80.3000	85.7145	87.1250	87.7462	(217)
Fuel for water heating, kWh/month													
	229.8776	202.1084	211.3463	189.5287	187.5263	173.1411	165.8823	184.9199	186.9622	199.4453	209.4572	224.2214	(219)
Water heating fuel used												2364.4167	(219)
Annual totals kWh/year													
Space heating fuel - main system												3329.8764	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6132.3038	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3329.8764	0.2160	719.2533	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4167	0.2160	510.7140	(264)
Space and water heating			1229.9673	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1457.2948	(272)
Emissions per m2 for space and water heating			15.5495	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5495 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.4200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.3652	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3104	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3958	0.3880	0.3803	0.3415	0.3337	0.2949	0.2949	0.2872	0.3104	0.3337	0.3492	0.3648	(22b)
Effective ac	0.5783	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5412	0.5482	0.5557	0.5610	0.5665	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.0236	38.8184	38.6172	37.6723	37.4955	36.6725	36.6725	36.5201	36.9895	37.4955	37.8531	38.2270	(38)
Heat transfer coeff	96.3593	96.1540	95.9528	95.0079	94.8311	94.0081	94.0081	93.8557	94.3251	94.8311	95.1888	95.5627	(39)
Average = Sum(39)m / 12 =												95.0071	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2182	1.2156	1.2131	1.2011	1.1989	1.1885	1.1885	1.1865	1.1925	1.1989	1.2034	1.2081	(40)
HLP (average)												1.2011	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	467.5049	552.8310	616.1965	665.1296	690.5580	670.8056	643.2819	611.7934	582.3556	524.8039	463.9763	439.2181	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0060	57.1277	57.2475	57.8168	57.9246	58.4317	58.4317	58.5266	58.2353	57.9246	57.7070	57.4812	
alpha	4.8004	4.8085	4.8165	4.8545	4.8616	4.8954	4.8954	4.9018	4.8824	4.8616	4.8471	4.8321	
util living area													
	0.9981	0.9954	0.9889	0.9692	0.9133	0.7823	0.6145	0.6626	0.8726	0.9777	0.9959	0.9986	(86)
MIT	19.6601	19.8293	20.0821	20.4060	20.7043	20.9093	20.9784	20.9689	20.8319	20.4432	19.9875	19.6291	(87)
Th 2	19.9055	19.9075	19.9096	19.9191	19.9209	19.9292	19.9292	19.9308	19.9260	19.9209	19.9173	19.9135	(88)
util rest of house													
	0.9975	0.9939	0.9848	0.9566	0.8755	0.6917	0.4791	0.5290	0.8051	0.9662	0.9943	0.9981	(89)
MIT 2	18.6889	18.8591	19.1115	19.4361	19.7150	19.8856	19.9236	19.9217	19.8309	19.4774	19.0251	18.6644	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8770	19.0470	19.2995	19.6239	19.9066	20.0839	20.1279	20.1245	20.0248	19.6645	19.2115	18.8512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8770	19.0470	19.2995	19.6239	19.9066	20.0839	20.1279	20.1245	20.0248	19.6645	19.2115	18.8512	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9921	0.9817	0.9523	0.8749	0.7063	0.5056	0.5550	0.8125	0.9626	0.9927	0.9975	(94)
Useful gains	465.9155	548.4849	604.9134	633.3821	604.1801	473.8081	325.2480	339.5561	473.1433	505.1513	460.5958	438.1042	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1404.6250	1360.2914	1228.1477	1018.8575	778.2379	515.5290	331.6485	349.5644	558.8577	859.5927	1152.8790	1400.1087	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	698.3999	545.5339	463.6863	277.5423	129.4990	0.0000	0.0000	0.0000	0.0000	263.7044	498.4439	715.7313	(98)
Space heating												3592.5411	(98)
Space heating per m2											(98) / (4) =	45.4177	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	883.6764	695.6601	713.3035	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8266	0.8988	0.8772	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	730.4287	625.2856	625.7376	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	875.6760	841.6632	806.5406	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.5781	160.9850	134.5174	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  400.0805 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.1445   40.2463   33.6294    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  100.0201 (107)
Space cooling per m2                                                                                             1.2645 (108)
Energy for space heating                                                                                        45.4177 (99)
Energy for space cooling                                                                                         1.2645 (108)
Total                                                                                                           46.6822 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                          46.7 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.6300	0.7000	0.7700	15.4361	(74)
South	6.4700	46.7521	0.6300	0.7000	0.7700	92.4436	(78)
West	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(80)

Solar gains	110.8809	186.7689	252.6501	312.5849	352.8797	352.3901	338.8209	307.8824	272.9730	205.3790	132.3617	95.2161	(83)
Total gains	451.6648	526.1497	580.1036	620.4746	640.1466	620.4642	594.8789	567.8102	543.3594	495.4640	445.0675	425.6158	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9963	0.9909	0.9743	0.9244	0.7979	0.6285	0.6754	0.8835	0.9808	0.9966	0.9988	(86)
MIT	19.7213	19.8773	20.1144	20.4237	20.7105	20.9126	20.9799	20.9711	20.8387	20.4669	20.0363	19.6958	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9979	0.9950	0.9876	0.9637	0.8908	0.7121	0.4973	0.5466	0.8209	0.9709	0.9952	0.9984	(89)
MIT 2	18.7886	18.9460	19.1835	19.4964	19.7671	19.9392	19.9769	19.9754	19.8852	19.5433	19.1143	18.7707	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9692	19.1264	19.3638	19.6760	19.9498	20.1277	20.1711	20.1683	20.0699	19.7222	19.2929	18.9499	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9692	19.1264	19.3638	19.6760	19.9498	20.1277	20.1711	20.1683	20.0699	19.7222	19.2929	18.9499	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9935	0.9850	0.9599	0.8900	0.7259	0.5230	0.5716	0.8276	0.9677	0.9939	0.9979	(94)
Useful gains	450.3732	522.7554	571.3906	595.5831	569.6997	450.3702	311.1160	324.5842	449.6851	479.4662	442.3321	424.7089	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1343.4290	1299.4265	1171.9135	969.6967	740.6547	490.9004	317.1439	333.9740	532.4051	818.9758	1099.8013	1336.9520	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	664.4335	521.9229	446.7891	269.3618	127.1905	0.0000	0.0000	0.0000	0.0000	252.5951	473.3778	678.7089	(98)
Space heating												3434.3796	(98)
Space heating per m2											(98) / (4) =	43.4182	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8275	0.9013	0.8808	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	690.7604	592.2919	593.2550	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	816.8354	785.0883	755.1317	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	90.7740	143.4406	120.4362	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												354.6508	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	22.6935	35.8601	30.1091	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												88.6627 (107)
Space cooling per m2												1.1209 (108)
Energy for space heating												43.4182 (99)
Energy for space cooling												1.1209 (108)
Total												44.5391 (109)
Target Fabric Energy Efficiency (TFEE)												51.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.4630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4133	0.3837	0.3936	0.3739	0.3739	0.3641	0.3542	0.3444	0.3345	0.3641	0.3444	0.3641	(22b)
Effective ac	0.5854	0.5736	0.5775	0.5699	0.5699	0.5663	0.5627	0.5593	0.5560	0.5663	0.5593	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4999	38.7062	38.9642	38.4547	38.4547	38.2097	37.9713	37.7394	37.5140	38.2097	37.7394	38.2097	(38)
Heat transfer coeff	96.8356	96.0418	96.2999	95.7903	95.7903	95.5454	95.3069	95.0750	94.8496	95.5454	95.0750	95.5454	(39)
Average = Sum(39)m / 12 =												95.6417	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2142	1.2174	1.2110	1.2110	1.2079	1.2049	1.2020	1.1991	1.2079	1.2020	1.2079	(40)
HLP (average)												1.2091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949	(83)
Total gains	706.3899	769.1272	829.6419	874.3899	871.9177	878.3894	839.4103	815.5152	786.4197	735.4355	692.8965	667.2350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7256	57.1944	57.0411	57.3446	57.3446	57.4916	57.6354	57.7760	57.9133	57.4916	57.7760	57.4916	
alpha	4.7817	4.8130	4.8027	4.8230	4.8230	4.8328	4.8424	4.8517	4.8609	4.8328	4.8517	4.8328	
util living area													
	0.9875	0.9804	0.9603	0.9085	0.7987	0.5951	0.4380	0.4492	0.6998	0.9059	0.9733	0.9897	(86)
MIT	19.9908	20.1154	20.3531	20.6392	20.8617	20.9743	20.9952	20.9948	20.9445	20.7051	20.3283	19.9797	(87)
Th 2	19.9007	19.9087	19.9061	19.9112	19.9112	19.9137	19.9161	19.9184	19.9207	19.9137	19.9184	19.9137	(88)
util rest of house													
	0.9834	0.9742	0.9472	0.8779	0.7338	0.4928	0.3189	0.3276	0.6033	0.8675	0.9633	0.9862	(89)
MIT 2	18.6002	18.7849	19.1210	19.5161	19.7906	19.8999	19.9148	19.9170	19.8850	19.6117	19.0998	18.5940	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9676	0.9390	0.8720	0.7395	0.5119	0.3421	0.3513	0.6196	0.8636	0.9561	0.9816	(94)
Useful gains	690.9265	744.1895	778.9933	762.4246	644.8019	449.6057	287.1451	286.4849	487.2787	635.1578	662.4926	654.9621	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1352.7468	1319.8640	1190.2314	980.2857	718.2389	459.3835	288.2161	287.6744	511.2557	804.8259	1087.4444	1324.4876	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	492.3943	386.8533	305.9611	156.8600	54.6371	0.0000	0.0000	0.0000	0.0000	126.2330	305.9653	498.1270	(98)
Space heating												2327.0311	(98)
RHI space heating demand												2327	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.4630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5018	0.4920	0.4821	0.4329	0.4231	0.3739	0.3739	0.3641	0.3936	0.4231	0.4428	0.4625	(22b)
Effective ac	0.6259	0.6210	0.6162	0.5937	0.5895	0.5699	0.5699	0.5663	0.5775	0.5895	0.5980	0.6069	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2338	41.9039	41.5805	40.0617	39.7775	38.4547	38.4547	38.2097	38.9642	39.7775	40.3524	40.9534	(38)
Heat transfer coeff	99.5695	99.2396	98.9162	97.3974	97.1132	95.7903	95.7903	95.5454	96.2999	97.1132	97.6881	98.2891	(39)
Average = Sum(39)m / 12 =												97.3960	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2588	1.2546	1.2505	1.2313	1.2277	1.2110	1.2110	1.2079	1.2174	1.2277	1.2350	1.2426	(40)
HLP (average)												1.2313	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	678.0847	760.3019	814.1464	849.5235	861.7488	830.9636	797.8770	770.8939	750.1445	706.2249	659.7326	645.1585	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1681	55.3515	55.5324	56.3984	56.5634	57.3446	57.3446	57.4916	57.0411	56.5634	56.2306	55.8867	
alpha	4.6779	4.6901	4.7022	4.7599	4.7709	4.8230	4.8230	4.8328	4.8027	4.7709	4.7487	4.7258	
util living area													
	0.9910	0.9837	0.9686	0.9307	0.8455	0.6840	0.5165	0.5533	0.7740	0.9375	0.9830	0.9928	(86)
MIT	19.8465	20.0098	20.2471	20.5462	20.7957	20.9475	20.9890	20.9847	20.9016	20.5927	20.1707	19.8198	(87)
Th 2	19.8733	19.8766	19.8798	19.8950	19.8979	19.9112	19.9112	19.9137	19.9061	19.8979	19.8921	19.8861	(88)
util rest of house													
	0.9881	0.9785	0.9582	0.9068	0.7924	0.5886	0.3947	0.4310	0.6888	0.9110	0.9767	0.9905	(89)
MIT 2	18.3717	18.6098	18.9519	19.3800	19.7037	19.8774	19.9073	19.9078	19.8332	19.4528	18.8556	18.3422	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6573	18.8809	19.2027	19.6059	19.9152	20.0847	20.1168	20.1164	20.0401	19.6735	19.1103	18.6284	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6573	18.8809	19.2027	19.6059	19.9152	20.0847	20.1168	20.1164	20.0401	19.6735	19.1103	18.6284	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9722	0.9500	0.8992	0.7934	0.6049	0.4184	0.4547	0.7004	0.9042	0.9705	0.9867	(94)
Useful gains	667.0416	739.1509	773.4706	763.8597	683.6979	502.6337	333.8164	350.5099	525.4177	638.5869	640.2611	636.5597	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1429.5523	1387.4620	1256.5077	1042.7240	797.8039	525.3798	336.8790	355.0801	572.0340	881.1612	1173.2598	1418.1540	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	567.3080	435.6650	359.3796	200.7823	84.8949	0.0000	0.0000	0.0000	0.0000	180.4752	383.7590	581.5061	(98)
Space heating												2793.7701	(98)
Space heating per m2										(98) / (4) =		35.3195	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3007.2875	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	567.3080	435.6650	359.3796	200.7823	84.8949	0.0000	0.0000	0.0000	0.0000	180.4752	383.7590	581.5061	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	610.6652	468.9613	386.8457	216.1273	91.3831	0.0000	0.0000	0.0000	0.0000	194.2683	413.0883	625.9485	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1677	89.0903	88.9441	88.6157	87.9641	86.7000	86.7000	86.7000	86.7000	88.5037	88.9963	89.1980	(217)
Fuel for water heating, kWh/month													
	182.0710	159.7462	165.9915	146.4984	142.5436	126.1921	118.3152	133.8039	134.8180	152.2499	163.6690	176.6760	(219)
Water heating fuel used												1802.5750	(219)
Annual totals kWh/year													
Space heating fuel - main system												3007.2875	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4617.4308	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3007.2875	3.4800	104.6536	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.5750	3.4800	62.7296	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			262.0015	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8867	(257)
SAP value		87.6304	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3007.2875	0.2160	649.5741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.5750	0.2160	389.3562	(264)
Space and water heating			1038.9303	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			939.0582	(272)
CO2 emissions per m2			11.8700	(273)
EI value			89.8603	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8811 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8811 = 0.2452, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			4.3700	
Infiltration rate			0.4630	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4133	0.3837	0.3936	0.3739	0.3739	0.3641	0.3542	0.3444	0.3345	0.3641	0.3444	0.3641	(22b)
Effective ac	0.5854	0.5736	0.5775	0.5699	0.5699	0.5663	0.5627	0.5593	0.5560	0.5663	0.5593	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4999	38.7062	38.9642	38.4547	38.4547	38.2097	37.9713	37.7394	37.5140	38.2097	37.7394	38.2097	(38)
Heat transfer coeff	96.8356	96.0418	96.2999	95.7903	95.7903	95.5454	95.3069	95.0750	94.8496	95.5454	95.0750	95.5454	(39)
Average = Sum(39)m / 12 =												95.6417	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2142	1.2174	1.2110	1.2110	1.2079	1.2049	1.2020	1.1991	1.2079	1.2020	1.2079	(40)
HLP (average)												1.2091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949 (83)
Total gains	706.3899	769.1272	829.6419	874.3899	871.9177	878.3894	839.4103	815.5152	786.4197	735.4355	692.8965	667.2350 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7256	57.1944	57.0411	57.3446	57.3446	57.4916	57.6354	57.7760	57.9133	57.4916	57.7760	57.4916	
alpha	4.7817	4.8130	4.8027	4.8230	4.8230	4.8328	4.8424	4.8517	4.8609	4.8328	4.8517	4.8328	
util living area													
	0.9875	0.9804	0.9603	0.9085	0.7987	0.5951	0.4380	0.4492	0.6998	0.9059	0.9733	0.9897	(86)
MIT	19.9908	20.1154	20.3531	20.6392	20.8617	20.9743	20.9952	20.9948	20.9445	20.7051	20.3283	19.9797	(87)
Th 2	19.9007	19.9087	19.9061	19.9112	19.9112	19.9137	19.9161	19.9184	19.9207	19.9137	19.9184	19.9137	(88)
util rest of house													
	0.9834	0.9742	0.9472	0.8779	0.7338	0.4928	0.3189	0.3276	0.6033	0.8675	0.9633	0.9862	(89)
MIT 2	18.6002	18.7849	19.1210	19.5161	19.7906	19.8999	19.9148	19.9170	19.8850	19.6117	19.0998	18.5940	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9676	0.9390	0.8720	0.7395	0.5119	0.3421	0.3513	0.6196	0.8636	0.9561	0.9816	(94)
Useful gains	690.9265	744.1895	778.9933	762.4246	644.8019	449.6057	287.1451	286.4849	487.2787	635.1578	662.4926	654.9621	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1352.7468	1319.8640	1190.2314	980.2857	718.2389	459.3835	288.2161	287.6744	511.2557	804.8259	1087.4444	1324.4876	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	492.3943	386.8533	305.9611	156.8600	54.6371	0.0000	0.0000	0.0000	0.0000	126.2330	305.9653	498.1270	(98)
Space heating												2327.0311	(98)
Space heating per m2											(98) / (4) =	29.4189	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2504.8774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	492.3943	386.8533	305.9611	156.8600	54.6371	0.0000	0.0000	0.0000	0.0000	126.2330	305.9653	498.1270	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	530.0262	416.4191	329.3446	168.8483	58.8128	0.0000	0.0000	0.0000	0.0000	135.8805	329.3490	536.1970	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0847	89.0164	88.8328	88.4221	87.6469	86.7000	86.7000	86.7000	86.7000	88.2189	88.8424	89.1096	(217)
Fuel for water heating, kWh/month													
	182.2407	159.8789	166.1994	146.8191	143.0595	126.1921	118.3152	133.8039	134.8180	152.7414	163.9524	176.8515	(219)
Water heating fuel used												1804.8721	(219)
Annual totals kWh/year													
Space heating fuel - main system												2504.8774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4042.2000	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2504.8774	7.3800	184.8600	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.8721	7.3800	133.1996	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			348.3798	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2504.8774	0.2160	541.0535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.8721	0.2160	389.8524	(264)
Space and water heating			930.9059	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			792.0477	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2504.8774	1.2200	3055.9505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.8721	1.2200	2201.9440	(264)
Space and water heating			5257.8945	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4436.5174	(272)
Primary energy kWh/m2/year			56.0875	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (23.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 89	A 92
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£425	£353	£72
Space heating	£313	£313	£0
Water heating	£133	£76	£58
Lighting	£104	£104	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£349	£291	£58
Total cost of uses	£348	£291	£58
Delivered energy	51 kWh/m²	39 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	43 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.4630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5018	0.4920	0.4821	0.4329	0.4231	0.3739	0.3739	0.3641	0.3936	0.4231	0.4428	0.4625	(22b)
Effective ac	0.6259	0.6210	0.6162	0.5937	0.5895	0.5699	0.5699	0.5663	0.5775	0.5895	0.5980	0.6069	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2338	41.9039	41.5805	40.0617	39.7775	38.4547	38.4547	38.2097	38.9642	39.7775	40.3524	40.9534	(38)
Heat transfer coeff	99.5695	99.2396	98.9162	97.3974	97.1132	95.7903	95.7903	95.5454	96.2999	97.1132	97.6881	98.2891	(39)
Average = Sum(39)m / 12 =												97.3960	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2588	1.2546	1.2505	1.2313	1.2277	1.2110	1.2110	1.2079	1.2174	1.2277	1.2350	1.2426	(40)
HLP (average)												1.2313	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2491 (H8)
Utilisation factor	0.5509 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-842.1367 (H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356 (63)
								Solar input (sum of months) = Sum(63)m =				-842.1367 (63)
Output from w/h												
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559 (64)
								Total per year (kWh/year) = Sum(64)m =				760.7271 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)
West	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(80)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184 (83)
Total gains	678.0847	760.3019	814.1464	849.5235	861.7488	830.9636	797.8770	770.8939	750.1445	706.2249	659.7326	645.1585 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1681	55.3515	55.5324	56.3984	56.5634	57.3446	57.3446	57.4916	57.0411	56.5634	56.2306	55.8867	
alpha	4.6779	4.6901	4.7022	4.7599	4.7709	4.8230	4.8230	4.8328	4.8027	4.7709	4.7487	4.7258	
util living area													
	0.9910	0.9837	0.9686	0.9307	0.8455	0.6840	0.5165	0.5533	0.7740	0.9375	0.9830	0.9928	(86)
MIT	19.8465	20.0098	20.2471	20.5462	20.7957	20.9475	20.9890	20.9847	20.9016	20.5927	20.1707	19.8198	(87)
Th 2	19.8733	19.8766	19.8798	19.8950	19.8979	19.9112	19.9112	19.9137	19.9061	19.8979	19.8921	19.8861	(88)
util rest of house													
	0.9881	0.9785	0.9582	0.9068	0.7924	0.5886	0.3947	0.4310	0.6888	0.9110	0.9767	0.9905	(89)
MIT 2	18.3717	18.6098	18.9519	19.3800	19.7037	19.8774	19.9073	19.9078	19.8332	19.4528	18.8556	18.3422	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6573	18.8809	19.2027	19.6059	19.9152	20.0847	20.1168	20.1164	20.0401	19.6735	19.1103	18.6284	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6573	18.8809	19.2027	19.6059	19.9152	20.0847	20.1168	20.1164	20.0401	19.6735	19.1103	18.6284	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9722	0.9500	0.8992	0.7934	0.6049	0.4184	0.4547	0.7004	0.9042	0.9705	0.9867	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.0416	739.1509	773.4706	763.8597	683.6979	502.6337	333.8164	350.5099	525.4177	638.5869	640.2611	636.5597	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1429.5523	1387.4620	1256.5077	1042.7240	797.8039	525.3798	336.8790	355.0801	572.0340	881.1612	1173.2598	1418.1540	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	567.3080	435.6650	359.3796	200.7823	84.8949	0.0000	0.0000	0.0000	0.0000	180.4752	383.7590	581.5061	(98)

Space heating 2793.7701 (98)
Space heating per m2 (98) / (4) = 35.3195 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3007.2875 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	567.3080	435.6650	359.3796	200.7823	84.8949	0.0000	0.0000	0.0000	0.0000	180.4752	383.7590	581.5061	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	610.6652	468.9613	386.8457	216.1273	91.3831	0.0000	0.0000	0.0000	0.0000	194.2683	413.0883	625.9485	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2557	89.2770	89.3107	89.3889	89.5370	86.7000	86.7000	86.7000	86.7000	88.8697	89.1329	89.2712	(217)
Fuel for water heating, kWh/month	154.5317	113.7672	87.6009	41.1766	11.7015	0.0000	0.0000	21.4599	46.8301	93.0044	130.9206	153.6397	(219)

Water heating fuel used 854.6325 (219)
Annual totals kWh/year
Space heating fuel - main system 3007.2875 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 363.0107 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) = -630.4424 -630.4424 (233)
Total delivered energy for all uses 3719.4883 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3007.2875	3.4800	104.6536	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.6325	3.4800	29.7412	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			235.6081	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7974 (257)
SAP value 88.8765
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3007.2875	0.2160	649.5741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.6325	0.2160	184.6006	(264)
Space and water heating			834.1747	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			760.2527 (272)
CO2 emissions per m2			9.6100 (273)
EI value			91.7910
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		4.3700	
Infiltration rate		0.4630	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3936	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4133	0.3837	0.3936	0.3739	0.3739	0.3641	0.3542	0.3444	0.3345	0.3641	0.3444	0.3641	(22b)
Effective ac	0.5854	0.5736	0.5775	0.5699	0.5699	0.5663	0.5627	0.5593	0.5560	0.5663	0.5593	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4999	38.7062	38.9642	38.4547	38.4547	38.2097	37.9713	37.7394	37.5140	38.2097	37.7394	38.2097	(38)
Heat transfer coeff	96.8356	96.0418	96.2999	95.7903	95.7903	95.5454	95.3069	95.0750	94.8496	95.5454	95.0750	95.5454	(39)
Average = Sum(39)m / 12 =												95.6417	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2142	1.2174	1.2110	1.2110	1.2079	1.2049	1.2020	1.1991	1.2079	1.2020	1.2079	(40)
HLP (average)												1.2091	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3979	(H8)
Utilisation factor												0.5110	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-874.1284	(H17)
Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486	(63)
								Solar input (sum of months) = Sum(63)m =				-874.1284	(63)
Output from w/h													
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
								Total per year (kWh/year) = Sum(64)m =				737.7444	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.3637	546.8518	525.4035	492.2835	458.4577	428.2320	410.6532	419.0283	438.1753	471.5060	508.4621	536.3401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)
West	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(80)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949	(83)
Total gains	706.3899	769.1272	829.6419	874.3899	871.9177	878.3894	839.4103	815.5152	786.4197	735.4355	692.8965	667.2350	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7256	57.1944	57.0411	57.3446	57.3446	57.4916	57.6354	57.7760	57.9133	57.4916	57.7760	57.4916	
alpha	4.7817	4.8130	4.8027	4.8230	4.8230	4.8328	4.8424	4.8517	4.8609	4.8328	4.8517	4.8328	
util living area													
	0.9875	0.9804	0.9603	0.9085	0.7987	0.5951	0.4380	0.4492	0.6998	0.9059	0.9733	0.9897	(86)
MIT	19.9908	20.1154	20.3531	20.6392	20.8617	20.9743	20.9952	20.9948	20.9445	20.7051	20.3283	19.9797	(87)
Th 2	19.9007	19.9087	19.9061	19.9112	19.9112	19.9137	19.9161	19.9184	19.9207	19.9137	19.9184	19.9137	(88)
util rest of house													
	0.9834	0.9742	0.9472	0.8779	0.7338	0.4928	0.3189	0.3276	0.6033	0.8675	0.9633	0.9862	(89)
MIT 2	18.6002	18.7849	19.1210	19.5161	19.7906	19.8999	19.9148	19.9170	19.8850	19.6117	19.0998	18.5940	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8695	19.0426	19.3596	19.7337	19.9980	20.1080	20.1241	20.1258	20.0902	19.8235	19.3378	18.8624	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9676	0.9390	0.8720	0.7395	0.5119	0.3421	0.3513	0.6196	0.8636	0.9561	0.9816	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	690.9265	744.1895	778.9933	762.4246	644.8019	449.6057	287.1451	286.4849	487.2787	635.1578	662.4926	654.9621 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1352.7468	1319.8640	1190.2314	980.2857	718.2389	459.3835	288.2161	287.6744	511.2557	804.8259	1087.4444	1324.4876 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	492.3943	386.8533	305.9611	156.8600	54.6371	0.0000	0.0000	0.0000	0.0000	126.2330	305.9653	498.1270 (98)
Space heating												2327.0311 (98)
Space heating per m2											(98) / (4) =	29.4189 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2504.8774 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	492.3943	386.8533	305.9611	156.8600	54.6371	0.0000	0.0000	0.0000	0.0000	126.2330	305.9653	498.1270	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	530.0262	416.4191	329.3446	168.8483	58.8128	0.0000	0.0000	0.0000	0.0000	135.8805	329.3490	536.1970	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1964	89.2142	89.2313	89.2878	89.1931	86.7000	86.7000	86.7000	86.7000	88.6427	89.0200	89.2015	(217)
Fuel for water heating, kWh/month	150.0424	114.0740	87.3539	40.0828	16.7519	0.0000	0.0000	14.5776	41.4721	88.8894	125.7383	150.3819	(219)
Water heating fuel used												829.3643	(219)
Annual totals kWh/year													
Space heating fuel - main system												2504.8774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3116.6922	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2504.8774	7.3800	184.8600	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.3643	7.3800	61.2071	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			290.7173	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2504.8774	0.2160	541.0535	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.3643	0.2160	179.1427	(264)
Space and water heating			720.1962	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			607.2880	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2504.8774	1.2200	3055.9505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.3643	1.2200	1011.8244	(264)
Space and water heating			4067.7749	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3399.8978	(272)
Primary energy kWh/m2/year			42.9823	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.7500	87.1704	0.7200	0.7000	0.7650	143.6803
South	6.4700	118.5567	0.7200	0.7000	0.7650	266.1735
West	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
total:						431.5904

	Jun	Jul	Aug	
Solar gains	461	432	398	(P3)
Internal gains	425	408	416	
Total summer gains	886	839	814	(P5)
Summer gain/loss ratio	1.48	1.41	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.13	18.96	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 428 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 428	**Prop Type Ref**	
Property	22 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.81	**TER**	18.42
Environmental	90 B	**% DER<TER**	25.04		
CO_2 Emissions (t/year)	0.79	**DFEE**	46.68	**TFEE**	51.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.81	$kgCO_2/m^2$	Pass
	-4.61 (-25.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.68	$kWh/m^2/yr$	
	-4.5 (-8.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.75 m², No overhang
Windows facing South	6.47 m², No overhang
Windows facing West	0.50 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.37 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 429 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 429	**Prop Type Ref**	
Property	23 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.66	**TER**	18.42
Environmental	90 B	**% DER<TER**	25.86		
CO_2 Emissions (t/year)	0.78	**DFEE**	46.31	**TFEE**	51.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.42 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.3 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
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3 Air permeability
Air permeability at 50 pascals: 3.94 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.75 m², No overhang
Windows facing East: 0.50 m², No overhang
Windows facing South: 6.47 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.028 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		3.9400	
Infiltration rate		0.4415	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3753	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4785	0.4691	0.4597	0.4128	0.4034	0.3565	0.3565	0.3472	0.3753	0.4034	0.4222	0.4410	(22b)
Effective ac	0.6145	0.6100	0.6057	0.5852	0.5814	0.5636	0.5636	0.5603	0.5704	0.5814	0.5891	0.5972	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4632	41.1632	40.8692	39.4881	39.2297	38.0268	38.0268	37.8041	38.4902	39.2297	39.7524	40.2989	(38)
Heat transfer coeff	98.7988	98.4988	98.2048	96.8238	96.5654	95.3625	95.3625	95.1397	95.8258	96.5654	97.0881	97.6346	(39)
Average = Sum(39)m / 12 =												96.8225	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2490	1.2452	1.2415	1.2241	1.2208	1.2056	1.2056	1.2028	1.2115	1.2208	1.2274	1.2343	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	372.0450	369.8669	356.3317	334.5838	312.5424	291.3538	277.6440	283.6867	294.9194	316.8780	342.0512	360.8913	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	498.7660	583.3171	645.0746	691.8237	715.8335	694.0854	664.8679	635.5523	606.8885	551.5969	493.3218	469.7097	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5984	55.7677	55.9347	56.7325	56.8843	57.6018	57.6018	57.7367	57.3233	56.8843	56.5781	56.2614	
alpha	4.7066	4.7178	4.7290	4.7822	4.7923	4.8401	4.8401	4.8491	4.8216	4.7923	4.7719	4.7508	
util living area													
	0.9975	0.9943	0.9869	0.9654	0.9064	0.7715	0.6042	0.6490	0.8617	0.9737	0.9948	0.9981	(86)
MIT	19.6560	19.8261	20.0805	20.4099	20.7079	20.9120	20.9790	20.9704	20.8377	20.4523	19.9945	19.6302	(87)
Th 2	19.8810	19.8840	19.8869	19.9008	19.9034	19.9155	19.9155	19.9178	19.9108	19.9034	19.8981	19.8926	(88)
util rest of house													
	0.9966	0.9924	0.9821	0.9515	0.8664	0.6791	0.4686	0.5152	0.7907	0.9604	0.9926	0.9975	(89)
MIT 2	18.1006	18.3507	18.7219	19.2027	19.6082	19.8544	19.9076	19.9053	19.7785	19.2705	18.6071	18.0710	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.4018	18.6364	18.9850	19.4365	19.8212	20.0592	20.1151	20.1116	19.9837	19.4994	18.8758	18.3730	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4018	18.6364	18.9850	19.4365	19.8212	20.0592	20.1151	20.1116	19.9837	19.4994	18.8758	18.3730	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9892	0.9767	0.9438	0.8628	0.6928	0.4949	0.5409	0.7964	0.9537	0.9896	0.9961	(94)
Useful gains	496.2136	576.9992	630.0291	652.9564	617.6331	480.8479	329.0556	343.7397	483.3106	526.0395	488.2001	467.8757	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1393.2415	1353.0221	1226.0904	1020.1818	784.2249	520.6035	335.2092	353.1206	563.8072	859.3727	1143.2929	1383.7729	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	667.3887	521.4874	443.4696	264.4023	123.9444	0.0000	0.0000	0.0000	0.0000	247.9999	471.6668	681.4275	(98)
Space heating												3421.7865	(98)
Space heating per m2											(98) / (4) =	43.2590	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3667.5097	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	667.3887	521.4874	443.4696	264.4023	123.9444	0.0000	0.0000	0.0000	0.0000	247.9999	471.6668	681.4275	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	715.3148	558.9361	475.3157	283.3894	132.8450	0.0000	0.0000	0.0000	0.0000	265.8091	505.5378	730.3617	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5722	89.5031	89.3730	89.0819	88.4529	86.7000	86.7000	86.7000	86.7000	88.9989	89.4238	89.6011	(217)
Fuel for water heating, kWh/month													
	181.2886	159.0405	165.2193	145.7443	141.7606	126.1873	118.3042	133.8032	134.8228	151.4191	162.9153	175.9177	(219)
Water heating fuel used												1796.4227	(219)
Annual totals kWh/year													
Space heating fuel - main system												3667.5097	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												5271.5007	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3667.5097	0.2160	792.1821	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1796.4227	0.2160	388.0273	(264)
Space and water heating			1180.2094	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total CO2, kg/year			1080.3373	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6600	ZC1
Total Floor Area	TFA	79.1000	
Assumed number of occupants	N	2.4456	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2977	ZC2
CO2 emissions from cooking, equation (L16)		2.2464	ZC3
Total CO2 emissions		32.2042	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.2042	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.1874	382.6415	368.4845	346.1167	323.4518	301.6413	287.9376	294.6018	306.4608	329.0394	354.8306	374.0370	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.6300	0.7000	0.7700	15.4361	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	6.4700	46.7521	0.6300	0.7000	0.7700	92.4436	(78)

Solar gains	110.8809	186.7689	252.6501	312.5849	352.8797	352.3901	338.8209	307.8824	272.9730	205.3790	132.3617	95.2161	(83)
Total gains	496.0682	569.4103	621.1346	658.7016	676.3314	654.0314	626.7585	602.4842	579.4338	534.4185	487.1923	469.2531	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9976	0.9947	0.9879	0.9676	0.9098	0.7729	0.6014	0.6442	0.8603	0.9740	0.9949	0.9982	(86)
MIT	19.7734	19.9274	20.1604	20.4627	20.7385	20.9250	20.9835	20.9767	20.8607	20.5081	20.0852	19.7472	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9967	0.9929	0.9835	0.9547	0.8720	0.6846	0.4734	0.5177	0.7917	0.9612	0.9928	0.9975	(89)
MIT 2	18.3231	18.5492	18.8892	19.3300	19.7057	19.9295	19.9759	19.9741	19.8641	19.4008	18.7886	18.2916	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.6040	18.8162	19.1354	19.5494	19.9057	20.1223	20.1711	20.1683	20.0571	19.6153	19.0397	18.5735	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6040	18.8162	19.1354	19.5494	19.9057	20.1223	20.1711	20.1683	20.0571	19.6153	19.0397	18.5735	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9900	0.9787	0.9479	0.8690	0.6980	0.4983	0.5420	0.7979	0.9551	0.9900	0.9963	(94)
Useful gains	493.6578	563.7362	607.8880	624.3917	587.7594	456.5420	312.2861	326.5697	462.3414	510.4455	482.3327	467.5026	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1309.9778	1271.0922	1151.1127	958.3086	736.6962	490.4190	317.1379	333.9757	531.2642	809.3753	1076.9699	1302.8365	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	607.3420	475.3432	404.1592	240.4202	110.8090	0.0000	0.0000	0.0000	0.0000	222.4038	428.1388	621.4884	(98)
Space heating												3110.1045	(98)
Space heating per m2											(98) / (4) =	39.3186	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3329.8764	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.3420	475.3432	404.1592	240.4202	110.8090	0.0000	0.0000	0.0000	0.0000	222.4038	428.1388	621.4884	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	650.2591	508.9328	432.7186	257.4092	118.6392	0.0000	0.0000	0.0000	0.0000	238.1197	458.3927	665.4052	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6535	87.4205	86.9797	86.0273	84.1790	80.3000	80.3000	80.3000	80.3000	85.7145	87.1250	87.7462	(217)
Fuel for water heating, kWh/month													
	229.8776	202.1084	211.3463	189.5287	187.5263	173.1411	165.8823	184.9199	186.9622	199.4453	209.4572	224.2214	(219)
Water heating fuel used												2364.4167	(219)
Annual totals kWh/year													
Space heating fuel - main system												3329.8764	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Total delivered energy for all uses												6132.3038	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3329.8764	0.2160	719.2533	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4167	0.2160	510.7140	(264)
Space and water heating			1229.9673	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Total CO2, kg/m2/year			1457.2948	(272)
Emissions per m2 for space and water heating			15.5495	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3818	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5495 * 1.00) + 2.3818 + 0.4921, rounded to 2 d.p.			18.4200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		3.9400	
Infiltration rate		0.3437	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2922	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3725	0.3652	0.3579	0.3214	0.3141	0.2776	0.2776	0.2702	0.2922	0.3141	0.3287	0.3433	(22b)
Effective ac	0.5694	0.5667	0.5640	0.5516	0.5493	0.5385	0.5385	0.5365	0.5427	0.5493	0.5540	0.5589	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4196	38.2378	38.0596	37.2227	37.0661	36.3372	36.3372	36.2022	36.6179	37.0661	37.3829	37.7141	(38)
Heat transfer coeff	95.7553	95.5735	95.3953	94.5584	94.4018	93.6728	93.6728	93.5378	93.9536	94.4018	94.7185	95.0497	(39)
Average = Sum(39)m / 12 =												94.5576	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2106	1.2083	1.2060	1.1954	1.1934	1.1842	1.1842	1.1825	1.1878	1.1934	1.1975	1.2016	(40)
HLP (average)												1.1954	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Average daily hot water use (litres/day)												92.2821	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	467.5049	552.8310	616.1965	665.1296	690.5580	670.8056	643.2819	611.7934	582.3556	524.8039	463.9763	439.2181	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3656	57.4747	57.5820	58.0917	58.1881	58.6409	58.6409	58.7255	58.4656	58.1881	57.9935	57.7914	
alpha	4.8244	4.8316	4.8388	4.8728	4.8792	4.9094	4.9094	4.9150	4.8977	4.8792	4.8662	4.8528	
util living area													
	0.9981	0.9954	0.9888	0.9689	0.9125	0.7810	0.6128	0.6610	0.8717	0.9775	0.9959	0.9986	(86)
MIT	19.6701	19.8388	20.0904	20.4116	20.7081	20.9108	20.9788	20.9695	20.8342	20.4478	19.9941	19.6376	(87)
Th 2	19.9116	19.9134	19.9152	19.9237	19.9252	19.9326	19.9326	19.9340	19.9298	19.9252	19.9220	19.9187	(88)
util rest of house													
	0.9975	0.9938	0.9847	0.9563	0.8747	0.6905	0.4780	0.5279	0.8040	0.9660	0.9943	0.9981	(89)
MIT 2	18.7037	18.8731	19.1242	19.4452	19.7221	19.8897	19.9271	19.9251	19.8360	19.4854	19.0355	18.6770	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8908	19.0602	19.3114	19.6324	19.9130	20.0875	20.1308	20.1273	20.0293	19.6718	19.2211	18.8630	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8908	19.0602	19.3114	19.6324	19.9130	20.0875	20.1308	20.1273	20.0293	19.6718	19.2211	18.8630	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9921	0.9816	0.9520	0.8741	0.7051	0.5044	0.5538	0.8115	0.9624	0.9927	0.9975	(94)
Useful gains	465.9207	548.4829	604.8725	633.2113	603.6423	473.0027	324.4858	338.8411	472.5849	505.0641	460.5955	438.1085	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1397.1493	1353.3352	1222.1427	1014.8375	775.3257	514.0274	330.7405	348.6480	557.0836	856.3964	1148.0961	1393.7180	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	692.8341	540.8607	459.2490	274.7709	127.7325	0.0000	0.0000	0.0000	0.0000	261.3912	495.0004	710.9734	(98)
Space heating												3562.8122	(98)
Space heating per m2											(98) / (4) =	45.0419	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	880.5244	693.1788	710.8874	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8285	0.9003	0.8788	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.4934	624.0721	624.7178	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	875.6760	841.6632	806.5406	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.2515	161.8878	135.2762	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											402.4155	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	26.3129	40.4720	33.8190	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											100.6039	(107)
Space cooling per m2											1.2719	(108)
Energy for space heating											45.0419	(99)
Energy for space cooling											1.2719	(108)
Total											46.3137	(109)
Dwelling Fabric Energy Efficiency (DFEE)											46.3	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1467	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3967	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3372	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4299	0.4215	0.4131	0.3709	0.3625	0.3204	0.3204	0.3119	0.3372	0.3625	0.3794	0.3962	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5569	0.5657	0.5720	0.5785	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7200	1.3258	15.5379			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	91.8100	13.8400	77.9700	0.1800	14.0346			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3995			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.2074	(36)
Total fabric heat loss (33) + (36) =	51.6068	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.9747	39.7325	39.4951	38.3802	38.1716	37.2005	37.2005	37.0206	37.5745	38.1716	38.5936	39.0347	(38)
Heat transfer coeff	91.5815	91.3393	91.1020	89.9870	89.7784	88.8073	88.8073	88.6275	89.1814	89.7784	90.2004	90.6416	(39)
Average = Sum(39)m / 12 =												89.9860	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1578	1.1547	1.1517	1.1376	1.1350	1.1227	1.1227	1.1204	1.1275	1.1350	1.1403	1.1459	(40)
HLP (average)												1.1376	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.5552	18.2569	14.8475	11.2405	8.4024	7.0937	7.6650	9.9632	13.3726	16.9796	19.8177	21.1265	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.7840	339.3808	327.4536	307.8897	287.2669	268.0740	256.0580	259.9278	270.3864	290.0850	312.7058	330.3997	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.6300	0.7000	0.7700	15.4361	(74)
East	0.5000	19.6403	0.6300	0.7000	0.7700	3.0012	(76)
South	6.4700	46.7521	0.6300	0.7000	0.7700	92.4436	(78)

Solar gains	110.8809	186.7689	252.6501	312.5849	352.8797	352.3901	338.8209	307.8824	272.9730	205.3790	132.3617	95.2161	(83)
Total gains	451.6648	526.1497	580.1036	620.4746	640.1466	620.4642	594.8789	567.8102	543.3594	495.4640	445.0675	425.6158	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9800	60.1390	60.2957	61.0428	61.1846	61.8536	61.8536	61.9791	61.5942	61.1846	60.8983	60.6019	
alpha	4.9987	5.0093	5.0197	5.0695	5.0790	5.1236	5.1236	5.1319	5.1063	5.0790	5.0599	5.0401	
util living area													
	0.9984	0.9963	0.9909	0.9743	0.9244	0.7979	0.6285	0.6754	0.8835	0.9808	0.9966	0.9988	(86)
MIT	19.7213	19.8773	20.1144	20.4237	20.7105	20.9126	20.9799	20.9711	20.8387	20.4669	20.0363	19.6958	(87)
Th 2	19.9539	19.9564	19.9588	19.9702	19.9724	19.9823	19.9823	19.9842	19.9785	19.9724	19.9680	19.9635	(88)
util rest of house													
	0.9979	0.9950	0.9876	0.9637	0.8908	0.7121	0.4973	0.5466	0.8209	0.9709	0.9952	0.9984	(89)
MIT 2	18.7886	18.9460	19.1835	19.4964	19.7671	19.9392	19.9769	19.9754	19.8852	19.5433	19.1143	18.7707	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.9692	19.1264	19.3638	19.6760	19.9498	20.1277	20.1711	20.1683	20.0699	19.7222	19.2929	18.9499	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9692	19.1264	19.3638	19.6760	19.9498	20.1277	20.1711	20.1683	20.0699	19.7222	19.2929	18.9499	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9935	0.9850	0.9599	0.8900	0.7259	0.5230	0.5716	0.8276	0.9677	0.9939	0.9979	(94)
Useful gains	450.3732	522.7554	571.3906	595.5831	569.6997	450.3702	311.1160	324.5842	449.6851	479.4662	442.3321	424.7089	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1343.4290	1299.4265	1171.9135	969.6967	740.6547	490.9004	317.1439	333.9740	532.4051	818.9758	1099.8013	1336.9520	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	664.4335	521.9229	446.7891	269.3618	127.1905	0.0000	0.0000	0.0000	0.0000	252.5951	473.3778	678.7089	(98)
Space heating												3434.3796	(98)
Space heating per m2											(98) / (4) =	43.4182	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	834.7887	657.1741	673.5689	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8275	0.9013	0.8808	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	690.7604	592.2919	593.2550	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	816.8354	785.0883	755.1317	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	90.7740	143.4406	120.4362	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												354.6508	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	22.6935	35.8601	30.1091	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												88.6627 (107)
Space cooling per m2												1.1209 (108)
Energy for space heating												43.4182 (99)
Energy for space cooling												1.1209 (108)
Total												44.5391 (109)
Target Fabric Energy Efficiency (TFEE)												51.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		3.9400	
Infiltration rate		0.4415	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3753	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3941	0.3659	0.3753	0.3565	0.3565	0.3472	0.3378	0.3284	0.3190	0.3472	0.3284	0.3472	(22b)
Effective ac	0.5776	0.5669	0.5704	0.5636	0.5636	0.5603	0.5570	0.5539	0.5509	0.5603	0.5539	0.5603	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9773	38.2555	38.4902	38.0268	38.0268	37.8041	37.5873	37.3764	37.1715	37.8041	37.3764	37.8041	(38)
Heat transfer coeff	96.3129	95.5912	95.8258	95.3625	95.3625	95.1397	94.9229	94.7121	94.5071	95.1397	94.7121	95.1397	(39)
Average = Sum(39)m / 12 =												95.2274	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2176	1.2085	1.2115	1.2056	1.2056	1.2028	1.2000	1.1974	1.1948	1.2028	1.1974	1.2028	(40)
HLP (average)												1.2039	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
RHI water heating demand												1591 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949	(83)
Total gains	706.4018	769.1375	829.6492	874.3938	871.9192	878.3879	839.4071	815.5150	786.4212	735.4404	692.9054	667.2459	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0334	57.4640	57.3233	57.6018	57.6018	57.7367	57.8686	57.9974	58.1232	57.7367	57.9974	57.7367	
alpha	4.8022	4.8309	4.8216	4.8401	4.8401	4.8491	4.8579	4.8665	4.8749	4.8491	4.8665	4.8491	
util living area													
	0.9874	0.9803	0.9600	0.9077	0.7972	0.5931	0.4364	0.4476	0.6983	0.9052	0.9732	0.9896	(86)
MIT	19.9994	20.1227	20.3599	20.6439	20.8643	20.9750	20.9954	20.9949	20.9455	20.7088	20.3333	19.9864	(87)
Th 2	19.9059	19.9132	19.9108	19.9155	19.9155	19.9178	19.9200	19.9221	19.9242	19.9178	19.9221	19.9178	(88)
util rest of house													
	0.9833	0.9740	0.9468	0.8770	0.7322	0.4913	0.3180	0.3268	0.6020	0.8666	0.9631	0.9862	(89)
MIT 2	18.6164	18.7987	19.1341	19.5257	19.7972	19.9044	19.9188	19.9207	19.8891	19.6197	19.1095	18.6066	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9780	0.9674	0.9386	0.8712	0.7381	0.5103	0.3411	0.3503	0.6183	0.8629	0.9560	0.9816	(94)
Useful gains	690.8893	744.1019	778.7204	761.7662	643.5717	448.2791	286.3211	285.7087	486.2427	634.6089	662.3868	654.9463	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.8672	1314.8698	1185.5128	976.7312	715.5903	457.7886	287.3577	286.8625	509.7462	802.0912	1084.1245	1319.9532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	488.0475	383.5560	302.6536	154.7748	53.5819	0.0000	0.0000	0.0000	0.0000	124.6068	303.6512	494.7652	(98)
Space heating												2305.6369	(98)
RHI space heating demand												2306	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		3.9400
Infiltration rate		0.4415 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3753 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4785	0.4691	0.4597	0.4128	0.4034	0.3565	0.3565	0.3472	0.3753	0.4034	0.4222	0.4410	(22b)
Effective ac	0.6145	0.6100	0.6057	0.5852	0.5814	0.5636	0.5636	0.5603	0.5704	0.5814	0.5891	0.5972	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4632	41.1632	40.8692	39.4881	39.2297	38.0268	38.0268	37.8041	38.4902	39.2297	39.7524	40.2989	(38)
Heat transfer coeff	98.7988	98.4988	98.2048	96.8238	96.5654	95.3625	95.3625	95.1397	95.8258	96.5654	97.0881	97.6346	(39)
Average = Sum(39)m / 12 =												96.8225	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2490	1.2452	1.2415	1.2241	1.2208	1.2056	1.2056	1.2028	1.2115	1.2208	1.2274	1.2343	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Average daily hot water use (litres/day)		92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	678.0966	760.3122	814.1537	849.5273	861.7502	830.9621	797.8738	770.8937	750.1459	706.2298	659.7415	645.1695	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5984	55.7677	55.9347	56.7325	56.8843	57.6018	57.6018	57.7367	57.3233	56.8843	56.5781	56.2614	
alpha	4.7066	4.7178	4.7290	4.7822	4.7923	4.8401	4.8401	4.8491	4.8216	4.7923	4.7719	4.7508	
util living area													
	0.9910	0.9835	0.9683	0.9300	0.8440	0.6820	0.5145	0.5513	0.7721	0.9369	0.9829	0.9928	(86)
MIT	19.8594	20.0220	20.2577	20.5530	20.7998	20.9488	20.9893	20.9852	20.9037	20.5984	20.1792	19.8309	(87)
Th 2	19.8810	19.8840	19.8869	19.9008	19.9034	19.9155	19.9155	19.9178	19.9108	19.9034	19.8981	19.8926	(88)
util rest of house													
	0.9881	0.9783	0.9578	0.9059	0.7908	0.5870	0.3936	0.4298	0.6871	0.9102	0.9765	0.9904	(89)
MIT 2	18.3959	18.6326	18.9721	19.3937	19.7133	19.8826	19.9118	19.9120	19.8396	19.4646	18.8722	18.3630	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6794	18.9017	19.2210	19.6183	19.9238	20.0891	20.1205	20.1199	20.0457	19.6842	19.1253	18.6473	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6794	18.9017	19.2210	19.6183	19.9238	20.0891	20.1205	20.1199	20.0457	19.6842	19.1253	18.6473	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9720	0.9497	0.8984	0.7919	0.6032	0.4171	0.4533	0.6988	0.9036	0.9704	0.9867	(94)
Useful gains	667.0249	739.0554	773.1921	763.2328	682.4241	501.2719	332.7577	349.4706	524.1944	638.1305	640.1846	636.5572	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1420.6671	1379.1492	1249.2683	1037.7821	794.1303	523.4523	335.7221	353.9078	569.7543	877.2213	1167.5155	1410.5532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	560.7098	430.1430	354.2007	197.6755	83.1094	0.0000	0.0000	0.0000	0.0000	177.8836	379.6782	575.8530	(98)
Space heating												2759.2532	(98)
Space heating per m2											(98) / (4) =	34.8831	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2957.3990	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	560.7098	430.1430	354.2007	197.6755	83.1094	0.0000	0.0000	0.0000	0.0000	177.8836	379.6782	575.8530	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	600.9751	461.0322	379.6363	211.8708	89.0777	0.0000	0.0000	0.0000	0.0000	190.6576	406.9435	617.2058	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4658	89.3772	89.2101	88.8377	88.1000	86.7000	86.7000	86.7000	86.7000	88.7123	89.2721	89.5014	(217)
Fuel for water heating, kWh/month													
	181.5041	159.2644	165.5210	146.1449	142.3285	126.1873	118.3042	133.8032	134.8228	151.9084	163.1921	176.1137	(219)
Water heating fuel used												1799.0945	(219)
Annual totals kWh/year													
Space heating fuel - main system												2957.3990	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												4564.0617	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2957.3990	3.4800	102.9175	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1799.0945	3.4800	62.6085	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			260.1442	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8804	(257)
SAP value		87.7181	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2957.3990	0.2160	638.7982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1799.0945	0.2160	388.6044	(264)
Space and water heating			1027.4026	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-630.4424	0.5190	-327.1996	(269)
Total kg/year			927.5305	(272)
CO2 emissions per m2			11.7300	(273)
EI value			89.9848	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8827 = 3.942, stars = 4
Water heating environmental impact	0.216 / 0.8827 = 0.2447, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5400 (2b)	=	100.4570	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445 (8)
Pressure test		Yes
Measured/design AP50		3.9400
Infiltration rate		0.4415 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3753 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3941	0.3659	0.3753	0.3565	0.3565	0.3472	0.3378	0.3284	0.3190	0.3472	0.3284	0.3472	(22b)
Effective ac	0.5776	0.5669	0.5704	0.5636	0.5636	0.5603	0.5570	0.5539	0.5509	0.5603	0.5539	0.5603	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7784	(36)
Total fabric heat loss					(33) + (36) =		57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9773	38.2555	38.4902	38.0268	38.0268	37.8041	37.5873	37.3764	37.1715	37.8041	37.3764	37.8041	(38)
Heat transfer coeff	96.3129	95.5912	95.8258	95.3625	95.3625	95.1397	94.9229	94.7121	94.5071	95.1397	94.7121	95.1397	(39)
Average = Sum(39)m / 12 =												95.2274	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2176	1.2085	1.2115	1.2056	1.2056	1.2028	1.2000	1.1974	1.1948	1.2028	1.1974	1.2028	(40)
HLP (average)												1.2039	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.5581 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949	(83)
Total gains	706.4018	769.1375	829.6492	874.3938	871.9192	878.3879	839.4071	815.5150	786.4212	735.4404	692.9054	667.2459	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0334	57.4640	57.3233	57.6018	57.6018	57.7367	57.8686	57.9974	58.1232	57.7367	57.9974	57.7367	
alpha	4.8022	4.8309	4.8216	4.8401	4.8401	4.8491	4.8579	4.8665	4.8749	4.8491	4.8665	4.8491	
util living area													
	0.9874	0.9803	0.9600	0.9077	0.7972	0.5931	0.4364	0.4476	0.6983	0.9052	0.9732	0.9896	(86)
MIT	19.9994	20.1227	20.3599	20.6439	20.8643	20.9750	20.9954	20.9949	20.9455	20.7088	20.3333	19.9864	(87)
Th 2	19.9059	19.9132	19.9108	19.9155	19.9155	19.9178	19.9200	19.9221	19.9242	19.9178	19.9221	19.9178	(88)
util rest of house													
	0.9833	0.9740	0.9468	0.8770	0.7322	0.4913	0.3180	0.3268	0.6020	0.8666	0.9631	0.9862	(89)
MIT 2	18.6164	18.7987	19.1341	19.5257	19.7972	19.9044	19.9188	19.9207	19.8891	19.6197	19.1095	18.6066	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9780	0.9674	0.9386	0.8712	0.7381	0.5103	0.3411	0.3503	0.6183	0.8629	0.9560	0.9816	(94)
Useful gains	690.8893	744.1019	778.7204	761.7662	643.5717	448.2791	286.3211	285.7087	486.2427	634.6089	662.3868	654.9463	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1346.8672	1314.8698	1185.5128	976.7312	715.5903	457.7886	287.3577	286.8625	509.7462	802.0912	1084.1245	1319.9532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	488.0475	383.5560	302.6536	154.7748	53.5819	0.0000	0.0000	0.0000	0.0000	124.6068	303.6512	494.7652	(98)
Space heating												2305.6369	(98)
Space heating per m2											(98) / (4) =	29.1484	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2471.2078	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	488.0475	383.5560	302.6536	154.7748	53.5819	0.0000	0.0000	0.0000	0.0000	124.6068	303.6512	494.7652	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	523.0949	411.0997	324.3875	165.8894	57.4297	0.0000	0.0000	0.0000	0.0000	133.5550	325.4568	530.2949	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3735	89.2964	89.0870	88.6214	87.7473	86.7000	86.7000	86.7000	86.7000	88.3930	89.1005	89.4031	(217)
Fuel for water heating, kWh/month													
	181.6915	159.4086	165.7497	146.5016	142.9006	126.1873	118.3042	133.8032	134.8228	152.4570	163.5064	176.3073	(219)
Water heating fuel used												1801.6401	(219)
Annual totals kWh/year													
Space heating fuel - main system												2471.2078	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												4005.2983	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2471.2078	7.3800	182.3751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1801.6401	7.3800	132.9610	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			345.6565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2471.2078	0.2160	533.7809	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.6401	0.2160	389.1543	(264)
Space and water heating			922.9351	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			784.0769	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2471.2078	1.2200	3014.8735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1801.6401	1.2200	2198.0009	(264)
Space and water heating			5212.8744	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			4391.4973	(272)
Primary energy kWh/m2/year			55.5183	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (23.5%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.33 kg/m²	B 89	A 92
Total Savings	£58	2.33 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£126	£140	-£14
Mains gas	£422	£350	£72
Space heating	£311	£311	£0
Water heating	£133	£75	£58
Lighting	£104	£104	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£346	£288	£58
Total cost of uses	£346	£288	£58
Delivered energy	51 kWh/m²	39 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	42 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.2445	(8)
Pressure test			Yes	
Measured/design AP50			3.9400	
Infiltration rate			0.4415	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3753	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4785	0.4691	0.4597	0.4128	0.4034	0.3565	0.3565	0.3472	0.3753	0.4034	0.4222	0.4410	(22b)
Effective ac	0.6145	0.6100	0.6057	0.5852	0.5814	0.5636	0.5636	0.5603	0.5704	0.5814	0.5891	0.5972	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4632	41.1632	40.8692	39.4881	39.2297	38.0268	38.0268	37.8041	38.4902	39.2297	39.7524	40.2989	(38)
Heat transfer coeff	98.7988	98.4988	98.2048	96.8238	96.5654	95.3625	95.3625	95.1397	95.8258	96.5654	97.0881	97.6346	(39)
Average = Sum(39)m / 12 =												96.8225	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2490	1.2452	1.2415	1.2241	1.2208	1.2056	1.2056	1.2028	1.2115	1.2208	1.2274	1.2343	(40)
HLP (average)												1.2241	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372	(61)
Total heat required for water heating calculated for each month													
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2491	(H8)
Utilisation factor												0.5509	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.2821	(H14)
Volume ratio Veff/V												0.8127	(H15)
Solar storage volume factor												0.9585	(H16)
Solar input												-842.1367	(H17)
Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
								Total per year (kWh/year) = Sum(64)m =				760.9040	(64)
Heat gains from water heating, kWh/month													
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	10.6334	0.7200	0.7000	0.7700	17.6412	(74)
East	0.5000	19.6403	0.7200	0.7000	0.7700	3.4299	(76)
South	6.4700	46.7521	0.7200	0.7000	0.7700	105.6498	(78)

Solar gains	126.7210	213.4501	288.7429	357.2399	403.2911	402.7316	387.2239	351.8656	311.9691	234.7189	151.2705	108.8184	(83)
Total gains	678.0966	760.3122	814.1537	849.5273	861.7502	830.9621	797.8738	770.8937	750.1459	706.2298	659.7415	645.1695	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5984	55.7677	55.9347	56.7325	56.8843	57.6018	57.6018	57.7367	57.3233	56.8843	56.5781	56.2614	
alpha	4.7066	4.7178	4.7290	4.7822	4.7923	4.8401	4.8401	4.8491	4.8216	4.7923	4.7719	4.7508	
util living area													
	0.9910	0.9835	0.9683	0.9300	0.8440	0.6820	0.5145	0.5513	0.7721	0.9369	0.9829	0.9928	(86)
MIT	19.8594	20.0220	20.2577	20.5530	20.7998	20.9488	20.9893	20.9852	20.9037	20.5984	20.1792	19.8309	(87)
Th 2	19.8810	19.8840	19.8869	19.9008	19.9034	19.9155	19.9155	19.9178	19.9108	19.9034	19.8981	19.8926	(88)
util rest of house													
	0.9881	0.9783	0.9578	0.9059	0.7908	0.5870	0.3936	0.4298	0.6871	0.9102	0.9765	0.9904	(89)
MIT 2	18.3959	18.6326	18.9721	19.3937	19.7133	19.8826	19.9118	19.9120	19.8396	19.4646	18.8722	18.3630	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6794	18.9017	19.2210	19.6183	19.9238	20.0891	20.1205	20.1199	20.0457	19.6842	19.1253	18.6473	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6794	18.9017	19.2210	19.6183	19.9238	20.0891	20.1205	20.1199	20.0457	19.6842	19.1253	18.6473	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9720	0.9497	0.8984	0.7919	0.6032	0.4171	0.4533	0.6988	0.9036	0.9704	0.9867	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	667.0249	739.0554	773.1921	763.2328	682.4241	501.2719	332.7577	349.4706	524.1944	638.1305	640.1846	636.5572	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1420.6671	1379.1492	1249.2683	1037.7821	794.1303	523.4523	335.7221	353.9078	569.7543	877.2213	1167.5155	1410.5532	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	560.7098	430.1430	354.2007	197.6755	83.1094	0.0000	0.0000	0.0000	0.0000	177.8836	379.6782	575.8530	(98)
Space heating												2759.2532	(98)
Space heating per m2											(98) / (4) =	34.8831	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2957.3990	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	560.7098	430.1430	354.2007	197.6755	83.1094	0.0000	0.0000	0.0000	0.0000	177.8836	379.6782	575.8530	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	600.9751	461.0322	379.6363	211.8708	89.0777	0.0000	0.0000	0.0000	0.0000	190.6576	406.9435	617.2058	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9638	101.5957	78.2588	36.8185	10.4814	0.0000	0.0000	18.6051	40.6058	82.6673	116.7190	137.1885	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5656	89.5893	89.6265	89.7151	89.8820	86.7000	86.7000	86.7000	86.7000	89.1258	89.4269	89.5843	(217)
Fuel for water heating, kWh/month	154.0365	113.4017	87.3166	41.0393	11.6613	0.0000	0.0000	21.4592	46.8349	92.7535	130.5189	153.1390	(219)
Water heating fuel used												852.1608	(219)
Annual totals kWh/year													
Space heating fuel - main system												2957.3990	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1080 * 1.00) =										-630.4424		-630.4424	(233)
Total delivered energy for all uses												3667.1281	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2957.3990	3.4800	102.9175	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	852.1608	3.4800	29.6552	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	363.0107	13.1900	47.8811	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-630.4424	13.1900	-83.1553	(252)
Total energy cost			233.7859	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7912	(257)
SAP value		88.9625	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2957.3990	0.2160	638.7982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	852.1608	0.2160	184.0667	(264)
Space and water heating			822.8649	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	363.0107	0.5190	188.4025 (268)
Energy saving/generation technologies			
PV Unit	-630.4424	0.5190	-327.1996 (269)
Total kg/year			748.9429 (272)
CO2 emissions per m2			9.4700 (273)
EI value			91.9131
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.5400	(2b) =	100.4570	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		204.4735	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2445	(8)
Pressure test		Yes	
Measured/design AP50		3.9400	
Infiltration rate		0.4415	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3753	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3941	0.3659	0.3753	0.3565	0.3565	0.3472	0.3378	0.3284	0.3190	0.3472	0.3284	0.3472	(22b)
Effective ac	0.5776	0.5669	0.5704	0.5636	0.5636	0.5603	0.5570	0.5539	0.5509	0.5603	0.5539	0.5603	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7200	1.2357	14.4829			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	91.8100	13.8400	77.9700	0.2700	21.0519			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			170.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.5573			(33)
Party Wall			44.8500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7784	(36)
Total fabric heat loss (33) + (36) =	57.3357	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9773	38.2555	38.4902	38.0268	38.0268	37.8041	37.5873	37.3764	37.1715	37.8041	37.3764	37.8041	(38)
Heat transfer coeff	96.3129	95.5912	95.8258	95.3625	95.3625	95.1397	94.9229	94.7121	94.5071	95.1397	94.7121	95.1397	(39)
Average = Sum(39)m / 12 =												95.2274	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2176	1.2085	1.2115	1.2056	1.2056	1.2028	1.2000	1.1974	1.1948	1.2028	1.1974	1.2028	(40)
HLP (average)												1.2039	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8472	10.6856	11.7996	11.3841	11.7381	11.3302	11.6896	11.7210	11.3595	11.7742	11.4349	11.8372 (61)
Total heat required for water heating calculated for each month												
	162.3841	142.3461	147.6615	129.8317	125.3915	109.4044	102.5697	116.0074	116.8913	134.7613	145.6850	157.6241 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755 (64)
								Total per year (kWh/year) = Sum(64)m =				737.9213 (64)
Heat gains from water heating, kWh/month												
	53.0153	46.4485	48.1240	42.2299	40.7243	35.4422	33.1400	37.6055	37.9292	43.8368	47.4969	51.4335 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.3879	45.6423	37.1188	28.1013	21.0061	17.7342	19.1624	24.9081	33.4315	42.4490	49.5443	52.8161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2571	69.1198	64.6828	58.6526	54.7369	49.2253	44.5431	50.5450	52.6795	58.9204	65.9679	69.1310	(72)
Total internal gains													
	551.3756	546.8621	525.4108	492.2874	458.4591	428.2306	410.6499	419.0281	438.1768	471.5109	508.4710	536.3511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.7500	13.4839	0.7200	0.7000	0.7700	22.3703	(74)
East	0.5000	25.1925	0.7200	0.7000	0.7700	4.3995	(76)
South	6.4700	56.7559	0.7200	0.7000	0.7700	128.2563	(78)

Solar gains	155.0262	222.2755	304.2384	382.1063	413.4600	450.1573	428.7572	396.4869	348.2444	263.9295	184.4344	130.8949 (83)
Total gains	706.4018	769.1375	829.6492	874.3938	871.9192	878.3879	839.4071	815.5150	786.4212	735.4404	692.9054	667.2459 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0334	57.4640	57.3233	57.6018	57.6018	57.7367	57.8686	57.9974	58.1232	57.7367	57.9974	57.7367	
alpha	4.8022	4.8309	4.8216	4.8401	4.8401	4.8491	4.8579	4.8665	4.8749	4.8491	4.8665	4.8491	
util living area													
	0.9874	0.9803	0.9600	0.9077	0.7972	0.5931	0.4364	0.4476	0.6983	0.9052	0.9732	0.9896	(86)
MIT	19.9994	20.1227	20.3599	20.6439	20.8643	20.9750	20.9954	20.9949	20.9455	20.7088	20.3333	19.9864	(87)
Th 2	19.9059	19.9132	19.9108	19.9155	19.9155	19.9178	19.9200	19.9221	19.9242	19.9178	19.9221	19.9178	(88)
util rest of house													
	0.9833	0.9740	0.9468	0.8770	0.7322	0.4913	0.3180	0.3268	0.6020	0.8666	0.9631	0.9862	(89)
MIT 2	18.6164	18.7987	19.1341	19.5257	19.7972	19.9044	19.9188	19.9207	19.8891	19.6197	19.1095	18.6066	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8843	19.0551	19.3715	19.7423	20.0039	20.1117	20.1273	20.1288	20.0937	19.8307	19.3465	18.8738	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9780	0.9674	0.9386	0.8712	0.7381	0.5103	0.3411	0.3503	0.6183	0.8629	0.9560	0.9816	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	690.8893	744.1019	778.7204	761.7662	643.5717	448.2791	286.3211	285.7087	486.2427	634.6089	662.3868	654.9463 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1346.8672	1314.8698	1185.5128	976.7312	715.5903	457.7886	287.3577	286.8625	509.7462	802.0912	1084.1245	1319.9532 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	488.0475	383.5560	302.6536	154.7748	53.5819	0.0000	0.0000	0.0000	0.0000	124.6068	303.6512	494.7652 (98)
Space heating												2305.6369 (98)
Space heating per m2											(98) / (4) =	29.1484 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2471.2078 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	488.0475	383.5560	302.6536	154.7748	53.5819	0.0000	0.0000	0.0000	0.0000	124.6068	303.6512	494.7652	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	523.0949	411.0997	324.3875	165.8894	57.4297	0.0000	0.0000	0.0000	0.0000	133.5550	325.4568	530.2949	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.8679	101.7979	77.9689	35.8002	14.9458	0.0000	0.0000	12.6382	35.9604	78.8085	111.9579	134.1755	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5001	89.5204	89.5384	89.6011	89.4896	86.7000	86.7000	86.7000	86.7000	88.8704	89.3011	89.5071	(217)
Fuel for water heating, kWh/month													
	149.5729	113.7148	87.0787	39.9551	16.7012	0.0000	0.0000	14.5769	41.4769	88.6780	125.3712	149.9049	(219)
Water heating fuel used												827.0306	(219)
Annual totals kWh/year													
Space heating fuel - main system												2471.2078	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												363.0107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1208 * 1.00) =										-705.5602		-705.5602	(233)
Total delivered energy for all uses												3080.6889	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2471.2078	7.3800	182.3751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	827.0306	7.3800	61.0349	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	363.0107	28.6600	104.0389	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-705.5602	28.6600	-202.2136	(252)
Total energy cost			288.0603	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2471.2078	0.2160	533.7809	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	827.0306	0.2160	178.6386	(264)
Space and water heating			712.4195	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	363.0107	0.5190	188.4025	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	0.5190	-366.1857	(269)
Total kg/year			599.5113	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2471.2078	1.2200	3014.8735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	827.0306	1.2200	1008.9774	(264)
Space and water heating			4023.8509	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	363.0107	3.0700	1114.4427	(268)
Energy saving/generation technologies				
PV Unit	-705.5602	3.0700	-2166.0698	(269)
Primary energy kWh/year			3355.9738	(272)
Primary energy kWh/m2/year			42.4270	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	539.81	(P1)
Transmission heat loss coefficient	57.34	(37)
Summer heat loss coefficient	597.15	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.7500	87.1704	0.7200	0.7000	0.7650	143.6803
East	0.5000	125.2818	0.7200	0.7000	0.7650	21.7366
South	6.4700	118.5567	0.7200	0.7000	0.7650	266.1735
total:						431.5904

	Jun	Jul	Aug	
Solar gains	461	432	398	(P3)
Internal gains	425	408	416	
Total summer gains	886	839	814	(P5)
Summer gain/loss ratio	1.48	1.41	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.13	18.96	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 429 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 429	**Prop Type Ref**	
Property	23 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.66	**TER**	18.42
Environmental	90 B	**% DER<TER**	25.86		
CO_2 Emissions (t/year)	0.78	**DFEE**	46.31	**TFEE**	51.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.42	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.66	$kgCO_2/m^2$	Pass
	-4.76 (-25.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.22	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.31	$kWh/m^2/yr$	
	-4.9 (-9.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.94 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	4.75 m², No overhang 0.50 m², No overhang 6.47 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.94 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.028	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 430 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 430	**Prop Type Ref**	
Property	24 Stock Dove Gardens , Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	20.84
Environmental	92 A	**% DER<TER**	37.29		
CO_2 Emissions (t/year)	0.47	**DFEE**	47.97	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached Maisonette, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.84 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.07 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.82 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.07 m², No overhang
Windows facing East: 0.71 m², No overhang
Windows facing South: 3.80 m², No overhang
Windows facing West: 1.49 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3058	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3899	0.3823	0.3746	0.3364	0.3287	0.2905	0.2905	0.2829	0.3058	0.3287	0.3440	0.3593	(22b)
Effective ac	0.5760	0.5731	0.5702	0.5566	0.5540	0.5422	0.5422	0.5400	0.5468	0.5540	0.5592	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.5255	22.4101	22.2970	21.7655	21.6661	21.2033	21.2033	21.1175	21.3815	21.6661	21.8672	22.0775	(38)
Heat transfer coeff	65.4231	65.3077	65.1945	64.6631	64.5637	64.1008	64.1008	64.0151	64.2791	64.5637	64.7648	64.9751	(39)
Average = Sum(39)m / 12 =												64.6626	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2731	1.2708	1.2605	1.2586	1.2495	1.2495	1.2479	1.2530	1.2586	1.2625	1.2666	(40)
HLP (average)												1.2605	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	274.8889	273.1952	263.3948	247.7199	232.0754	216.7746	206.6900	211.5326	219.4569	235.3038	253.5002	266.8876	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	367.1472	433.2278	490.5501	543.7793	577.6475	566.1574	540.8941	507.7218	470.2461	414.3310	364.5163	345.5171	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4532	54.5495	54.6442	55.0932	55.1781	55.5765	55.5765	55.6509	55.4224	55.1781	55.0067	54.8287	
alpha	4.6302	4.6366	4.6429	4.6729	4.6785	4.7051	4.7051	4.7101	4.6948	4.6785	4.6671	4.6552	
util living area													
	0.9957	0.9903	0.9765	0.9362	0.8395	0.6725	0.5095	0.5604	0.7995	0.9572	0.9912	0.9968	(86)
MIT	19.6988	19.8855	20.1648	20.5095	20.7926	20.9469	20.9884	20.9821	20.8785	20.5066	20.0332	19.6606	(87)
Th 2	19.8602	19.8620	19.8637	19.8719	19.8734	19.8806	19.8806	19.8819	19.8778	19.8734	19.8703	19.8671	(88)
util rest of house													
	0.9943	0.9871	0.9684	0.9135	0.7847	0.5753	0.3860	0.4339	0.7156	0.9372	0.9877	0.9957	(89)
MIT 2	18.1485	18.4209	18.8243	19.3127	19.6778	19.8469	19.8766	19.8750	19.7860	19.3202	18.6432	18.0976	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.8572	19.0904	19.4370	19.8598	20.1874	20.3497	20.3848	20.3811	20.2854	19.8625	19.2786	18.8120	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8572	19.0904	19.4370	19.8598	20.1874	20.3497	20.3848	20.3811	20.2854	19.8625	19.2786	18.8120	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9925	0.9841	0.9645	0.9132	0.8015	0.6180	0.4428	0.4920	0.7490	0.9370	0.9852	0.9942	(94)
Useful gains	364.4016	426.3435	473.1570	496.5731	462.9833	349.8811	239.5005	249.8123	352.2030	388.2201	359.1040	343.5227	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	952.3750	926.7394	843.4243	708.6925	547.9760	368.5638	242.6092	254.8497	397.5944	598.0220	788.7424	949.4189	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	437.4522	336.2661	275.4789	152.7260	63.2345	0.0000	0.0000	0.0000	0.0000	156.0926	309.3397	450.7867	(98)
Space heating												2181.3768	(98)
Space heating per m2											(98) / (4) =	42.5220	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2348.0912	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	437.4522	336.2661	275.4789	152.7260	63.2345	0.0000	0.0000	0.0000	0.0000	156.0926	309.3397	450.7867	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	470.8850	361.9656	296.5327	164.3983	68.0673	0.0000	0.0000	0.0000	0.0000	168.0222	332.9814	485.2387	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1265	89.0465	88.8901	88.5469	87.8802	86.7000	86.7000	86.7000	86.7000	88.5349	88.9776	89.1607	(217)
Fuel for water heating, kWh/month													
	150.8993	132.4629	137.8104	121.8623	118.7537	105.2670	98.9250	111.5511	112.2971	126.4917	135.7816	146.4918	(219)
Water heating fuel used												1498.5940	(219)
Annual totals kWh/year													
Space heating fuel - main system												2348.0912	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3537.2188	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2348.0912	0.2160	507.1877	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1498.5940	0.2160	323.6963	(264)
Space and water heating			830.8840	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			670.2710	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0700	ZC1
Total Floor Area	TFA	51.3000	
Assumed number of occupants	N	1.7284	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3973	ZC2
CO2 emissions from cooking, equation (L16)		3.1283	ZC3
Total CO2 emissions		33.5956	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.5956	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	42.1812	36.7137	39.1135	36.3674	36.0458	33.3986	34.5119	36.0458	36.3674	39.1135	39.3361	42.1812	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608 (64)
								Total per year (kWh/year) = Sum(64)m =				1635.3511 (64)
Heat gains from water heating, kWh/month												
	51.3606	44.8758	46.6148	41.2068	39.8265	34.9407	33.2685	37.2868	37.7049	43.1241	46.2335	50.0728 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	69.0331	66.7794	62.6544	57.2316	53.5302	48.5287	44.7157	50.1166	52.3679	57.9625	64.2132	67.3021	(72)
Total internal gains													
	285.1184	282.9126	272.6018	256.4172	240.2613	224.4500	214.3683	219.7213	228.1583	244.5148	263.2200	277.1187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008 (83)
Total gains	365.8443	422.9412	471.3626	515.4692	542.6370	530.1600	506.7969	478.8869	447.5989	401.1636	360.3591	345.9195 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9958	0.9910	0.9790	0.9432	0.8539	0.6892	0.5231	0.5715	0.8088	0.9596	0.9914	0.9967	(86)
MIT	19.7466	19.9180	20.1805	20.5130	20.7901	20.9468	20.9887	20.9829	20.8819	20.5242	20.0736	19.7157	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9944	0.9880	0.9717	0.9226	0.8025	0.5942	0.4008	0.4472	0.7280	0.9407	0.9880	0.9957	(89)
MIT 2	18.2391	18.4898	18.8702	19.3460	19.7073	19.8839	19.9143	19.9133	19.8239	19.3718	18.7257	18.2007	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9282	19.1426	19.4692	19.8795	20.2023	20.3698	20.4054	20.4022	20.3075	19.8986	19.3418	18.8932	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9853	0.9681	0.9220	0.8178	0.6358	0.4571	0.5043	0.7600	0.9405	0.9856	0.9942	(94)
Useful gains	363.1533	416.7065	456.3210	475.2761	443.7621	337.0971	231.6373	241.5204	340.1922	377.2926	355.1631	343.9302	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	928.3313	901.6352	819.0285	685.4691	529.6690	355.8228	234.6796	246.3539	384.3176	579.2762	765.9678	923.5361	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating												2108.7545	(98)
Space heating per m2											(98) / (4) =	41.1063	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2257.7671	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	420.4924	325.8721	269.8544	151.3390	63.9148	0.0000	0.0000	0.0000	0.0000	150.2758	295.7794	431.2268	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	450.2060	348.8994	288.9233	162.0331	68.4312	0.0000	0.0000	0.0000	0.0000	160.8948	316.6803	461.6989	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	164.9341	144.0742	149.8999	132.9536	128.7226	113.3716	108.6187	121.0844	122.4216	139.4014	148.8082	161.0608	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3062	87.0435	86.5140	85.3779	83.3912	80.3000	80.3000	80.3000	80.3000	85.2405	86.7480	87.4103	(217)
Fuel for water heating, kWh/month													
	188.9145	165.5197	173.2665	155.7237	154.3598	141.1851	135.2661	150.7900	152.4553	163.5389	171.5409	184.2584	(219)
Water heating fuel used												1936.8188	(219)
Annual totals kWh/year													
Space heating fuel - main system												2257.7671	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Total delivered energy for all uses												4508.8727	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2257.7671	0.2160	487.6777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1936.8188	0.2160	418.3529	(264)
Space and water heating			906.0306	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Total CO2, kg/m2/year			1069.1454	(272)
Emissions per m2 for space and water heating			17.6614	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4209	(272b)
Emissions per m2 for pumps and fans			0.7588	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6614 * 1.00) + 2.4209 + 0.7588, rounded to 2 d.p.			20.8400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3058	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3899	0.3823	0.3746	0.3364	0.3287	0.2905	0.2905	0.2829	0.3058	0.3287	0.3440	0.3593	(22b)
Effective ac	0.5760	0.5731	0.5702	0.5566	0.5540	0.5422	0.5422	0.5400	0.5468	0.5540	0.5592	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.5255	22.4101	22.2970	21.7655	21.6661	21.2033	21.2033	21.1175	21.3815	21.6661	21.8672	22.0775	(38)
Heat transfer coeff	65.4231	65.3077	65.1945	64.6631	64.5637	64.1008	64.1008	64.0151	64.2791	64.5637	64.7648	64.9751	(39)
Average = Sum(39)m / 12 =												64.6626	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2731	1.2708	1.2605	1.2586	1.2495	1.2495	1.2479	1.2530	1.2586	1.2625	1.2666	(40)
HLP (average)												1.2605	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	340.4040	407.1154	465.7453	520.7514	555.7735	545.9073	522.0229	487.0824	448.9776	391.2236	339.3323	319.4003	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4532	54.5495	54.6442	55.0932	55.1781	55.5765	55.5765	55.6509	55.4224	55.1781	55.0067	54.8287	
alpha	4.6302	4.6366	4.6429	4.6729	4.6785	4.7051	4.7051	4.7101	4.6948	4.6785	4.6671	4.6552	
util living area													
	0.9969	0.9924	0.9807	0.9446	0.8542	0.6909	0.5262	0.5809	0.8193	0.9650	0.9934	0.9977	(86)
MIT	19.6518	19.8407	20.1248	20.4786	20.7743	20.9406	20.9867	20.9793	20.8640	20.4724	19.9898	19.6144	(87)
Th 2	19.8602	19.8620	19.8637	19.8719	19.8734	19.8806	19.8806	19.8819	19.8778	19.8734	19.8703	19.8671	(88)
util rest of house													
	0.9958	0.9899	0.9738	0.9242	0.8019	0.5934	0.3995	0.4513	0.7384	0.9480	0.9907	0.9969	(89)
MIT 2	18.6449	18.8339	19.1155	19.4624	19.7262	19.8545	19.8774	19.8764	19.8062	19.4644	18.9897	18.6130	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1052	19.2942	19.5769	19.9269	20.2053	20.3509	20.3845	20.3805	20.2897	19.9252	19.4468	19.0708	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1052	19.2942	19.5769	19.9269	20.2053	20.3509	20.3845	20.3805	20.2897	19.9252	19.4468	19.0708	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9882	0.9717	0.9253	0.8189	0.6366	0.4579	0.5110	0.7712	0.9490	0.9894	0.9961	(94)
Useful gains	338.6568	402.3066	452.5507	481.8761	455.1287	347.5194	239.0172	248.9224	346.2540	371.2663	335.7287	318.1618	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	968.6001	940.0494	852.5422	713.0346	549.1330	368.6397	242.5903	254.8131	397.8708	602.0669	799.6413	966.2302	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	468.6778	361.3632	297.5937	166.4341	69.9392	0.0000	0.0000	0.0000	0.0000	171.7157	334.0171	482.1629	(98)
Space heating												2351.9037	(98)
Space heating per m2											(98) / (4) =	45.8461	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	602.5478	474.3462	486.5149	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8820	0.9345	0.9144	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	531.4268	443.2858	444.8795	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.4180	674.2629	634.4069	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	123.8337	171.8470	141.0084	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												436.6891	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   30.9584   42.9617   35.2521    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          109.1723 (107)
Space cooling per m2                                                                                                     2.1281 (108)
Energy for space heating                                                                                                45.8461 (99)
Energy for space cooling                                                                                                 2.1281 (108)
Total                                                                                                                   47.9742 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   48.0 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4188	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3560	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4538	0.4449	0.4360	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4182	(22b)
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			10.0700	1.3258	13.3504			(27)
Ground floor			51.3000	0.1300	6.6690			(28a)
External Wall	59.5700	12.1900	47.3800	0.1800	8.5284			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.0918			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7895	(36)
Total fabric heat loss					(33) + (36) =		39.8813	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5804	23.4240	23.2707	22.5507	22.4160	21.7889	21.7889	21.6728	22.0305	22.4160	22.6885	22.9734	(38)
Heat transfer coeff	63.4617	63.3053	63.1520	62.4320	62.2973	61.6702	61.6702	61.5541	61.9117	62.2973	62.5698	62.8547	(39)
Average = Sum(39)m / 12 =												62.4314	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2371	1.2340	1.2310	1.2170	1.2144	1.2021	1.2021	1.1999	1.2069	1.2144	1.2197	1.2252	(40)
HLP (average)												1.2170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	26.0850	22.8141	23.5421	20.5246	19.6938	16.9943	15.7477	18.0707	18.2865	21.3112	23.2628	25.2619 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	86.4210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5494	12.0345	9.7871	7.4095	5.5387	4.6760	5.0525	6.5675	8.8149	11.1925	13.0633	13.9260	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	150.6096	152.1724	148.2341	139.8498	129.2662	119.3191	112.6738	111.1109	115.0492	123.4335	134.0172	143.9643	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	31.6421	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	35.0605	33.9495	31.6426	28.5064	26.4702	23.6032	21.1662	24.2886	25.3979	28.6441	32.3095	33.9542	(72)
Total internal gains													
	248.1458	247.0828	238.5901	224.6919	210.2013	196.5245	187.8188	190.8933	198.1884	212.1964	228.3162	240.7708	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.6300	0.7000	0.7700	13.2263	(74)
East	0.7100	19.6403	0.6300	0.7000	0.7700	4.2616	(76)
South	3.8000	46.7521	0.6300	0.7000	0.7700	54.2945	(78)
West	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(80)

Solar gains	80.7259	140.0286	198.7608	259.0520	302.3757	305.7100	292.4286	259.1655	219.4406	156.6488	97.1391	68.8008	(83)
Total gains	328.8717	387.1113	437.3509	483.7440	512.5770	502.2344	480.2474	450.0588	417.6289	368.8452	325.4553	309.5716	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1362	56.2749	56.4115	57.0621	57.1855	57.7670	57.7670	57.8760	57.5416	57.1855	56.9364	56.6783	
alpha	4.7424	4.7517	4.7608	4.8041	4.8124	4.8511	4.8511	4.8584	4.8361	4.8124	4.7958	4.7786	
util living area													
	0.9973	0.9937	0.9843	0.9543	0.8745	0.7167	0.5490	0.6028	0.8379	0.9702	0.9944	0.9980	(86)
MIT	19.6812	19.8559	20.1246	20.4686	20.7627	20.9370	20.9861	20.9785	20.8600	20.4752	20.0128	19.6509	(87)
Th 2	19.8905	19.8929	19.8953	19.9064	19.9085	19.9183	19.9183	19.9201	19.9145	19.9085	19.9043	19.8999	(88)
util rest of house													
	0.9964	0.9916	0.9786	0.9370	0.8270	0.6218	0.4222	0.4742	0.7619	0.9556	0.9921	0.9973	(89)
MIT 2	18.6980	18.8736	19.1413	19.4834	19.7502	19.8898	19.9149	19.9142	19.8388	19.4970	19.0396	18.6753	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1474	19.3226	19.5908	19.9338	20.2130	20.3685	20.4045	20.4007	20.3056	19.9441	19.4845	19.1213	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9902	0.9767	0.9375	0.8417	0.6636	0.4807	0.5335	0.7923	0.9561	0.9909	0.9966	(94)
Useful gains	327.4139	383.3033	427.1509	453.4944	431.4587	333.2823	230.8535	240.1229	330.9076	352.6689	322.4907	308.5312	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	942.2408	913.0286	826.7081	688.8592	530.3395	355.7443	234.6264	246.2593	384.1998	582.1139	774.8944	937.8715	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	457.4312	355.9754	297.2706	169.4627	73.5673	0.0000	0.0000	0.0000	0.0000	170.7070	325.7306	468.2292	(98)
Space heating												2318.3740	(98)
Space heating per m2											(98) / (4) =	45.1925	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	579.6997	456.3593	467.8108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8741	0.9304	0.9103	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	506.7211	424.5918	425.8391	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	652.3719	625.4344	591.1325	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.8686	149.4268	122.9784	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												377.2738	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   26.2171   37.3567   30.7446    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              94.3184 (107)
Space cooling per m2                                                                                                        1.8386 (108)
Energy for space heating                                                                                                   45.1925 (99)
Energy for space cooling                                                                                                    1.8386 (108)
Total                                                                                                                      47.0310 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                      54.1 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3058	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3211	0.2982	0.3058	0.2905	0.2905	0.2829	0.2752	0.2676	0.2599	0.2829	0.2676	0.2829	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5422	0.5422	0.5400	0.5379	0.5358	0.5338	0.5400	0.5358	0.5400	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.5690	21.2913	21.3815	21.2033	21.2033	21.1175	21.0341	20.9530	20.8741	21.1175	20.9530	21.1175	(38)
Heat transfer coeff	64.4665	64.1888	64.2791	64.1008	64.1008	64.0151	63.9317	63.8506	63.7717	64.0151	63.8506	64.0151	(39)
Average = Sum(39)m / 12 =												64.0488	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2567	1.2512	1.2530	1.2495	1.2495	1.2479	1.2462	1.2447	1.2431	1.2479	1.2447	1.2479	(40)
HLP (average)												1.2485	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132 (64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397 (64)
RHI water heating demand												1322 (64)
Heat gains from water heating, kWh/month												
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2612	55.5003	55.4224	55.5765	55.5765	55.6509	55.7235	55.7943	55.8633	55.6509	55.7943	55.6509	
alpha	4.6841	4.7000	4.6948	4.7051	4.7051	4.7101	4.7149	4.7196	4.7242	4.7101	4.7196	4.7101	
util living area	0.9806	0.9695	0.9366	0.8561	0.7131	0.5040	0.3672	0.3830	0.6282	0.8678	0.9603	0.9840	(86)
MIT	20.0447	20.1772	20.4364	20.7218	20.9098	20.9857	20.9974	20.9969	20.9612	20.7519	20.3734	20.0193	(87)
Th 2	19.8749	19.8792	19.8778	19.8806	19.8806	19.8819	19.8832	19.8844	19.8857	19.8819	19.8844	19.8819	(88)
util rest of house	0.9745	0.9602	0.9176	0.8154	0.6416	0.4103	0.2632	0.2749	0.5317	0.8202	0.9461	0.9788	(89)
MIT 2	18.6583	18.8496	19.2108	19.5893	19.8068	19.8747	19.8825	19.8837	19.8622	19.6380	19.1353	18.6275	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2921	19.4565	19.7710	20.1070	20.3110	20.3826	20.3922	20.3926	20.3645	20.1472	19.7013	19.2637	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2921	19.4565	19.7710	20.1070	20.3110	20.3826	20.3922	20.3926	20.3645	20.1472	19.7013	19.2637	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9560	0.9155	0.8244	0.6705	0.4530	0.3109	0.3245	0.5747	0.8328	0.9432	0.9752	(94)
Useful gains	500.7817	542.3299	573.0225	560.9223	465.1195	320.7963	209.8780	209.5195	347.8200	457.3398	479.5795	474.7087	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	927.8078	908.6869	820.9108	679.9146	500.6929	325.3608	210.4739	210.2314	361.2379	559.9518	753.5174	913.0913	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	317.7074	246.1920	184.4289	85.6745	26.4666	0.0000	0.0000	0.0000	0.0000	76.3434	197.2352	326.1567	(98)
Space heating												1460.2046	(98)
RHI space heating demand												1460	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1688	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3058	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3899	0.3823	0.3746	0.3364	0.3287	0.2905	0.2905	0.2829	0.3058	0.3287	0.3440	0.3593	(22b)
Effective ac	0.5760	0.5731	0.5702	0.5566	0.5540	0.5422	0.5422	0.5400	0.5468	0.5540	0.5592	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.5255	22.4101	22.2970	21.7655	21.6661	21.2033	21.2033	21.1175	21.3815	21.6661	21.8672	22.0775	(38)
Heat transfer coeff	65.4231	65.3077	65.1945	64.6631	64.5637	64.1008	64.1008	64.0151	64.2791	64.5637	64.7648	64.9751	(39)
Average = Sum(39)m / 12 =												64.6626	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2731	1.2708	1.2605	1.2586	1.2495	1.2495	1.2479	1.2530	1.2586	1.2625	1.2666	(40)
HLP (average)												1.2605	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7284 (42)
Average daily hot water use (litres/day)		75.2500 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	10.6334	0.7200	0.7000	0.7700	15.1158	(74)
East	0.7100	19.6403	0.7200	0.7000	0.7700	4.8705	(76)
South	3.8000	46.7521	0.7200	0.7000	0.7700	62.0509	(78)
West	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(80)

Solar gains	92.2582	160.0327	227.1552	296.0595	345.5722	349.3828	334.2041	296.1892	250.7892	179.0272	111.0161	78.6295	(83)
Total gains	494.3932	558.9712	610.9826	656.5158	682.3650	664.6815	636.7099	605.0403	572.8755	524.6564	482.8607	470.0549	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4532	54.5495	54.6442	55.0932	55.1781	55.5765	55.5765	55.6509	55.4224	55.1781	55.0067	54.8287	
alpha	4.6302	4.6366	4.6429	4.6729	4.6785	4.7051	4.7051	4.7101	4.6948	4.6785	4.6671	4.6552	
util living area													
	0.9859	0.9742	0.9490	0.8876	0.7675	0.5911	0.4376	0.4781	0.7057	0.9085	0.9739	0.9886	(86)
MIT	19.9169	20.0924	20.3453	20.6416	20.8622	20.9689	20.9938	20.9907	20.9294	20.6503	20.2286	19.8762	(87)
Th 2	19.8602	19.8620	19.8637	19.8719	19.8734	19.8806	19.8806	19.8819	19.8778	19.8734	19.8703	19.8671	(88)
util rest of house													
	0.9815	0.9664	0.9335	0.8541	0.7047	0.4986	0.3291	0.3663	0.6157	0.8736	0.9646	0.9851	(89)
MIT 2	18.4636	18.7161	19.0743	19.4809	19.7504	19.8619	19.8786	19.8785	19.8287	19.5043	18.9210	18.4101	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.1279	19.3452	19.6553	20.0115	20.2586	20.3679	20.3884	20.3869	20.3319	20.0282	19.5187	19.0803	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1279	19.3452	19.6553	20.0115	20.2586	20.3679	20.3884	20.3869	20.3319	20.0282	19.5187	19.0803	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9779	0.9620	0.9301	0.8587	0.7276	0.5401	0.3789	0.4176	0.6542	0.8791	0.9609	0.9818	(94)
Useful gains	483.4531	537.7417	568.2925	563.7666	496.4761	358.9616	241.2195	252.6734	374.7498	461.2328	463.9771	461.4980	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	970.0900	943.3856	857.6557	718.5020	552.5751	369.7276	242.8369	255.2232	400.5802	608.7163	804.2964	966.8471	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	362.0579	272.5927	215.2862	111.4095	41.7376	0.0000	0.0000	0.0000	0.0000	109.7277	245.0300	375.9797	(98)
Space heating												1733.8214	(98)
Space heating per m2											(98) / (4) =	33.7977	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1866.3308	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	362.0579	272.5927	215.2862	111.4095	41.7376	0.0000	0.0000	0.0000	0.0000	109.7277	245.0300	375.9797	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	389.7286	293.4260	231.7398	119.9242	44.9275	0.0000	0.0000	0.0000	0.0000	118.1138	263.7567	404.7145	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0102	88.9089	88.7126	88.2966	87.5907	86.7000	86.7000	86.7000	86.7000	88.2547	88.8174	89.0526	(217)
Fuel for water heating, kWh/month													
	151.0965	132.6680	138.0863	122.2078	119.1463	105.2670	98.9250	111.5511	112.2971	126.8933	136.0265	146.6697	(219)
Water heating fuel used												1500.8345	(219)
Annual totals kWh/year													
Space heating fuel - main system												1866.3308	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3057.6990	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1866.3308	3.4800	64.9483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1500.8345	3.4800	52.2290	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	239.2868	13.1900	31.5619	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			196.3587	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8564	(257)
SAP value		88.0533	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1866.3308	0.2160	403.1275	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1500.8345	0.2160	324.1803	(264)
Space and water heating			727.3077	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			566.6947	(272)
CO2 emissions per m2			11.0500	(273)
EI value			92.1145	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8795 = 3.957, stars = 4
Water heating environmental impact	0.216 / 0.8795 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.3000 (1b)	x	2.3100 (2b)	=	118.5030	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	118.5030	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1688	(8)
Pressure test			Yes	
Measured/design AP50			3.8200	
Infiltration rate			0.3598	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3058	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3211	0.2982	0.3058	0.2905	0.2905	0.2829	0.2752	0.2676	0.2599	0.2829	0.2676	0.2829	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5422	0.5422	0.5400	0.5379	0.5358	0.5338	0.5400	0.5358	0.5400	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0700	1.2357	12.4439			(27)
Opening Type 5			2.1200	1.5000	3.1800			(26a)
Ground floor			51.3000	0.1900	9.7470			(28a)
External Wall	59.5700	12.1900	47.3800	0.2700	12.7926			(29a)
Total net area of external elements Aum(A, m2)			110.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.1635			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7341	(36)
Total fabric heat loss					(33) + (36) =		42.8976	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.5690	21.2913	21.3815	21.2033	21.2033	21.1175	21.0341	20.9530	20.8741	21.1175	20.9530	21.1175	(38)
Heat transfer coeff	64.4665	64.1888	64.2791	64.1008	64.1008	64.0151	63.9317	63.8506	63.7717	64.0151	63.8506	64.0151	(39)
Average = Sum(39)m / 12 =												64.0488	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2567	1.2512	1.2530	1.2495	1.2495	1.2479	1.2462	1.2447	1.2431	1.2479	1.2447	1.2479	(40)
HLP (average)												1.2485	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7284	(42)
Average daily hot water use (litres/day)	75.2500	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.7750	79.7650	76.7550	73.7450	70.7350	67.7250	67.7250	70.7350	73.7450	76.7550	79.7650	82.7750	(44)
Energy conte	122.7529	107.3605	110.7864	96.5862	92.6768	79.9730	74.1068	85.0386	86.0542	100.2879	109.4721	118.8796	(45)
Energy content (annual)										Total = Sum(45)m =		1183.9750	(45)
Distribution loss (46)m = 0.15 x (45)m	18.4129	16.1041	16.6180	14.4879	13.9015	11.9960	11.1160	12.7558	12.9081	15.0432	16.4208	17.8319	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7384	10.5932	11.7135	11.3190	11.6843	11.2934	11.6612	11.6762	11.3074	11.7014	11.3432	11.7335	(61)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total heat required for water heating calculated for each month

	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
								Total per year (kWh/year) = Sum(64)m =				1321.7397	(64)
Heat gains from water heating, kWh/month													
	43.7499	38.3456	39.7648	34.9447	33.7361	29.4144	27.5558	31.1944	31.4399	36.2711	39.2353	42.4609	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	103.7052	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8735	30.0862	24.4677	18.5236	13.8466	11.6899	12.6314	16.4187	22.0372	27.9813	32.6583	34.8150	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	224.7904	227.1231	221.2449	208.7311	192.9346	178.0881	168.1698	165.8372	171.7153	184.2291	200.0256	214.8721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	47.0989	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	-69.1368	(71)
Water heating gains (Table 5)													
	58.8037	57.0620	53.4474	48.5343	45.3442	40.8533	37.0374	41.9279	43.6665	48.7515	54.4934	57.0710	(72)
Total internal gains													
	402.1349	398.9385	383.8273	360.4563	336.7928	315.2987	302.5059	308.8511	322.0863	345.6292	371.8446	391.4254	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.0700	13.4839	0.7200	0.7000	0.7700	19.1679	(74)
East	0.7100	25.1925	0.7200	0.7000	0.7700	6.2473	(76)
South	3.8000	56.7559	0.7200	0.7000	0.7700	75.3283	(78)
West	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(80)

Solar gains	113.8540	168.3807	242.1164	319.9056	356.9490	392.8873	372.5281	336.8099	283.1388	203.5304	136.6082	95.3616	(83)
Total gains	515.9890	567.3193	625.9437	680.3619	693.7418	708.1860	675.0339	645.6611	605.2251	549.1596	508.4529	486.7870	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2612	55.5003	55.4224	55.5765	55.5765	55.6509	55.7235	55.7943	55.8633	55.6509	55.7943	55.6509	
alpha	4.6841	4.7000	4.6948	4.7051	4.7051	4.7101	4.7149	4.7196	4.7242	4.7101	4.7196	4.7101	
util living area													
	0.9806	0.9695	0.9366	0.8561	0.7131	0.5040	0.3672	0.3830	0.6282	0.8678	0.9603	0.9840	(86)
MIT	20.0447	20.1772	20.4364	20.7218	20.9098	20.9857	20.9974	20.9969	20.9612	20.7519	20.3734	20.0193	(87)
Th 2	19.8749	19.8792	19.8778	19.8806	19.8806	19.8819	19.8832	19.8844	19.8857	19.8819	19.8844	19.8819	(88)
util rest of house													
	0.9745	0.9602	0.9176	0.8154	0.6416	0.4103	0.2632	0.2749	0.5317	0.8202	0.9461	0.9788	(89)
MIT 2	18.6583	18.8496	19.2108	19.5893	19.8068	19.8747	19.8825	19.8837	19.8622	19.6380	19.1353	18.6275	(90)
Living area fraction									fLA = Living area / (4) =			0.4571	(91)
MIT	19.2921	19.4565	19.7710	20.1070	20.3110	20.3826	20.3922	20.3926	20.3645	20.1472	19.7013	19.2637	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2921	19.4565	19.7710	20.1070	20.3110	20.3826	20.3922	20.3926	20.3645	20.1472	19.7013	19.2637	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9705	0.9560	0.9155	0.8244	0.6705	0.4530	0.3109	0.3245	0.5747	0.8328	0.9432	0.9752	(94)
Useful gains	500.7817	542.3299	573.0225	560.9223	465.1195	320.7963	209.8780	209.5195	347.8200	457.3398	479.5795	474.7087	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	927.8078	908.6869	820.9108	679.9146	500.6929	325.3608	210.4739	210.2314	361.2379	559.9518	753.5174	913.0913	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	317.7074	246.1920	184.4289	85.6745	26.4666	0.0000	0.0000	0.0000	0.0000	76.3434	197.2352	326.1567	(98)
Space heating												1460.2046	(98)
Space heating per m2											(98) / (4) =	28.4640	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1571.8026	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	317.7074	246.1920	184.4289	85.6745	26.4666	0.0000	0.0000	0.0000	0.0000	76.3434	197.2352	326.1567	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	341.9886	265.0075	198.5241	92.2222	28.4894	0.0000	0.0000	0.0000	0.0000	82.1780	212.3092	351.0836	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.4912	117.9536	122.4999	107.9053	104.3611	91.2665	85.7680	96.7148	97.3616	111.9893	120.8153	130.6132	(64)
Efficiency of water heater	88.9239	88.8379	88.5949	88.0877	87.3288	86.7000	86.7000	86.7000	86.7000	87.9693	88.6570	88.9611	(216) (217)m
Fuel for water heating, kWh/month	151.2431	132.7740	138.2696	122.4976	119.5035	105.2670	98.9250	111.5511	112.2971	127.3050	136.2727	146.8205	(219)

Water heating fuel used	1502.7262	(219)
Annual totals kWh/year		
Space heating fuel - main system	1571.8026	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	239.2868	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) = -692.9382	-692.9382	(233)
Total delivered energy for all uses	2695.8774	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1571.8026	7.3800	115.9990	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1502.7262	7.3800	110.9012	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	239.2868	28.6600	68.5796	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			225.3787	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1571.8026	0.2160	339.5094	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.7262	0.2160	324.5889	(264)
Space and water heating			664.0982	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	239.2868	0.5190	124.1899	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			467.5781	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1571.8026	1.2200	1917.5991	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1502.7262	1.2200	1833.3260	(264)
Space and water heating			3750.9251	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	239.2868	3.0700	734.6105	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			2588.4653	(272)
Primary energy kWh/m2/year			50.4574	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£90	£90	£0
Mains gas	£334	£334	£0
Space heating	£244	£244	£0
Water heating	£111	£111	£0
Lighting	£69	£69	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£225	£225	£0
Total cost of uses	£225	£225	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	234.64 (P1)
Transmission heat loss coefficient	42.90 (37)
Summer heat loss coefficient	277.53 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.0700	87.1704	0.7200	0.7000	0.7650	123.1114
East	0.7100	125.2818	0.7200	0.7000	0.7650	30.8660
South	3.8000	118.5567	0.7200	0.7000	0.7650	156.3306
West	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
total:						375.0832

	Jun	Jul	Aug	
Solar gains	402	375	338	(P3)
Internal gains	312	300	306	
Total summer gains	714	675	644	(P5)
Summer gain/loss ratio	2.57	2.43	2.32	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.22	19.98	19.87	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 430 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 430	**Prop Type Ref**	
Property	24 Stock Dove Gardens , Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.07	**TER**	20.84
Environmental	92 A	**% DER<TER**	37.29		
CO_2 Emissions (t/year)	0.47	**DFEE**	47.97	**TFEE**	54.09
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.30		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.84	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.07	$kgCO_2/m^2$	Pass
	-7.77 (-37.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.09	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.97	$kWh/m^2/yr$	
	-6.1 (-11.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.82 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.07 m², No overhang
Windows facing East	0.71 m², No overhang
Windows facing South	3.80 m², No overhang
Windows facing West	1.49 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.82 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 431 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 431	**Prop Type Ref**	
Property	12 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.95	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.61		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.14	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached Maisonette, total floor area 60 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.95 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.13 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.47 m², No overhang
Windows facing East: 1.49 m², No overhang
Windows facing South: 5.22 m², No overhang
Windows facing West: 1.30 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.1300	
Infiltration rate		0.3466	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3756	0.3683	0.3609	0.3241	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3462	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8793	26.7503	26.6238	26.0296	25.9184	25.4009	25.4009	25.3051	25.6003	25.9184	26.1433	26.3784	(38)
Heat transfer coeff	81.0609	80.9319	80.8054	80.2112	80.1001	79.5826	79.5826	79.4867	79.7819	80.1001	80.3249	80.5601	(39)
Average = Sum(39)m / 12 =												80.2107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3452	1.3430	1.3409	1.3311	1.3292	1.3207	1.3207	1.3191	1.3240	1.3292	1.3330	1.3369	(40)
HLP (average)												1.3311	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7810	10.6258	11.7402	11.3343	11.6923	11.2923	11.6545	11.6790	11.3152	11.7204	11.3739	11.7731	(61)
Total heat required for water heating calculated for each month													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3217	(64)
Heat gains from water heating, kWh/month													
	47.1170	41.2894	42.8008	37.5895	36.2722	31.6008	29.5805	33.5203	33.7948	39.0180	42.2363	45.7213	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3294	61.4425	57.5279	52.2076	48.7530	43.8901	39.7587	45.0542	46.9373	52.4436	58.6615	61.4534	(72)
Total internal gains													
	308.3017	306.4793	295.4483	277.7376	259.9385	242.6208	231.2614	236.4925	245.4919	263.3886	283.9509	299.1976	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	429.2802	515.2434	588.8399	655.2347	696.2264	681.8631	652.1814	612.4929	567.7778	496.1496	429.3312	402.4300	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6244	51.7067	51.7877	52.1713	52.2437	52.5834	52.5834	52.6468	52.4520	52.2437	52.0974	51.9454	
alpha	4.4416	4.4471	4.4525	4.4781	4.4829	4.5056	4.5056	4.5098	4.4968	4.4829	4.4732	4.4630	
util living area													
	0.9958	0.9902	0.9762	0.9367	0.8441	0.6834	0.5213	0.5720	0.8052	0.9579	0.9914	0.9969	(86)
MIT	19.6060	19.8063	20.1011	20.4617	20.7627	20.9345	20.9846	20.9769	20.8590	20.4600	19.9580	19.5648	(87)
Th 2	19.8056	19.8073	19.8089	19.8166	19.8180	19.8247	19.8247	19.8259	19.8221	19.8180	19.8151	19.8121	(88)
util rest of house													
	0.9944	0.9868	0.9678	0.9137	0.7886	0.5824	0.3899	0.4381	0.7194	0.9378	0.9879	0.9958	(89)
MIT 2	17.9760	18.2681	18.6937	19.2045	19.5943	19.7833	19.8195	19.8172	19.7158	19.2143	18.4958	17.9203	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.6552	18.9091	19.2801	19.7284	20.0812	20.2630	20.3050	20.3004	20.1922	19.7334	19.1051	18.6055	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6552	18.9091	19.2801	19.7284	20.0812	20.2630	20.3050	20.3004	20.1922	19.7334	19.1051	18.6055	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9834	0.9630	0.9116	0.8024	0.6223	0.4451	0.4943	0.7494	0.9359	0.9850	0.9942	(94)
Useful gains	426.0355	506.7006	567.0757	597.3142	558.6688	424.3281	290.2777	302.7580	425.4977	464.3696	422.8725	400.0950	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1163.6473	1133.7795	1032.7048	868.5574	671.3334	450.6769	294.8537	310.0320	486.0471	731.5868	964.3089	1160.5094	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	548.7832	421.3970	346.4280	195.2951	83.8225	0.0000	0.0000	0.0000	0.0000	198.8096	389.8342	565.7484	(98)
Space heating												2750.1180	(98)
Space heating per m2											(98) / (4) =	45.6375	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2947.6077	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	548.7832	421.3970	346.4280	195.2951	83.8225	0.0000	0.0000	0.0000	0.0000	198.8096	389.8342	565.7484	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	588.1920	451.6581	371.3055	209.3195	89.8419	0.0000	0.0000	0.0000	0.0000	213.0864	417.8287	606.3755	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5247	89.4409	89.2792	88.9251	88.2053	86.7000	86.7000	86.7000	86.7000	88.9086	89.3728	89.5605	(217)
Fuel for water heating, kWh/month													
	161.5516	141.7864	147.4443	130.2932	126.9656	112.8512	105.9464	119.6203	120.4684	135.2575	145.2886	156.7977	(219)
Water heating fuel used												1604.2712	(219)
Annual totals kWh/year													
Space heating fuel - main system												2947.6077	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4277.4870	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2947.6077	0.2160	636.6833	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1604.2712	0.2160	346.5226	(264)
Space and water heating			983.2059	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			840.7964	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9500	ZC1
Total Floor Area	TFA	60.2600	
Assumed number of occupants	N	1.9890	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0715	ZC2
CO2 emissions from cooking, equation (L16)		2.7669	ZC3
Total CO2 emissions		33.7885	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.7885	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	45.6500	39.7329	42.3300	39.3581	39.0100	36.1452	37.3500	39.0100	39.3581	42.3300	42.5710	45.6500	(61)
Total heat required for water heating calculated for each month													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
								Total per year (kWh/year) = Sum(64)m =				1769.8350	(64)
Heat gains from water heating, kWh/month													
	55.5843	48.5662	50.4482	44.5954	43.1016	37.8141	36.0043	40.3531	40.8056	46.6704	50.0355	54.1905	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	74.7101	72.2711	67.8068	61.9381	57.9323	52.5195	48.3929	54.2380	56.6744	62.7291	69.4938	72.8367	(72)
Total internal gains													
	319.6824	317.3078	305.7271	287.4681	269.1179	251.2502	239.8956	245.6763	255.2290	273.6741	294.7833	310.5810	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	425.5386	499.9764	562.4448	617.7780	650.8697	635.5873	608.2007	574.6767	537.2292	477.3400	421.9910	400.9093	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9960	0.9910	0.9785	0.9425	0.8546	0.6936	0.5282	0.5766	0.8103	0.9599	0.9917	0.9969	(86)
MIT	19.6903	19.8732	20.1471	20.4886	20.7750	20.9402	20.9867	20.9802	20.8718	20.4978	20.0271	19.6555	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9946	0.9879	0.9710	0.9216	0.8025	0.5964	0.4015	0.4481	0.7282	0.9408	0.9883	0.9959	(89)
MIT 2	18.1361	18.4033	18.7999	19.2872	19.6610	19.8462	19.8802	19.8787	19.7834	19.3107	18.6359	18.0912	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7837	19.0158	19.3613	19.7878	20.1252	20.3021	20.3413	20.3376	20.2370	19.8054	19.2156	18.7430	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9848	0.9667	0.9196	0.8154	0.6349	0.4547	0.5020	0.7571	0.9393	0.9857	0.9944	(94)
Useful gains	422.4614	492.3986	543.7382	568.1216	530.6913	403.5094	276.5414	288.4971	406.7427	448.3875	415.9368	398.6646	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1113.0485	1082.4655	984.2000	824.9901	637.2052	427.5177	280.5025	294.7483	461.6698	696.2112	919.7639	1108.3779	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating												2577.3801	(98)
Space heating per m2											(98) / (4) =	42.7710	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2759.5076	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.7968	396.5249	327.7036	184.9454	79.2463	0.0000	0.0000	0.0000	0.0000	184.3809	362.7555	528.0267	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	550.1036	424.5449	350.8604	198.0143	84.8462	0.0000	0.0000	0.0000	0.0000	197.4099	388.3891	565.3391	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.4975	155.9222	162.2269	143.8871	139.3081	122.6948	117.5510	131.0418	132.4890	150.8651	161.0456	174.3057	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5604	87.3009	86.7856	85.6842	83.6904	80.3000	80.3000	80.3000	80.3000	85.5573	87.0343	87.6635	(217)
Fuel for water heating, kWh/month													
	203.8564	178.6033	186.9285	167.9272	166.4566	152.7955	146.3898	163.1903	164.9925	176.3323	185.0369	198.8350	(219)
Water heating fuel used												2091.3443	(219)
Annual totals kWh/year													
Space heating fuel - main system												2759.5076	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Total delivered energy for all uses												5200.2131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2759.5076	0.2160	596.0536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2091.3443	0.2160	451.7304	(264)
Space and water heating			1047.7840	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Total CO2, kg/m2/year			1229.1025	(272)
Emissions per m2 for space and water heating			17.3877	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3630	(272b)
Emissions per m2 for pumps and fans			0.6460	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3877 * 1.00) + 2.3630 + 0.6460, rounded to 2 d.p.			20.4000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.1300	
Infiltration rate		0.3466	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3756	0.3683	0.3609	0.3241	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3462	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8793	26.7503	26.6238	26.0296	25.9184	25.4009	25.4009	25.3051	25.6003	25.9184	26.1433	26.3784	(38)
Heat transfer coeff	81.0609	80.9319	80.8054	80.2112	80.1001	79.5826	79.5826	79.4867	79.7819	80.1001	80.3249	80.5601	(39)
Average = Sum(39)m / 12 =												80.2107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3452	1.3430	1.3409	1.3311	1.3292	1.3207	1.3207	1.3191	1.3240	1.3292	1.3330	1.3369	(40)
HLP (average)												1.3311	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	400.8945	487.5422	562.5567	630.8777	673.1204	660.5172	632.3296	590.7247	545.3271	471.7056	402.6362	374.7230	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6244	51.7067	51.7877	52.1713	52.2437	52.5834	52.5834	52.6468	52.4520	52.2437	52.0974	51.9454	
alpha	4.4416	4.4471	4.4525	4.4781	4.4829	4.5056	4.5056	4.5098	4.4968	4.4829	4.4732	4.4630	
util living area													
	0.9968	0.9921	0.9798	0.9438	0.8565	0.6992	0.5358	0.5898	0.8219	0.9645	0.9933	0.9977	(86)
MIT	19.5641	19.7664	20.0655	20.4341	20.7458	20.9282	20.9829	20.9739	20.8455	20.4294	19.9192	19.5236	(87)
Th 2	19.8056	19.8073	19.8089	19.8166	19.8180	19.8247	19.8247	19.8259	19.8221	19.8180	19.8151	19.8121	(88)
util rest of house													
	0.9957	0.9893	0.9726	0.9228	0.8032	0.5981	0.4017	0.4533	0.7388	0.9470	0.9905	0.9968	(89)
MIT 2	18.5147	18.7170	19.0132	19.3738	19.6526	19.7933	19.8207	19.8191	19.7411	19.3778	18.8762	18.4794	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9520	19.1543	19.4517	19.8156	20.1081	20.2662	20.3050	20.3003	20.2013	19.8160	19.3108	18.9145	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9520	19.1543	19.4517	19.8156	20.1081	20.2662	20.3050	20.3003	20.2013	19.8160	19.3108	18.9145	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9874	0.9698	0.9228	0.8178	0.6385	0.4582	0.5108	0.7688	0.9470	0.9889	0.9960	(94)
Useful gains	398.7548	481.3760	545.5810	582.1565	550.5052	421.7353	289.7152	301.7394	419.2425	446.6904	398.1792	373.2189	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1187.7045	1153.6281	1046.5652	875.5541	673.4918	450.9313	294.8507	310.0222	486.7740	738.2035	980.8327	1185.4028	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	586.9786	451.7534	372.7322	211.2463	91.5020	0.0000	0.0000	0.0000	0.0000	216.8857	419.5105	604.2649	(98)
Space heating												2954.8736	(98)
Space heating per m2											(98) / (4) =	49.0354	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	748.0760	588.9109	604.0991	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8650	0.9221	0.9002	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	647.0650	543.0150	543.7869	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.3257	811.9197	764.4492	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	143.4677	200.0651	164.1727	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  507.7056 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   35.8669   50.0163   41.0432    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  126.9264 (107)
Space cooling per m2                                                                                             2.1063 (108)
Energy for space heating                                                                                        49.0354 (99)
Energy for space cooling                                                                                         2.1063 (108)
Total                                                                                                           51.1417 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                        51.1 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3901	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3316	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4228	0.4145	0.4062	0.3647	0.3564	0.3150	0.3150	0.3067	0.3316	0.3564	0.3730	0.3896	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5665	0.5635	0.5496	0.5496	0.5470	0.5550	0.5635	0.5696	0.5759	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.4800	1.3258	16.5455			(27)
Ground floor			3.5800	0.1300	0.4654			(28a)
External Wall	86.6200	14.6000	72.0200	0.1800	12.9636			(29a)
Roof	56.6800		56.6800	0.1300	7.3684			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8869			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1954	(36)
Total fabric heat loss					(33) + (36) =		49.0822	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.7659	27.6024	27.4422	26.6895	26.5487	25.8932	25.8932	25.7718	26.1457	26.5487	26.8336	27.1314	(38)
Heat transfer coeff	76.8481	76.6846	76.5244	75.7717	75.6309	74.9754	74.9754	74.8540	75.2279	75.6309	75.9158	76.2136	(39)
Average = Sum(39)m / 12 =												75.7711	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2753	1.2726	1.2699	1.2574	1.2551	1.2442	1.2442	1.2422	1.2484	1.2551	1.2598	1.2647	(40)
HLP (average)												1.2574	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.2301	24.6902	25.4781	22.2124	21.3134	18.3918	17.0427	19.5568	19.7903	23.0637	25.1758	27.3393	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	99.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.5355	13.7985	11.2217	8.4955	6.3505	5.3614	5.7931	7.5301	10.1069	12.8331	14.9781	15.9672	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	173.6022	175.4036	170.8640	161.1998	149.0004	137.5347	129.8749	128.0735	132.6131	142.2773	154.4767	165.9424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	32.9449	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	37.9437	36.7414	34.2448	30.8506	28.6470	25.5442	22.9069	26.2860	27.4866	30.9996	34.9665	36.7464	(72)
Total internal gains													
	279.9160	278.7781	269.1651	253.3805	236.8325	221.2749	211.4096	214.7242	223.0412	238.9447	257.2559	271.4907	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.6300	0.7000	0.7700	14.5262	(74)
East	1.4900	19.6403	0.6300	0.7000	0.7700	8.9435	(76)
South	5.2200	46.7521	0.6300	0.7000	0.7700	74.5836	(78)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)

Solar gains	105.8562	182.6686	256.7177	330.3100	381.7519	384.3370	368.3051	329.0004	282.0001	203.6658	127.2077	90.3283	(83)
Total gains	385.7722	461.4467	525.8828	583.6905	618.5844	605.6119	579.7146	543.7246	505.0413	442.6105	384.4636	361.8190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4544	54.5705	54.6848	55.2280	55.3308	55.8146	55.8146	55.9052	55.6273	55.3308	55.1232	54.9078	
alpha	4.6303	4.6380	4.6457	4.6819	4.6887	4.7210	4.7210	4.7270	4.7085	4.6887	4.6749	4.6605	
util living area													
	0.9973	0.9935	0.9834	0.9525	0.8727	0.7178	0.5512	0.6044	0.8359	0.9693	0.9943	0.9980	(86)
MIT	19.6307	19.8167	20.0964	20.4483	20.7499	20.9309	20.9842	20.9759	20.8516	20.4533	19.9718	19.5966	(87)
Th 2	19.8603	19.8624	19.8645	19.8743	19.8762	19.8848	19.8848	19.8864	19.8815	19.8762	19.8725	19.8686	(88)
util rest of house													
	0.9964	0.9912	0.9774	0.9344	0.8241	0.6208	0.4205	0.4721	0.7581	0.9541	0.9920	0.9973	(89)
MIT 2	18.6239	18.8105	19.0886	19.4369	19.7101	19.8537	19.8810	19.8798	19.8018	19.4491	18.9736	18.5964	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0434	19.2298	19.5085	19.8584	20.1434	20.3026	20.3407	20.3366	20.2393	19.8675	19.3895	19.0132	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9896	0.9750	0.9341	0.8371	0.6595	0.4756	0.5278	0.7860	0.9539	0.9906	0.9966	(94)
Useful gains	384.0342	456.6256	512.7279	545.2031	517.7941	399.4181	275.6838	286.9784	396.9810	422.2205	380.8568	360.5938	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1133.0054	1098.8740	995.4685	830.3348	638.5804	427.5523	280.4571	294.6670	461.8437	700.9114	932.9704	1128.9672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	557.2346	431.5909	359.1590	205.2948	89.8650	0.0000	0.0000	0.0000	0.0000	207.3461	397.5218	571.6698	(98)
Space heating												2819.6819	(98)
Space heating per m2											(98) / (4) =	46.7919	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	704.7684	554.8177	568.8901	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8653	0.9238	0.9028	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	609.8029	512.5501	513.5980	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	782.1507	750.4217	709.5141	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.0904	176.9765	145.7615	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  446.8284 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.0226   44.2441   36.4404    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  111.7071 (107)
Space cooling per m2                                                                                             1.8538 (108)
Energy for space heating                                                                                        46.7919 (99)
Energy for space cooling                                                                                         1.8538 (108)
Total                                                                                                           48.6457 (109)
Target Fabric Energy Efficiency (TFEE)                                                                          55.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.1300	
Infiltration rate		0.3466	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3093	0.2872	0.2946	0.2799	0.2799	0.2725	0.2651	0.2578	0.2504	0.2725	0.2578	0.2725	(22b)
Effective ac	0.5478	0.5413	0.5434	0.5392	0.5392	0.5371	0.5352	0.5332	0.5314	0.5371	0.5332	0.5371	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8098	25.4993	25.6003	25.4009	25.4009	25.3051	25.2118	25.1211	25.0329	25.3051	25.1211	25.3051	(38)
Heat transfer coeff	79.9914	79.6809	79.7819	79.5826	79.5826	79.4867	79.3934	79.3027	79.2146	79.4867	79.3027	79.4867	(39)
Average = Sum(39)m / 12 =												79.5244	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3274	1.3223	1.3240	1.3207	1.3207	1.3191	1.3175	1.3160	1.3145	1.3191	1.3160	1.3191	(40)
HLP (average)												1.3197	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7810	10.6258	11.7402	11.3343	11.6923	11.2923	11.6545	11.6790	11.3152	11.7204	11.3739	11.7731	(61)
Total heat required for water heating calculated for each month													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3217	(64)
RHI water heating demand												1419	(64)
Heat gains from water heating, kWh/month													
	47.1170	41.2894	42.8008	37.5895	36.2722	31.6008	29.5805	33.5203	33.7948	39.0180	42.2363	45.7213	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3294	61.4425	57.5279	52.2076	48.7530	43.8901	39.7587	45.0542	46.9373	52.4436	58.6615	61.4534	(72)
Total internal gains													
	452.9781	449.4375	432.3054	405.7455	378.7202	354.2715	339.7871	346.7364	361.8369	388.5829	418.3713	440.7491	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0564	668.6549	744.1958	812.4911	828.2430	847.1075	807.8695	773.1312	724.6759	652.6040	596.9767	565.7830	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3146	52.5185	52.4520	52.5834	52.5834	52.6468	52.7087	52.7690	52.8277	52.6468	52.7690	52.6468	
alpha	4.4876	4.5012	4.4968	4.5056	4.5056	4.5098	4.5139	4.5179	4.5218	4.5098	4.5179	4.5098	
util living area													
	0.9822	0.9713	0.9398	0.8635	0.7273	0.5196	0.3801	0.3962	0.6432	0.8762	0.9635	0.9854	(86)
MIT	19.9484	20.0911	20.3692	20.6771	20.8880	20.9804	20.9962	20.9955	20.9501	20.7108	20.2985	19.9201	(87)
Th 2	19.8194	19.8234	19.8221	19.8247	19.8247	19.8259	19.8271	19.8283	19.8295	19.8259	19.8283	19.8259	(88)
util rest of house													
	0.9765	0.9624	0.9211	0.8229	0.6537	0.4195	0.2675	0.2792	0.5419	0.8290	0.9499	0.9807	(89)
MIT 2	18.4804	18.6865	19.0754	19.4859	19.7329	19.8162	19.8262	19.8272	19.7993	19.5408	18.9889	18.4449	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0921	19.2717	19.6145	19.9822	20.2142	20.3013	20.3137	20.3140	20.2788	20.0283	19.5346	19.0596	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0921	19.2717	19.6145	19.9822	20.2142	20.3013	20.3137	20.3140	20.2788	20.0283	19.5346	19.0596	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9172	0.8290	0.6796	0.4609	0.3146	0.3282	0.5826	0.8382	0.9457	0.9765	(94)
Useful gains	585.1180	640.0048	682.5692	673.5451	562.8846	390.4716	254.1870	253.7432	422.2196	547.0280	564.5694	552.5001	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1135.2490	1113.2820	1006.4103	834.2035	613.9167	397.5394	255.1492	254.8816	441.9256	685.8364	922.6569	1117.5533	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	409.2975	318.0422	240.9377	115.6741	37.9679	0.0000	0.0000	0.0000	0.0000	103.2734	257.8230	420.3996	(98)
Space heating												1903.4155	(98)
RHI space heating demand												1903	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.1300	
Infiltration rate		0.3466	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3756	0.3683	0.3609	0.3241	0.3167	0.2799	0.2799	0.2725	0.2946	0.3167	0.3314	0.3462	(22b)
Effective ac	0.5705	0.5678	0.5651	0.5525	0.5501	0.5392	0.5392	0.5371	0.5434	0.5501	0.5549	0.5599	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.8793	26.7503	26.6238	26.0296	25.9184	25.4009	25.4009	25.3051	25.6003	25.9184	26.1433	26.3784	(38)
Heat transfer coeff	81.0609	80.9319	80.8054	80.2112	80.1001	79.5826	79.5826	79.4867	79.7819	80.1001	80.3249	80.5601	(39)
Average = Sum(39)m / 12 =												80.2107	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3452	1.3430	1.3409	1.3311	1.3292	1.3207	1.3207	1.3191	1.3240	1.3292	1.3330	1.3369	(40)
HLP (average)												1.3311	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.9890	(42)
Average daily hot water use (litres/day)												81.4382	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7810	10.6258	11.7402	11.3343	11.6923	11.2923	11.6545	11.6790	11.3152	11.7204	11.3739	11.7731	(61)
Total heat required for water heating calculated for each month													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3217	(64)
Heat gains from water heating, kWh/month													
	47.1170	41.2894	42.8008	37.5895	36.2722	31.6008	29.5805	33.5203	33.7948	39.0180	42.2363	45.7213	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3294	61.4425	57.5279	52.2076	48.7530	43.8901	39.7587	45.0542	46.9373	52.4436	58.6615	61.4534	(72)
Total internal gains													
	452.9781	449.4375	432.3054	405.7455	378.7202	354.2715	339.7871	346.7364	361.8369	388.5829	418.3713	440.7491	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	10.6334	0.7200	0.7000	0.7700	16.6013	(74)
East	1.4900	19.6403	0.7200	0.7000	0.7700	10.2211	(76)
South	5.2200	46.7521	0.7200	0.7000	0.7700	85.2384	(78)
West	1.3000	19.6403	0.7200	0.7000	0.7700	8.9177	(80)

Solar gains	120.9785	208.7641	293.3916	377.4971	436.2879	439.2423	420.9201	376.0005	322.2859	232.7610	145.3803	103.2323	(83)
Total gains	573.9566	658.2016	725.6970	783.2426	815.0081	793.5138	760.7071	722.7368	684.1228	621.3438	563.7516	543.9814	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6244	51.7067	51.7877	52.1713	52.2437	52.5834	52.5834	52.6468	52.4520	52.2437	52.0974	51.9454	
alpha	4.4416	4.4471	4.4525	4.4781	4.4829	4.5056	4.5056	4.5098	4.4968	4.4829	4.4732	4.4630	
util living area													
	0.9871	0.9757	0.9513	0.8931	0.7791	0.6077	0.4527	0.4941	0.7198	0.9146	0.9761	0.9897	(86)
MIT	19.8153	20.0051	20.2751	20.5911	20.8340	20.9590	20.9912	20.9871	20.9123	20.6004	20.1460	19.7716	(87)
Th 2	19.8056	19.8073	19.8089	19.8166	19.8180	19.8247	19.8247	19.8259	19.8221	19.8180	19.8151	19.8121	(88)
util rest of house													
	0.9830	0.9681	0.9361	0.8599	0.7153	0.5100	0.3357	0.3739	0.6269	0.8805	0.9673	0.9864	(89)
MIT 2	18.2787	18.5520	18.9351	19.3699	19.6693	19.8002	19.8219	19.8213	19.7610	19.3952	18.7636	18.2201	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	18.9190	19.1575	19.4935	19.8788	20.1546	20.2831	20.3091	20.3071	20.2407	19.8974	19.3396	18.8666	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9190	19.1575	19.4935	19.8788	20.1546	20.2831	20.3091	20.3071	20.2407	19.8974	19.3396	18.8666	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9629	0.9312	0.8619	0.7349	0.5496	0.3847	0.4242	0.6622	0.8832	0.9628	0.9828	(94)
Useful gains	561.8986	633.7629	675.7568	675.0656	598.9560	436.0925	292.6302	306.5965	453.0509	548.7508	542.7676	534.6373	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1185.0329	1153.8853	1049.9413	880.6198	677.2170	452.2723	295.1819	310.5599	489.9199	744.7214	983.1481	1181.5431	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	463.6120	349.5223	278.3932	147.9990	58.2262	0.0000	0.0000	0.0000	0.0000	145.8021	317.0740	481.2979	(98)
Space heating												2241.9266	(98)
Space heating per m2											(98) / (4) =	37.2042	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2402.9224	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	463.6120	349.5223	278.3932	147.9990	58.2262	0.0000	0.0000	0.0000	0.0000	145.8021	317.0740	481.2979	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	496.9046	374.6219	298.3850	158.6270	62.4075	0.0000	0.0000	0.0000	0.0000	156.2724	339.8435	515.8606	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4172	89.3127	89.1121	88.6831	87.8987	86.7000	86.7000	86.7000	86.7000	88.6365	89.2236	89.4610	(217)
Fuel for water heating, kWh/month													
	161.7458	141.9900	147.7209	130.6488	127.4085	112.8512	105.9464	119.6203	120.4684	135.6727	145.5315	156.9722	(219)
Water heating fuel used												1606.5766	(219)
Annual totals kWh/year													
Space heating fuel - main system												2402.9224	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3735.1071	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2402.9224	3.4800	83.6217	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1606.5766	3.4800	55.9089	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	274.3612	13.1900	36.1882	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			223.3383	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8911	(257)
SAP value		87.5685	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2402.9224	0.2160	519.0312	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1606.5766	0.2160	347.0205	(264)
Space and water heating			866.0518	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			723.6424	(272)
CO2 emissions per m2			12.0100	(273)
EI value			90.7878	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8821 = 3.945, stars = 4
Water heating environmental impact	0.216 / 0.8821 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	3.5800 (1b)	x	2.8300 (2b)	=	10.1314	(1b) - (3b)
First floor	56.6800 (1c)	x	2.3400 (2c)	=	132.6312	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	142.7626	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1401	(8)
Pressure test		Yes	
Measured/design AP50		4.1300	
Infiltration rate		0.3466	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2946	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3093	0.2872	0.2946	0.2799	0.2799	0.2725	0.2651	0.2578	0.2504	0.2725	0.2578	0.2725	(22b)
Effective ac	0.5478	0.5413	0.5434	0.5392	0.5392	0.5371	0.5352	0.5332	0.5314	0.5371	0.5332	0.5371	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.4800	1.2357	15.4221			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			3.5800	0.2100	0.7518			(28a)
External Wall	86.6200	14.6000	72.0200	0.2700	19.4454			(29a)
Roof	56.6800		56.6800	0.1600	9.0688			(30)
Total net area of external elements Aum(A, m2)			146.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8681			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3136	(36)
Total fabric heat loss					(33) + (36) =		54.1816	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8098	25.4993	25.6003	25.4009	25.4009	25.3051	25.2118	25.1211	25.0329	25.3051	25.1211	25.3051	(38)
Heat transfer coeff	79.9914	79.6809	79.7819	79.5826	79.5826	79.4867	79.3934	79.3027	79.2146	79.4867	79.3027	79.4867	(39)
Average = Sum(39)m / 12 =												79.5244	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3274	1.3223	1.3240	1.3207	1.3207	1.3191	1.3175	1.3160	1.3145	1.3191	1.3160	1.3191	(40)
HLP (average)												1.3197	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.9890	(42)
Average daily hot water use (litres/day)	81.4382	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	89.5820	86.3245	83.0669	79.8094	76.5519	73.2944	73.2944	76.5519	79.8094	83.0669	86.3245	89.5820	(44)
Energy conte	132.8475	116.1893	119.8969	104.5291	100.2981	86.5497	80.2010	92.0318	93.1309	108.5351	118.4746	128.6557	(45)
Energy content (annual)										Total = Sum(45)m =		1281.3397	(45)
Distribution loss (46)m = 0.15 x (45)m	19.9271	17.4284	17.9845	15.6794	15.0447	12.9824	12.0301	13.8048	13.9696	16.2803	17.7712	19.2984	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7810	10.6258	11.7402	11.3343	11.6923	11.2923	11.6545	11.6790	11.3152	11.7204	11.3739	11.7731	(61)
Total heat required for water heating calculated for each month													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
								Total per year (kWh/year) = Sum(64)m =				1419.3217	(64)
Heat gains from water heating, kWh/month													
	47.1170	41.2894	42.8008	37.5895	36.2722	31.6008	29.5805	33.5203	33.7948	39.0180	42.2363	45.7213	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	119.3386	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.8387	34.4962	28.0542	21.2388	15.8763	13.4034	14.4829	18.8254	25.2674	32.0827	37.4453	39.9181	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.1077	261.7965	255.0210	240.5967	222.3887	205.2757	193.8432	191.1545	197.9300	212.3542	230.5622	247.6752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	48.9228	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	-79.5590	(71)
Water heating gains (Table 5)													
	63.3294	61.4425	57.5279	52.2076	48.7530	43.8901	39.7587	45.0542	46.9373	52.4436	58.6615	61.4534	(72)
Total internal gains													
	452.9781	449.4375	432.3054	405.7455	378.7202	354.2715	339.7871	346.7364	361.8369	388.5829	418.3713	440.7491	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4700	13.4839	0.7200	0.7000	0.7700	21.0517	(74)
East	1.4900	25.1925	0.7200	0.7000	0.7700	13.1106	(76)
South	5.2200	56.7559	0.7200	0.7000	0.7700	103.4773	(78)
West	1.3000	25.1925	0.7200	0.7000	0.7700	11.4388	(80)

Solar gains	149.0783	219.2173	311.8904	406.7456	449.5228	492.8360	468.0824	426.3948	362.8390	264.0212	178.6054	125.0340	(83)
Total gains	602.0564	668.6549	744.1958	812.4911	828.2430	847.1075	807.8695	773.1312	724.6759	652.6040	596.9767	565.7830	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3146	52.5185	52.4520	52.5834	52.5834	52.6468	52.7087	52.7690	52.8277	52.6468	52.7690	52.6468	
alpha	4.4876	4.5012	4.4968	4.5056	4.5056	4.5098	4.5139	4.5179	4.5218	4.5098	4.5179	4.5098	
util living area													
	0.9822	0.9713	0.9398	0.8635	0.7273	0.5196	0.3801	0.3962	0.6432	0.8762	0.9635	0.9854	(86)
MIT	19.9484	20.0911	20.3692	20.6771	20.8880	20.9804	20.9962	20.9955	20.9501	20.7108	20.2985	19.9201	(87)
Th 2	19.8194	19.8234	19.8221	19.8247	19.8247	19.8259	19.8271	19.8283	19.8295	19.8259	19.8283	19.8259	(88)
util rest of house													
	0.9765	0.9624	0.9211	0.8229	0.6537	0.4195	0.2675	0.2792	0.5419	0.8290	0.9499	0.9807	(89)
MIT 2	18.4804	18.6865	19.0754	19.4859	19.7329	19.8162	19.8262	19.8272	19.7993	19.5408	18.9889	18.4449	(90)
Living area fraction									fLA = Living area / (4) =			0.4167	(91)
MIT	19.0921	19.2717	19.6145	19.9822	20.2142	20.3013	20.3137	20.3140	20.2788	20.0283	19.5346	19.0596	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0921	19.2717	19.6145	19.9822	20.2142	20.3013	20.3137	20.3140	20.2788	20.0283	19.5346	19.0596	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9572	0.9172	0.8290	0.6796	0.4609	0.3146	0.3282	0.5826	0.8382	0.9457	0.9765	(94)
Useful gains	585.1180	640.0048	682.5692	673.5451	562.8846	390.4716	254.1870	253.7432	422.2196	547.0280	564.5694	552.5001	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1135.2490	1113.2820	1006.4103	834.2035	613.9167	397.5394	255.1492	254.8816	441.9256	685.8364	922.6569	1117.5533	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	409.2975	318.0422	240.9377	115.6741	37.9679	0.0000	0.0000	0.0000	0.0000	103.2734	257.8230	420.3996	(98)
Space heating												1903.4155	(98)
Space heating per m2											(98) / (4) =	31.5867	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2040.1024	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	409.2975	318.0422	240.9377	115.6741	37.9679	0.0000	0.0000	0.0000	0.0000	103.2734	257.8230	420.3996	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	438.6897	340.8813	258.2398	123.9808	40.6945	0.0000	0.0000	0.0000	0.0000	110.6897	276.3376	450.5891	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.6285	126.8151	131.6372	115.8633	111.9904	97.8420	91.8555	103.7108	104.4461	120.2555	129.8485	140.4288	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3315	89.2436	88.9944	88.4619	87.5841	86.7000	86.7000	86.7000	86.7000	88.3269	89.0614	89.3708	(217)
Fuel for water heating, kWh/month													
	161.9009	142.0998	147.9162	130.9754	127.8662	112.8512	105.9464	119.6203	120.4684	136.1482	145.7966	157.1305	(219)
Water heating fuel used												1608.7202	(219)
Annual totals kWh/year													
Space heating fuel - main system												2040.1024	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												274.3612	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3305.2456	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2040.1024	7.3800	150.5596	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1608.7202	7.3800	118.7236	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	274.3612	28.6600	78.6319	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			277.8139	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2040.1024	0.2160	440.6621	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1608.7202	0.2160	347.4836	(264)
Space and water heating			788.1457	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.3612	0.5190	142.3935	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			609.8292	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2040.1024	1.2200	2488.9249	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1608.7202	1.2200	1962.6387	(264)
Space and water heating			4451.5636	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	274.3612	3.0700	842.2889	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3396.7821	(272)
Primary energy kWh/m2/year			56.3688	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£100	£100	£0
Mains gas	£376	£376	£0
Space heating	£279	£279	£0
Water heating	£119	£119	£0
Lighting	£79	£79	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£277	£277	£0
Total cost of uses	£278	£278	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	376.89 (P1)
Transmission heat loss coefficient	54.18 (37)
Summer heat loss coefficient	431.07 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.4700	87.1704	0.7200	0.7000	0.7650	135.2108
East	1.4900	125.2818	0.7200	0.7000	0.7650	64.7752
South	5.2200	118.5567	0.7200	0.7000	0.7650	214.7489
West	1.3000	125.2818	0.7200	0.7000	0.7650	56.5153
total:						471.2501

	Jun	Jul	Aug	
Solar gains	504	471	428	(P3)
Internal gains	351	337	344	
Total summer gains	856	808	772	(P5)
Summer gain/loss ratio	1.98	1.87	1.79	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.63	19.42	19.34	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 431 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 431	**Prop Type Ref**	
Property	12 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.95	**TER**	20.40
Environmental	91 B	**% DER<TER**	31.61		
CO_2 Emissions (t/year)	0.61	**DFEE**	51.14	**TFEE**	55.94
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.58		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.40	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.95	$kgCO_2/m^2$	Pass
	-6.45 (-31.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.94	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.14	$kWh/m^2/yr$	
	-4.8 (-8.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.21 (max. 0.25)	0.21 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.13 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	4.47 m², No overhang
Windows facing East	1.49 m², No overhang
Windows facing South	5.22 m², No overhang
Windows facing West	1.30 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.13 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 432 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	10 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.22	**TER**	18.99
Environmental	89 B	**% DER<TER**	25.12		
CO_2 Emissions (t/year)	0.81	**DFEE**	49.98	**TFEE**	55.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.99 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.22 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.0 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.40 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.46 m², No overhang
Windows facing East: 3.61 m², No overhang
Windows facing West: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4000	
Infiltration rate			0.3645	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3950	0.3873	0.3795	0.3408	0.3331	0.2943	0.2943	0.2866	0.3098	0.3331	0.3485	0.3640	(22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6041	39.3965	39.1931	38.2374	38.0586	37.2262	37.2262	37.0721	37.5468	38.0586	38.4203	38.7985	(38)
Heat transfer coeff	99.9309	99.7233	99.5199	98.5642	98.3854	97.5530	97.5530	97.3989	97.8737	98.3854	98.7471	99.1253	(39)
Average = Sum(39)m / 12 =												98.5634	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2442	1.2416	1.2390	1.2271	1.2249	1.2146	1.2146	1.2126	1.2185	1.2249	1.2294	1.2341	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411 (83)
Total gains	463.5035	545.6694	644.8394	758.2967	836.8308	830.8277	789.9492	719.8318	630.5538	524.4801	454.9604	436.5819 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8163	55.9325	56.0469	56.5903	56.6931	57.1769	57.1769	57.2674	56.9896	56.6931	56.4855	56.2700	
alpha	4.7211	4.7288	4.7365	4.7727	4.7795	4.8118	4.8118	4.8178	4.7993	4.7795	4.7657	4.7513	
util living area													
	0.9983	0.9960	0.9877	0.9547	0.8617	0.6932	0.5298	0.5969	0.8547	0.9796	0.9965	0.9987	(86)
MIT	19.6135	19.7785	20.0725	20.4596	20.7764	20.9440	20.9876	20.9787	20.8425	20.4124	19.9405	19.5843	(87)
Th 2	19.8848	19.8869	19.8889	19.8983	19.9001	19.9084	19.9084	19.9099	19.9052	19.9001	19.8965	19.8928	(88)
util rest of house													
	0.9977	0.9946	0.9832	0.9375	0.8115	0.5975	0.4053	0.4679	0.7818	0.9689	0.9951	0.9983	(89)
MIT 2	18.0412	18.2835	18.7118	19.2681	19.6844	19.8721	19.9040	19.9014	19.7780	19.2128	18.5276	18.0041	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4361	18.6590	19.0535	19.5673	19.9586	20.1413	20.1761	20.1719	20.0453	19.5140	18.8824	18.4010	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4361	18.6590	19.0535	19.5673	19.9586	20.1413	20.1761	20.1719	20.0453	19.5140	18.8824	18.4010	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9923	0.9784	0.9309	0.8146	0.6193	0.4368	0.5004	0.7927	0.9637	0.9930	0.9973	(94)
Useful gains	461.8847	541.4497	630.9196	705.9265	681.6553	514.5528	345.0111	360.1971	499.8624	505.4427	451.7899	435.4242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1412.6295	1372.0896	1249.3198	1051.4176	812.5276	540.5684	348.8608	367.3816	581.8899	877.0085	1163.4799	1407.6733	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	707.3541	558.1901	460.0897	248.7536	97.3689	0.0000	0.0000	0.0000	0.0000	276.4450	512.4168	723.3533	(98)
Space heating												3583.9716	(98)
Space heating per m2											(98) / (4) =	44.6212	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3857.8812	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	707.3541	558.1901	460.0897	248.7536	97.3689	0.0000	0.0000	0.0000	0.0000	276.4450	512.4168	723.3533	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	761.4146	600.8504	495.2527	267.7649	104.8105	0.0000	0.0000	0.0000	0.0000	297.5727	551.5789	778.6365	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2821	89.2279	89.0978	88.7724	88.0660	86.7000	86.7000	86.7000	86.7000	88.8217	89.1684	89.3076	(217)
Fuel for water heating, kWh/month													
	182.8523	160.3889	166.6238	147.0435	143.1559	126.8734	118.9465	134.5283	135.5512	152.5389	164.2602	177.4413	(219)
Water heating fuel used												1810.2042	(219)
Annual totals kWh/year													
Space heating fuel - main system												3857.8812	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5510.4626	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3857.8812	0.2160	833.3023	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.2042	0.2160	391.0041	(264)
Space and water heating			1224.3065	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1142.5002	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2200	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.6783	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6783	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.6300	0.7000	0.7700	7.9943	(74)
East	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(76)
West	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(80)

Solar gains	77.5011	151.2476	249.8836	368.2777	456.4068	469.8453	446.2047	379.5995	291.6448	179.5259	96.5288	63.8235	(83)
Total gains	465.5857	536.9472	621.3979	717.3147	782.6292	774.0779	736.5811	676.6068	600.5256	511.0960	454.0586	440.6205	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9983	0.9962	0.9890	0.9600	0.8746	0.7088	0.5422	0.6064	0.8608	0.9804	0.9965	0.9987	(86)
MIT	19.6829	19.8349	20.1084	20.4745	20.7790	20.9455	20.9884	20.9804	20.8512	20.4449	19.9991	19.6587	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9977	0.9949	0.9849	0.9446	0.8279	0.6161	0.4202	0.4809	0.7911	0.9702	0.9951	0.9983	(89)
MIT 2	18.1711	18.3947	18.7937	19.3233	19.7273	19.9176	19.9494	19.9474	19.8281	19.2914	18.6433	18.1423	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.5508	18.7563	19.1239	19.6124	19.9914	20.1757	20.2103	20.2068	20.0850	19.5811	18.9837	18.5231	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5508	18.7563	19.1239	19.6124	19.9914	20.1757	20.2103	20.2068	20.0850	19.5811	18.9837	18.5231	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9806	0.9385	0.8304	0.6372	0.4510	0.5125	0.8016	0.9654	0.9931	0.9973	(94)
Useful gains	463.9753	533.0671	609.3738	673.1979	649.8615	493.2193	332.1968	346.7474	481.3907	493.4370	450.9425	439.4504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1365.3196	1324.1592	1203.3723	1009.1658	779.3606	518.6586	335.8368	353.4248	558.9843	844.1856	1122.0626	1358.7281	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	670.6002	531.6139	441.9349	241.8968	96.3473	0.0000	0.0000	0.0000	0.0000	260.9569	483.2065	683.9426	(98)
Space heating												3410.4993	(98)
Space heating per m2											(98) / (4) =	42.4614	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3651.4981	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	670.6002	531.6139	441.9349	241.8968	96.3473	0.0000	0.0000	0.0000	0.0000	260.9569	483.2065	683.9426	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	717.9874	569.1798	473.1638	258.9902	103.1556	0.0000	0.0000	0.0000	0.0000	279.3972	517.3517	732.2726	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8385	87.6380	87.1656	86.0277	83.8369	80.3000	80.3000	80.3000	80.3000	86.0982	87.3742	87.9210	(217)
Fuel for water heating, kWh/month													
	230.4229	202.8179	212.1623	190.6665	189.4226	174.1812	166.8789	186.0308	188.0853	199.7495	210.1145	224.7719	(219)
Water heating fuel used												2375.3043	(219)
Annual totals kWh/year													
Space heating fuel - main system												3651.4981	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6457.4692	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3651.4981	0.2160	788.7236	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2375.3043	0.2160	513.0657	(264)
Space and water heating			1301.7893	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1525.3054	(272)
Emissions per m2 for space and water heating			16.2075	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2075 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.9900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4000	
Infiltration rate			0.3645	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3950	0.3873	0.3795	0.3408	0.3331	0.2943	0.2943	0.2866	0.3098	0.3331	0.3485	0.3640	(22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6041	39.3965	39.1931	38.2374	38.0586	37.2262	37.2262	37.0721	37.5468	38.0586	38.4203	38.7985	(38)
Heat transfer coeff	99.9309	99.7233	99.5199	98.5642	98.3854	97.5530	97.5530	97.3989	97.8737	98.3854	98.7471	99.1253	(39)
Average = Sum(39)m / 12 =												98.5634	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2442	1.2416	1.2390	1.2271	1.2249	1.2146	1.2146	1.2126	1.2185	1.2249	1.2294	1.2341	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562 (71)

Water heating gains (Table 5)

	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896 (72)

Total internal gains

	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411	(83)
Total gains	432.1080	515.0515	615.8362	731.4872	811.4460	807.4478	768.2714	695.9711	605.9161	497.5722	425.4886	405.9596	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8163	55.9325	56.0469	56.5903	56.6931	57.1769	57.1769	57.2674	56.9896	56.6931	56.4855	56.2700	
alpha	4.7211	4.7288	4.7365	4.7727	4.7795	4.8118	4.8118	4.8178	4.7993	4.7795	4.7657	4.7513	
util living area	0.9987	0.9969	0.9898	0.9601	0.8726	0.7076	0.5432	0.6140	0.8692	0.9834	0.9974	0.9991	(86)
MIT	19.5777	19.7440	20.0410	20.4346	20.7613	20.9388	20.9862	20.9760	20.8283	20.3841	19.9071	19.5493	(87)
Th 2	19.8848	19.8869	19.8889	19.8983	19.9001	19.9084	19.9084	19.9099	19.9052	19.9001	19.8965	19.8928	(88)
util rest of house	0.9983	0.9957	0.9859	0.9445	0.8246	0.6120	0.4163	0.4829	0.7999	0.9744	0.9963	0.9987	(89)
MIT 2	18.5904	18.7579	19.0544	19.4450	19.7413	19.8810	19.9050	19.9033	19.8088	19.4039	18.9287	18.5683	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8383	19.0055	19.3021	19.6935	19.9975	20.1466	20.1765	20.1727	20.0648	19.6501	19.1744	18.8146	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8383	19.0055	19.3021	19.6935	19.9975	20.1466	20.1765	20.1727	20.0648	19.6501	19.1744	18.8146	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9832	0.9409	0.8295	0.6344	0.4485	0.5162	0.8118	0.9717	0.9952	0.9983	(94)
Useful gains	431.1161	512.2210	605.5089	688.2730	673.0599	512.2670	344.5898	359.2592	491.8971	483.4840	423.4671	405.2663	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1452.8277	1406.6466	1274.0655	1063.8567	816.3492	541.0899	348.9020	367.4523	583.7963	890.3952	1192.3107	1448.6811	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	760.1535	601.0540	497.4061	270.4203	106.6072	0.0000	0.0000	0.0000	0.0000	302.7420	553.5674	776.3006	(98)
Space heating												3868.2510	(98)
Space heating per m2											(98) / (4) =	48.1605	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	916.9986	721.8925	740.2317	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8743	0.9291	0.8999	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	801.7265	670.7314	666.1061	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1036.0445	988.3629	905.4637	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	168.7089	236.3178	178.0820	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												583.1088 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	42.1772	59.0795	44.5205	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												145.7772 (107)
Space cooling per m2												1.8150 (108)
Energy for space heating												48.1605 (99)
Energy for space cooling												1.8150 (108)
Total												49.9755 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.6300	0.7000	0.7700	7.9943	(74)
East	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(76)
West	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(80)

Solar gains	77.5011	151.2476	249.8836	368.2777	456.4068	469.8453	446.2047	379.5995	291.6448	179.5259	96.5288	63.8235	(83)
Total gains	421.0364	493.4447	580.1385	678.8761	746.2451	740.3270	704.5279	641.7426	564.2526	471.9256	411.6987	396.8420	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9989	0.9974	0.9917	0.9674	0.8905	0.7315	0.5642	0.6337	0.8829	0.9858	0.9978	0.9992	(86)
MIT	19.6316	19.7853	20.0628	20.4374	20.7558	20.9372	20.9862	20.9762	20.8294	20.4031	19.9506	19.6081	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9985	0.9965	0.9886	0.9543	0.8474	0.6392	0.4386	0.5052	0.8191	0.9782	0.9968	0.9989	(89)
MIT 2	18.6766	18.8318	19.1097	19.4849	19.7778	19.9247	19.9502	19.9486	19.8517	19.4585	19.0063	18.6605	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9164	19.0712	19.3490	19.7241	20.0234	20.1790	20.2103	20.2067	20.0972	19.6957	19.2434	18.8985	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9164	19.0712	19.3490	19.7241	20.0234	20.1790	20.2103	20.2067	20.0972	19.6957	19.2434	18.8985	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9954	0.9863	0.9510	0.8511	0.6607	0.4705	0.5379	0.8297	0.9757	0.9959	0.9985	(94)
Useful gains	420.2013	491.1904	572.2032	645.5918	635.1593	489.1316	331.4517	345.1658	468.1827	460.4718	410.0172	396.2553	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1400.3522	1354.2532	1224.8361	1019.6923	782.3683	518.9632	335.8368	353.4129	560.1198	854.9601	1146.5807	1394.3413	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	729.2323	579.9782	485.5589	269.3523	109.5235	0.0000	0.0000	0.0000	0.0000	293.4992	530.3257	742.5760	(98)
Space heating												3740.0461	(98)
Space heating per m2											(98) / (4) =	46.5643	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8687	0.9267	0.8978	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.6106	637.9227	633.4518	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.5916	913.8574	842.0797	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	142.5463	205.2955	155.2192	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												503.0609	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   35.6366   51.3239   38.8048    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        125.7652 (107)
Space cooling per m2                                                                                                   1.5658 (108)
Energy for space heating                                                                                              46.5643 (99)
Energy for space cooling                                                                                               1.5658 (108)
Total                                                                                                                 48.1301 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                55.3 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.3645	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3253	0.3021	0.3098	0.2943	0.2943	0.2866	0.2788	0.2711	0.2633	0.2866	0.2711	0.2866	(22b)
Effective ac	0.5529	0.5456	0.5480	0.5433	0.5433	0.5411	0.5389	0.5367	0.5347	0.5411	0.5367	0.5411	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8839	37.3845	37.5468	37.2262	37.2262	37.0721	36.9220	36.7761	36.6343	37.0721	36.7761	37.0721	(38)
Heat transfer coeff	98.2107	97.7113	97.8737	97.5530	97.5530	97.3989	97.2489	97.1030	96.9611	97.3989	97.1030	97.3989	(39)
Average = Sum(39)m / 12 =												97.4595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2227	1.2165	1.2185	1.2146	1.2146	1.2126	1.2108	1.2090	1.2072	1.2126	1.2090	1.2126	(40)
HLP (average)												1.2134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6565	739.4225	843.2060	960.1161	1007.1230	1040.3523	987.7040	923.5218	827.7408	716.2496	652.7867	631.7709	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7940	57.0843	56.9896	57.1769	57.1769	57.2674	57.3557	57.4419	57.5259	57.2674	57.4419	57.2674	
alpha	4.7863	4.8056	4.7993	4.8118	4.8118	4.8178	4.8237	4.8295	4.8351	4.8178	4.8295	4.8178	
util living area													
	0.9906	0.9842	0.9602	0.8855	0.7390	0.5212	0.3816	0.4068	0.6844	0.9178	0.9802	0.9923	(86)
MIT	19.9397	20.0685	20.3526	20.6860	20.9018	20.9851	20.9973	20.9965	20.9487	20.6790	20.2686	19.9231	(87)
Th 2	19.9018	19.9068	19.9052	19.9084	19.9084	19.9099	19.9114	19.9128	19.9143	19.9099	19.9128	19.9099	(88)
util rest of house													
	0.9874	0.9791	0.9471	0.8502	0.6696	0.4273	0.2764	0.2952	0.5876	0.8825	0.9724	0.9897	(89)
MIT 2	18.5276	18.7168	19.1196	19.5715	19.8265	19.9023	19.9107	19.9119	19.8817	19.5768	19.0119	18.5096	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9737	0.9400	0.8481	0.6824	0.4506	0.3029	0.3233	0.6099	0.8803	0.9667	0.9861	(94)
Useful gains	657.5308	719.9946	792.6074	814.3087	687.2816	468.7893	299.2095	298.6130	504.8720	630.5436	631.0712	623.0119	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1373.1993	1344.1405	1216.4933	1009.8076	741.0657	474.7432	299.8748	299.4938	528.4002	823.3683	1109.6431	1350.3969	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	532.4574	419.4260	315.3711	140.7592	40.0154	0.0000	0.0000	0.0000	0.0000	143.4616	344.5717	541.1745	(98)
Space heating												2477.2370	(98)
RHI space heating demand												2477	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1445	(8)
Pressure test				Yes	
Measured/design AP50				4.4000	
Infiltration rate				0.3645	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3950	0.3873	0.3795	0.3408	0.3331	0.2943	0.2943	0.2866	0.3098	0.3331	0.3485	0.3640	(22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6041	39.3965	39.1931	38.2374	38.0586	37.2262	37.2262	37.0721	37.5468	38.0586	38.4203	38.7985	(38)
Heat transfer coeff	99.9309	99.7233	99.5199	98.5642	98.3854	97.5530	97.5530	97.3989	97.8737	98.3854	98.7471	99.1253	(39)
Average = Sum(39)m / 12 =												98.5634	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2442	1.2416	1.2390	1.2271	1.2249	1.2146	1.2146	1.2126	1.2185	1.2249	1.2294	1.2341	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411 (83)
Total gains	643.7508	723.6640	814.9884	917.1096	983.8543	968.7678	923.9455	856.0807	774.6483	679.9108	622.1803	612.8854 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8163	55.9325	56.0469	56.5903	56.6931	57.1769	57.1769	57.2674	56.9896	56.6931	56.4855	56.2700	
alpha	4.7211	4.7288	4.7365	4.7727	4.7795	4.8118	4.8118	4.8178	4.7993	4.7795	4.7657	4.7513	
util living area													
	0.9931	0.9872	0.9698	0.9155	0.7957	0.6145	0.4583	0.5121	0.7664	0.9475	0.9873	0.9945	(86)
MIT	19.8165	19.9751	20.2490	20.5930	20.8475	20.9664	20.9933	20.9888	20.9057	20.5628	20.1260	19.7841	(87)
Th 2	19.8848	19.8869	19.8889	19.8983	19.9001	19.9084	19.9084	19.9099	19.9052	19.9001	19.8965	19.8928	(88)
util rest of house													
	0.9909	0.9830	0.9598	0.8880	0.7362	0.5220	0.3479	0.3964	0.6805	0.9242	0.9824	0.9927	(89)
MIT 2	18.3366	18.5677	18.9616	19.4430	19.7609	19.8878	19.9061	19.9057	19.8358	19.4159	18.7952	18.2952	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7083	18.9211	19.2849	19.7318	20.0337	20.1587	20.1791	20.1777	20.1045	19.7039	19.1293	18.6691	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7083	18.9211	19.2849	19.7318	20.0337	20.1587	20.1791	20.1777	20.1045	19.7039	19.1293	18.6691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9781	0.9527	0.8831	0.7442	0.5441	0.3757	0.4256	0.6977	0.9190	0.9776	0.9898	(94)
Useful gains	635.7106	707.7992	776.4736	809.9256	732.1369	527.1125	347.1371	364.3289	540.4976	624.8464	608.2540	606.6602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1439.8309	1398.2306	1272.3485	1067.6260	819.9188	542.2642	349.1546	367.9444	587.6819	895.6928	1187.8636	1434.2566	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	598.2655	463.9699	368.9309	185.5443	65.3097	0.0000	0.0000	0.0000	0.0000	201.5097	417.3189	615.7318	(98)
Space heating												2916.5807	(98)
Space heating per m2											(98) / (4) =	36.3120	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3139.4841	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	598.2655	463.9699	368.9309	185.5443	65.3097	0.0000	0.0000	0.0000	0.0000	201.5097	417.3189	615.7318	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	643.9887	499.4294	397.1269	199.7247	70.3011	0.0000	0.0000	0.0000	0.0000	216.9103	449.2131	662.7898	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1942	89.1245	88.9579	88.5503	87.7661	86.7000	86.7000	86.7000	86.7000	88.5855	89.0462	89.2259	(217)
Fuel for water heating, kWh/month													
	183.0323	160.5749	166.8858	147.4124	143.6451	126.8734	118.9465	134.5283	135.5512	152.9457	164.4856	177.6038	(219)
Water heating fuel used												1812.4852	(219)
Annual totals kWh/year													
Space heating fuel - main system												3139.4841	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4794.3465	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3139.4841	3.4800	109.2540	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1812.4852	3.4800	63.0745	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			271.5381	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9100	(257)
SAP value		87.3050	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3139.4841	0.2160	678.1286	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1812.4852	0.2160	391.4968	(264)
Space and water heating			1069.6254	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			987.8191	(272)
CO2 emissions per m2			12.3000	(273)
EI value			89.4376	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8810 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8810 = 0.2452, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.4000	
Infiltration rate			0.3645	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3253	0.3021	0.3098	0.2943	0.2943	0.2866	0.2788	0.2711	0.2633	0.2866	0.2711	0.2866	(22b)
Effective ac	0.5529	0.5456	0.5480	0.5433	0.5433	0.5411	0.5389	0.5367	0.5347	0.5411	0.5367	0.5411	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8839	37.3845	37.5468	37.2262	37.2262	37.0721	36.9220	36.7761	36.6343	37.0721	36.7761	37.0721	(38)
Heat transfer coeff	98.2107	97.7113	97.8737	97.5530	97.5530	97.3989	97.2489	97.1030	96.9611	97.3989	97.1030	97.3989	(39)
Average = Sum(39)m / 12 =												97.4595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2227	1.2165	1.2185	1.2146	1.2146	1.2126	1.2108	1.2090	1.2072	1.2126	1.2090	1.2126	(40)
HLP (average)												1.2134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6565	739.4225	843.2060	960.1161	1007.1230	1040.3523	987.7040	923.5218	827.7408	716.2496	652.7867	631.7709	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7940	57.0843	56.9896	57.1769	57.1769	57.2674	57.3557	57.4419	57.5259	57.2674	57.4419	57.2674	
alpha	4.7863	4.8056	4.7993	4.8118	4.8118	4.8178	4.8237	4.8295	4.8351	4.8178	4.8295	4.8178	
util living area													
	0.9906	0.9842	0.9602	0.8855	0.7390	0.5212	0.3816	0.4068	0.6844	0.9178	0.9802	0.9923	(86)
MIT	19.9397	20.0685	20.3526	20.6860	20.9018	20.9851	20.9973	20.9965	20.9487	20.6790	20.2686	19.9231	(87)
Th 2	19.9018	19.9068	19.9052	19.9084	19.9084	19.9099	19.9114	19.9128	19.9143	19.9099	19.9128	19.9099	(88)
util rest of house													
	0.9874	0.9791	0.9471	0.8502	0.6696	0.4273	0.2764	0.2952	0.5876	0.8825	0.9724	0.9897	(89)
MIT 2	18.5276	18.7168	19.1196	19.5715	19.8265	19.9023	19.9107	19.9119	19.8817	19.5768	19.0119	18.5096	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9737	0.9400	0.8481	0.6824	0.4506	0.3029	0.3233	0.6099	0.8803	0.9667	0.9861	(94)
Useful gains	657.5308	719.9946	792.6074	814.3087	687.2816	468.7893	299.2095	298.6130	504.8720	630.5436	631.0712	623.0119	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1373.1993	1344.1405	1216.4933	1009.8076	741.0657	474.7432	299.8748	299.4938	528.4002	823.3683	1109.6431	1350.3969	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	532.4574	419.4260	315.3711	140.7592	40.0154	0.0000	0.0000	0.0000	0.0000	143.4616	344.5717	541.1745	(98)
Space heating												2477.2370	(98)
Space heating per m2											(98) / (4) =	30.8421	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2666.5629	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	532.4574	419.4260	315.3711	140.7592	40.0154	0.0000	0.0000	0.0000	0.0000	143.4616	344.5717	541.1745	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	573.1511	451.4812	339.4738	151.5169	43.0736	0.0000	0.0000	0.0000	0.0000	154.4258	370.9061	582.5344	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1281	89.0637	88.8504	88.3313	87.4500	86.7000	86.7000	86.7000	86.7000	88.3168	88.9210	89.1547	(217)
Fuel for water heating, kWh/month													
	183.1682	160.6846	167.0878	147.7777	144.1644	126.8734	118.9465	134.5283	135.5512	153.4111	164.7171	177.7458	(219)
Water heating fuel used												1814.6561	(219)
Annual totals kWh/year													
Space heating fuel - main system												2666.5629	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4243.7865	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2666.5629	7.3800	196.7923	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1814.6561	7.3800	133.9216	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			369.6658	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2666.5629	0.2160	575.9776	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.6561	0.2160	391.9657	(264)
Space and water heating			967.9433	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			844.7158	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2666.5629	1.2200	3253.2068	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1814.6561	1.2200	2213.8805	(264)
Space and water heating			5467.0872	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4738.1693	(272)
Primary energy kWh/m2/year			58.9912	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (22.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	B 91
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£438	£365	£72
Space heating	£325	£325	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£370	£312	£58
Total cost of uses	£370	£312	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	46 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.3645	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3950	0.3873	0.3795	0.3408	0.3331	0.2943	0.2943	0.2866	0.3098	0.3331	0.3485	0.3640	(22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5607	0.5663	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6041	39.3965	39.1931	38.2374	38.0586	37.2262	37.2262	37.0721	37.5468	38.0586	38.4203	38.7985	(38)
Heat transfer coeff	99.9309	99.7233	99.5199	98.5642	98.3854	97.5530	97.5530	97.3989	97.8737	98.3854	98.7471	99.1253	(39)
Average = Sum(39)m / 12 =												98.5634	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2442	1.2416	1.2390	1.2271	1.2249	1.2146	1.2146	1.2126	1.2185	1.2249	1.2294	1.2341	(40)
HLP (average)												1.2271	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	10.6334	0.7200	0.7000	0.7700	9.1363	(74)
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	88.5727	172.8544	285.5813	420.8888	521.6078	536.9661	509.9482	433.8281	333.3083	205.1724	110.3187	72.9411	(83)
Total gains	643.7508	723.6640	814.9884	917.1096	983.8543	968.7678	923.9455	856.0807	774.6483	679.9108	622.1803	612.8854	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8163	55.9325	56.0469	56.5903	56.6931	57.1769	57.1769	57.2674	56.9896	56.6931	56.4855	56.2700	
alpha	4.7211	4.7288	4.7365	4.7727	4.7795	4.8118	4.8118	4.8178	4.7993	4.7795	4.7657	4.7513	
util living area													
	0.9931	0.9872	0.9698	0.9155	0.7957	0.6145	0.4583	0.5121	0.7664	0.9475	0.9873	0.9945	(86)
MIT	19.8165	19.9751	20.2490	20.5930	20.8475	20.9664	20.9933	20.9888	20.9057	20.5628	20.1260	19.7841	(87)
Th 2	19.8848	19.8869	19.8889	19.8983	19.9001	19.9084	19.9084	19.9099	19.9052	19.9001	19.8965	19.8928	(88)
util rest of house													
	0.9909	0.9830	0.9598	0.8880	0.7362	0.5220	0.3479	0.3964	0.6805	0.9242	0.9824	0.9927	(89)
MIT 2	18.3366	18.5677	18.9616	19.4430	19.7609	19.8878	19.9061	19.9057	19.8358	19.4159	18.7952	18.2952	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7083	18.9211	19.2849	19.7318	20.0337	20.1587	20.1791	20.1777	20.1045	19.7039	19.1293	18.6691	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7083	18.9211	19.2849	19.7318	20.0337	20.1587	20.1791	20.1777	20.1045	19.7039	19.1293	18.6691	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9781	0.9527	0.8831	0.7442	0.5441	0.3757	0.4256	0.6977	0.9190	0.9776	0.9898	(94)

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Useful gains	635.7106	707.7992	776.4736	809.9256	732.1369	527.1125	347.1371	364.3289	540.4976	624.8464	608.2540	606.6602	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1439.8309	1398.2306	1272.3485	1067.6260	819.9188	542.2642	349.1546	367.9444	587.6819	895.6928	1187.8636	1434.2566	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	598.2655	463.9699	368.9309	185.5443	65.3097	0.0000	0.0000	0.0000	0.0000	201.5097	417.3189	615.7318	(98)

Space heating 2916.5807 (98)
Space heating per m2 (98) / (4) = 36.3120 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3139.4841 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	598.2655	463.9699	368.9309	185.5443	65.3097	0.0000	0.0000	0.0000	0.0000	201.5097	417.3189	615.7318	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	643.9887	499.4294	397.1269	199.7247	70.3011	0.0000	0.0000	0.0000	0.0000	216.9103	449.2131	662.7898	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2796	89.3048	89.3194	89.3483	89.4295	86.7000	86.7000	86.7000	86.7000	88.9403	89.1772	89.2966	(217)
Fuel for water heating, kWh/month	155.4321	114.4989	88.3024	41.7173	12.1397	0.0000	0.0000	21.8859	47.3296	93.6081	131.6763	154.5173	(219)

Water heating fuel used 861.1077 (219)
Annual totals kWh/year
Space heating fuel - main system 3139.4841 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) = -588.2895 -588.2895 (233)
Total delivered energy for all uses 3892.9690 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3139.4841	3.4800	109.2540	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.1077	3.4800	29.9665	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			245.0251	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8212 (257)
SAP value 88.5445
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3139.4841	0.2160	678.1286	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.1077	0.2160	185.9993	(264)
Space and water heating			864.1278	(265)

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Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			808.2716 (272)
CO2 emissions per m2			10.0600 (273)
EI value			91.3575
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.4000	
Infiltration rate		0.3645	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3098	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3253	0.3021	0.3098	0.2943	0.2943	0.2866	0.2788	0.2711	0.2633	0.2866	0.2711	0.2866	(22b)
Effective ac	0.5529	0.5456	0.5480	0.5433	0.5433	0.5411	0.5389	0.5367	0.5347	0.5411	0.5367	0.5411	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.8839	37.3845	37.5468	37.2262	37.2262	37.0721	36.9220	36.7761	36.6343	37.0721	36.7761	37.0721	(38)
Heat transfer coeff	98.2107	97.7113	97.8737	97.5530	97.5530	97.3989	97.2489	97.1030	96.9611	97.3989	97.1030	97.3989	(39)
Average = Sum(39)m / 12 =												97.4595	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2227	1.2165	1.2185	1.2146	1.2146	1.2126	1.2108	1.2090	1.2072	1.2126	1.2090	1.2126	(40)
HLP (average)												1.2134	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.4600	13.4839	0.7200	0.7000	0.7700	11.5855	(74)
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	113.4785	188.6130	313.7989	463.8954	544.8764	608.5506	573.7067	501.2692	386.4008	241.5112	140.9251	91.8266	(83)
Total gains	668.6565	739.4225	843.2060	960.1161	1007.1230	1040.3523	987.7040	923.5218	827.7408	716.2496	652.7867	631.7709	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7940	57.0843	56.9896	57.1769	57.1769	57.2674	57.3557	57.4419	57.5259	57.2674	57.4419	57.2674	
alpha	4.7863	4.8056	4.7993	4.8118	4.8118	4.8178	4.8237	4.8295	4.8351	4.8178	4.8295	4.8178	
util living area													
	0.9906	0.9842	0.9602	0.8855	0.7390	0.5212	0.3816	0.4068	0.6844	0.9178	0.9802	0.9923	(86)
MIT	19.9397	20.0685	20.3526	20.6860	20.9018	20.9851	20.9973	20.9965	20.9487	20.6790	20.2686	19.9231	(87)
Th 2	19.9018	19.9068	19.9052	19.9084	19.9084	19.9099	19.9114	19.9128	19.9143	19.9099	19.9128	19.9099	(88)
util rest of house													
	0.9874	0.9791	0.9471	0.8502	0.6696	0.4273	0.2764	0.2952	0.5876	0.8825	0.9724	0.9897	(89)
MIT 2	18.5276	18.7168	19.1196	19.5715	19.8265	19.9023	19.9107	19.9119	19.8817	19.5768	19.0119	18.5096	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8822	19.0562	19.4292	19.8514	20.0965	20.1742	20.1836	20.1843	20.1496	19.8536	19.3275	18.8646	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9737	0.9400	0.8481	0.6824	0.4506	0.3029	0.3233	0.6099	0.8803	0.9667	0.9861	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	657.5308	719.9946	792.6074	814.3087	687.2816	468.7893	299.2095	298.6130	504.8720	630.5436	631.0712	623.0119	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1373.1993	1344.1405	1216.4933	1009.8076	741.0657	474.7432	299.8748	299.4938	528.4002	823.3683	1109.6431	1350.3969	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	532.4574	419.4260	315.3711	140.7592	40.0154	0.0000	0.0000	0.0000	0.0000	143.4616	344.5717	541.1745	(98)
Space heating												2477.2370	(98)
Space heating per m2											(98) / (4) =	30.8421	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2666.5629	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	532.4574	419.4260	315.3711	140.7592	40.0154	0.0000	0.0000	0.0000	0.0000	143.4616	344.5717	541.1745	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	573.1511	451.4812	339.4738	151.5169	43.0736	0.0000	0.0000	0.0000	0.0000	154.4258	370.9061	582.5344	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2352	89.2533	89.2431	89.2258	88.9910	86.7000	86.7000	86.7000	86.7000	88.7334	89.0899	89.2426	(217)
Fuel for water heating, kWh/month	150.9011	114.7834	88.0370	40.6101	17.2056	0.0000	0.0000	14.9624	41.9393	89.4538	126.4397	151.2207	(219)
Water heating fuel used												835.5531	(219)
Annual totals kWh/year													
Space heating fuel - main system												2666.5629	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												3314.6835	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2666.5629	7.3800	196.7923	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.5531	7.3800	61.6638	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			311.7380	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2666.5629	0.2160	575.9776	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5531	0.2160	180.4795	(264)
Space and water heating			756.4571	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			659.1796	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2666.5629	1.2200	3253.2068	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.5531	1.2200	1019.3748	(264)
Space and water heating			4272.5816	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3697.1636	(272)
Primary energy kWh/m2/year			46.0304	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.4600	87.1704	0.7200	0.7000	0.7650	74.4113
East	3.6100	125.2818	0.7200	0.7000	0.7650	156.9385
West	7.9700	125.2818	0.7200	0.7000	0.7650	346.4820
total:						577.8319

	Jun	Jul	Aug	
Solar gains	623	578	503	(P3)
Internal gains	429	411	419	
Total summer gains	1052	989	923	(P5)
Summer gain/loss ratio	1.73	1.63	1.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.38	19.18	19.07	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 432 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	10 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	87 B	**DER**	14.22	**TER**	18.99
Environmental	89 B	**% DER<TER**	25.12		
CO_2 Emissions (t/year)	0.81	**DFEE**	49.98	**TFEE**	55.35
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.99	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.22	$kgCO_2/m^2$	Pass
	-4.77 (-25.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.35	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.98	$kWh/m^2/yr$	
	-5.3 (-9.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	2.46 m², No overhang 3.61 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.40 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 433 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	8 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	88 B	**DER**	13.71	**TER**	18.57
Environmental	90 B	**% DER<TER**	26.16		
CO_2 Emissions (t/year)	0.78	**DFEE**	47.82	**TFEE**	53.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 80 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.57 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.8 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.27 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.61 m², No overhang
Windows facing South: 2.46 m², No overhang
Windows facing West: 7.97 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3580	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3880	0.3804	0.3728	0.3347	0.3271	0.2891	0.2891	0.2815	0.3043	0.3271	0.3423	0.3575	(22b)
Effective ac	0.5753	0.5723	0.5695	0.5560	0.5535	0.5418	0.5418	0.5396	0.5463	0.5535	0.5586	0.5639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4151	39.2149	39.0186	38.0967	37.9242	37.1213	37.1213	36.9726	37.4306	37.9242	38.2732	38.6380	(38)
Heat transfer coeff	99.7420	99.5417	99.3455	98.4236	98.2511	97.4481	97.4481	97.2994	97.7574	98.2511	98.6000	98.9648	(39)
Average = Sum(39)m / 12 =												98.4227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2418	1.2393	1.2369	1.2254	1.2232	1.2132	1.2132	1.2114	1.2171	1.2232	1.2276	1.2321	(40)
HLP (average)												1.2254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	374.9308	372.8149	359.2581	337.4079	315.2230	293.8617	280.0010	286.0037	297.2455	319.3077	344.6417	363.6408	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
South	2.4600	46.7521	0.7200	0.7000	0.7700	40.1698	(78)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	119.6062	221.1823	339.7145	467.9477	556.1096	563.2256	538.5902	473.0494	385.1780	255.3469	146.6628	100.0350	(83)
Total gains	494.5370	593.9972	698.9726	805.3555	871.3326	857.0872	818.5912	759.0531	682.4235	574.6546	491.3045	463.6759	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9221	56.0346	56.1453	56.6712	56.7707	57.2384	57.2384	57.3259	57.0573	56.7707	56.5697	56.3612	
alpha	4.7281	4.7356	4.7430	4.7781	4.7847	4.8159	4.8159	4.8217	4.8038	4.7847	4.7713	4.7574	
util living area													
	0.9977	0.9943	0.9831	0.9442	0.8462	0.6768	0.5125	0.5698	0.8228	0.9711	0.9952	0.9983	(86)
MIT	19.6518	19.8356	20.1328	20.5035	20.7964	20.9496	20.9893	20.9826	20.8695	20.4649	19.9835	19.6179	(87)
Th 2	19.8867	19.8887	19.8906	19.8997	19.9014	19.9094	19.9094	19.9109	19.9063	19.9014	19.8980	19.8944	(88)
util rest of house													
	0.9970	0.9923	0.9770	0.9239	0.7933	0.5814	0.3913	0.4447	0.7438	0.9567	0.9932	0.9978	(89)
MIT 2	18.0985	18.3677	18.7992	19.3278	19.7078	19.8772	19.9057	19.9041	19.8048	19.2861	18.5911	18.0543	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.4886	18.7363	19.1341	19.6231	19.9812	20.1465	20.1778	20.1749	20.0722	19.5821	18.9407	18.4469	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4886	18.7363	19.1341	19.6231	19.9812	20.1465	20.1778	20.1749	20.0722	19.5821	18.9407	18.4469	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9893	0.9714	0.9176	0.7976	0.6035	0.4219	0.4762	0.7575	0.9511	0.9906	0.9966	(94)
Useful gains	492.3004	587.6506	678.9983	739.0307	694.9999	517.2254	345.3428	361.4861	516.9145	546.5674	486.6960	462.1056	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1415.1974	1377.2893	1255.1383	1055.4015	813.6341	540.4934	348.6484	367.2947	583.8227	882.5038	1167.4972	1409.9439	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	686.6353	530.6372	428.6482	227.7870	88.2638	0.0000	0.0000	0.0000	0.0000	249.9367	490.1768	705.1917	(98)
Space heating												3407.2768	(98)
Space heating per m2											(98) / (4) =	42.4213	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3667.6822	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	686.6353	530.6372	428.6482	227.7870	88.2638	0.0000	0.0000	0.0000	0.0000	249.9367	490.1768	705.1917	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	739.1123	571.1918	461.4082	245.1959	95.0095	0.0000	0.0000	0.0000	0.0000	269.0384	527.6392	759.0868	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2671	89.2007	89.0545	88.7073	87.9898	86.7000	86.7000	86.7000	86.7000	88.7485	89.1431	89.2953	(217)
Fuel for water heating, kWh/month													
	182.8829	160.4379	166.7049	147.1515	143.2800	126.8734	118.9465	134.5283	135.5512	152.6647	164.3069	177.4659	(219)
Water heating fuel used												1810.7940	(219)
Annual totals kWh/year													
Space heating fuel - main system												3667.6822	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5320.8534	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3667.6822	0.2160	792.2194	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1810.7940	0.2160	391.1315	(264)
Space and water heating			1183.3509	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1101.5446	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.7100	ZC1
Total Floor Area	TFA	80.3200	
Assumed number of occupants	N	2.4689	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2390	ZC2
CO2 emissions from cooking, equation (L16)		2.2193	ZC3
Total CO2 emissions		32.1683	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.1683	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3945 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3353 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423 (36)
Total fabric heat loss	(33) + (36) =	55.2864 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.2940	48.2546	44.8667	44.4699	41.2041	42.5776	44.4699	44.8667	48.2546	48.5293	50.9589	(61)
Total heat required for water heating calculated for each month													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
								Total per year (kWh/year) = Sum(64)m =				2015.3850	(64)
Heat gains from water heating, kWh/month													
	63.0939	55.3636	57.5091	50.8371	49.1342	43.1066	41.0436	46.0010	46.5168	53.2026	57.0387	61.5051	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	84.8037	82.3863	77.2972	70.6071	66.0407	59.8703	55.1661	61.8293	64.6067	71.5088	79.2203	82.6681	(72)
Total internal gains													
	388.0846	385.6995	371.5143	349.0370	326.2224	304.2326	290.3764	297.0073	308.8808	331.5701	357.5298	376.7970	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(76)
South	2.4600	46.7521	0.6300	0.7000	0.7700	35.1486	(78)
West	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(80)

Solar gains	104.6554	193.5345	297.2502	409.4542	486.5959	492.8224	471.2664	413.9182	337.0307	223.4286	128.3299	87.5307	(83)
Total gains	492.7400	579.2340	668.7645	758.4912	812.8183	797.0550	761.6428	710.9255	645.9115	554.9987	485.8597	464.3277	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9978	0.9947	0.9851	0.9511	0.8609	0.6937	0.5259	0.5811	0.8319	0.9729	0.9953	0.9984	(86)
MIT	19.7141	19.8828	20.1598	20.5127	20.7968	20.9505	20.9898	20.9837	20.8750	20.4902	20.0353	19.6860	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9970	0.9929	0.9798	0.9330	0.8116	0.6010	0.4068	0.4589	0.7563	0.9595	0.9934	0.9978	(89)
MIT 2	18.2166	18.4643	18.8673	19.3746	19.7473	19.9213	19.9500	19.9489	19.8511	19.3539	18.6958	18.1822	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.5927	18.8205	19.1918	19.6604	20.0108	20.1797	20.2111	20.2087	20.1082	19.6393	19.0322	18.5598	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5927	18.8205	19.1918	19.6604	20.0108	20.1797	20.2111	20.2087	20.1082	19.6393	19.0322	18.5598	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9903	0.9748	0.9270	0.8152	0.6224	0.4369	0.4897	0.7693	0.9544	0.9910	0.9967	(94)
Useful gains	490.5862	573.5889	651.8843	703.1525	662.5839	496.0559	332.7472	348.1336	496.9198	529.6736	481.4889	462.7900	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1369.3332	1330.2902	1209.8502	1013.6930	781.1885	519.0314	335.9100	353.6068	561.1470	849.6567	1126.6374	1362.2165	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	653.7878	508.5033	415.1266	223.5892	88.2418	0.0000	0.0000	0.0000	0.0000	238.0674	464.5070	669.1734	(98)
Space heating												3260.9964	(98)
Space heating per m2											(98) / (4) =	40.6001	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3491.4308	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	653.7878	508.5033	415.1266	223.5892	88.2418	0.0000	0.0000	0.0000	0.0000	238.0674	464.5070	669.1734	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	699.9869	544.4361	444.4611	239.3888	94.4773	0.0000	0.0000	0.0000	0.0000	254.8901	497.3308	716.4597	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.4001	177.7455	184.9327	164.0260	158.8061	139.8675	134.0037	149.3828	151.0325	171.9806	183.5859	197.6216	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7897	87.5479	87.0265	85.8316	83.6377	80.3000	80.3000	80.3000	80.3000	85.8701	87.2899	87.8799	(217)
Fuel for water heating, kWh/month													
	230.5511	203.0266	212.5015	191.1021	189.8738	174.1812	166.8789	186.0308	188.0853	200.2801	210.3174	224.8769	(219)
Water heating fuel used												2377.7057	(219)
Annual totals kWh/year													
Space heating fuel - main system												3491.4308	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Total delivered energy for all uses												6299.8033	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3491.4308	0.2160	754.1491	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2377.7057	0.2160	513.5844	(264)
Space and water heating			1267.7335	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Total CO2, kg/m2/year			1491.2495	(272)
Emissions per m2 for space and water heating			15.7835	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2982	(272b)
Emissions per m2 for pumps and fans			0.4846	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7835 * 1.00) + 2.2982 + 0.4846, rounded to 2 d.p.			18.5700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3580	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3880	0.3804	0.3728	0.3347	0.3271	0.2891	0.2891	0.2815	0.3043	0.3271	0.3423	0.3575	(22b)
Effective ac	0.5753	0.5723	0.5695	0.5560	0.5535	0.5418	0.5418	0.5396	0.5463	0.5535	0.5586	0.5639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4151	39.2149	39.0186	38.0967	37.9242	37.1213	37.1213	36.9726	37.4306	37.9242	38.2732	38.6380	(38)
Heat transfer coeff	99.7420	99.5417	99.3455	98.4236	98.2511	97.4481	97.4481	97.2994	97.7574	98.2511	98.6000	98.9648	(39)
Average = Sum(39)m / 12 =												98.4227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2418	1.2393	1.2369	1.2254	1.2232	1.2132	1.2132	1.2114	1.2171	1.2232	1.2276	1.2321	(40)
HLP (average)												1.2254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
South	2.4600	46.7521	0.7200	0.7000	0.7700	40.1698	(78)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	119.6062	221.1823	339.7145	467.9477	556.1096	563.2256	538.5902	473.0494	385.1780	255.3469	146.6628	100.0350	(83)
Total gains	463.1415	563.3793	669.9694	778.5461	845.9479	833.7073	796.9135	735.1924	657.7857	547.7467	461.8327	433.0535	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9221	56.0346	56.1453	56.6712	56.7707	57.2384	57.2384	57.3259	57.0573	56.7707	56.5697	56.3612	
alpha	4.7281	4.7356	4.7430	4.7781	4.7847	4.8159	4.8159	4.8217	4.8038	4.7847	4.7713	4.7574	
util living area													
	0.9983	0.9954	0.9857	0.9503	0.8574	0.6909	0.5251	0.5857	0.8379	0.9759	0.9963	0.9988	(86)
MIT	19.6161	19.8013	20.1020	20.4797	20.7826	20.9449	20.9881	20.9804	20.8575	20.4377	19.9503	19.5829	(87)
Th 2	19.8867	19.8887	19.8906	19.8997	19.9014	19.9094	19.9094	19.9109	19.9063	19.9014	19.8980	19.8944	(88)
util rest of house													
	0.9977	0.9938	0.9804	0.9317	0.8064	0.5954	0.4016	0.4584	0.7616	0.9635	0.9947	0.9983	(89)
MIT 2	18.6302	18.8162	19.1155	19.4877	19.7588	19.8851	19.9066	19.9056	19.8294	19.4559	18.9728	18.6031	(90)
Living area fraction										fLA = Living area / (4) =		0.2511	(91)
MIT	18.8778	19.0636	19.3632	19.7368	20.0159	20.1512	20.1782	20.1755	20.0876	19.7025	19.2182	18.8492	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8778	19.0636	19.3632	19.7368	20.0159	20.1512	20.1782	20.1755	20.0876	19.7025	19.2182	18.8492	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9922	0.9772	0.9284	0.8124	0.6180	0.4329	0.4907	0.7761	0.9606	0.9934	0.9978	(94)
Useful gains	461.7271	558.9643	654.6920	722.7797	687.2873	515.2200	344.9923	360.7588	510.5247	526.1496	458.7824	432.0844	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1454.0167	1409.8694	1277.8999	1066.5967	817.0469	540.9581	348.6845	367.3534	585.3276	894.3274	1194.8583	1449.7506	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	738.2635	571.8082	463.6667	247.5482	96.5411	0.0000	0.0000	0.0000	0.0000	273.9243	529.9747	757.1437	(98)
Space heating												3678.8704	(98)
Space heating per m2											(98) / (4) =	45.8027	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	916.0125	721.1162	739.4758	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8846	0.9367	0.9141	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	810.2594	675.5017	675.9370	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1066.7374	1021.8405	951.3068	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	184.6641	257.6761	204.8752	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											647.2154	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	46.1660	64.4190	51.2188	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											161.8039	(107)
Space cooling per m2											2.0145	(108)
Energy for space heating											45.8027	(99)
Energy for space cooling											2.0145	(108)
Total											47.8172	(109)
Dwelling Fabric Energy Efficiency (DFEE)											47.8	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3945	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3353	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4275	0.4191	0.4108	0.3688	0.3605	0.3186	0.3186	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5712	0.5776	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			14.0400	1.3258	18.6136			(27)
Ground floor			40.1600	0.1300	5.2208			(28a)
External Wall	92.5200	16.1600	76.3600	0.1800	13.7448			(29a)
Main Roof	40.1600		40.1600	0.1300	5.2208			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3440			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		9.9423	(36)
Total fabric heat loss	(33) + (36) =	55.2864	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5203	40.2771	40.0388	38.9193	38.7099	37.7348	37.7348	37.5543	38.1104	38.7099	39.1336	39.5765	(38)
Heat transfer coeff	95.8066	95.5635	95.3252	94.2057	93.9962	93.0212	93.0212	92.8407	93.3968	93.9962	94.4200	94.8629	(39)
Average = Sum(39)m / 12 =												94.2047	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1928	1.1898	1.1868	1.1729	1.1703	1.1581	1.1581	1.1559	1.1628	1.1703	1.1755	1.1811	(40)
HLP (average)												1.1729	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4689	(42)
Average daily hot water use (litres/day)		92.8365	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	32.1813	28.1459	29.0441	25.3213	24.2964	20.9660	19.4280	22.2940	22.5602	26.2918	28.6995	31.1658	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	123.4452	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1393	17.8876	14.5471	11.0131	8.2324	6.9502	7.5099	9.7617	13.1021	16.6361	19.4168	20.6991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	220.1080	222.3921	216.6364	204.3832	188.9158	174.3786	164.6668	162.3828	168.1385	180.3916	195.8591	210.3963	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	35.3445	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	43.2544	41.8838	39.0377	35.1685	32.6565	29.1194	26.1130	29.9650	31.3337	35.3384	39.8605	41.8896	(72)
Total internal gains													
	343.5353	342.1970	330.2548	310.5984	289.8383	270.4817	258.3233	262.1430	272.6078	292.3997	315.1699	333.0185	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.6300	0.7000	0.7700	21.6684	(76)
South	2.4600	46.7521	0.6300	0.7000	0.7700	35.1486	(78)
West	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(80)

Solar gains	104.6554	193.5345	297.2502	409.4542	486.5959	492.8224	471.2664	413.9182	337.0307	223.4286	128.3299	87.5307	(83)
Total gains	448.1908	535.7315	627.5051	720.0526	776.4342	763.3041	729.5897	676.0612	609.6385	515.8283	443.4998	420.5491	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2191	58.3672	58.5132	59.2085	59.3404	59.9624	59.9624	60.0790	59.7213	59.3404	59.0741	58.7983	
alpha	4.8813	4.8911	4.9009	4.9472	4.9560	4.9975	4.9975	5.0053	4.9814	4.9560	4.9383	4.9199	
util living area													
	0.9986	0.9963	0.9885	0.9594	0.8773	0.7160	0.5468	0.6068	0.8551	0.9797	0.9969	0.9990	(86)
MIT	19.6629	19.8335	20.1150	20.4771	20.7752	20.9430	20.9880	20.9803	20.8563	20.4499	19.9871	19.6355	(87)
Th 2	19.9258	19.9282	19.9306	19.9418	19.9439	19.9536	19.9536	19.9555	19.9499	19.9439	19.9396	19.9352	(88)
util rest of house													
	0.9981	0.9949	0.9843	0.9438	0.8313	0.6233	0.4241	0.4813	0.7841	0.9692	0.9956	0.9986	(89)
MIT 2	18.7078	18.8798	19.1609	19.5219	19.7930	19.9277	19.9506	19.9499	19.8702	19.5031	19.0425	18.6879	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9477	19.1193	19.4005	19.7617	20.0397	20.1827	20.2111	20.2087	20.1178	19.7408	19.2797	18.9259	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9477	19.1193	19.4005	19.7617	20.0397	20.1827	20.2111	20.2087	20.1178	19.7408	19.2797	18.9259	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9936	0.9815	0.9406	0.8361	0.6451	0.4552	0.5131	0.7972	0.9665	0.9944	0.9981	(94)
Useful gains	447.0286	532.2965	615.9221	677.2536	649.1441	492.4189	332.1180	346.8843	486.0306	498.5590	441.0262	419.7482	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1403.3443	1358.8442	1229.7448	1023.2385	783.8982	519.3074	335.9114	353.6002	562.0437	859.2050	1150.0090	1396.9393	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	711.4988	555.4401	456.6841	249.1092	100.2571	0.0000	0.0000	0.0000	0.0000	268.3206	510.4676	727.0301	(98)
Space heating												3578.8076	(98)
Space heating per m2											(98) / (4) =	44.5569	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	874.3995	688.3571	705.5891	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8785	0.9340	0.9114	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	768.1705	642.9466	643.0646	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	984.4479	943.1504	882.1925	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	155.7197	223.3516	177.9111	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												556.9825	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.9299	55.8379	44.4778	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												139.2456 (107)
Space cooling per m2												1.7336 (108)
Energy for space heating												44.5569 (99)
Energy for space cooling												1.7336 (108)
Total												46.2905 (109)
Target Fabric Energy Efficiency (TFEE)												53.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3580	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3195	0.2967	0.3043	0.2891	0.2891	0.2815	0.2739	0.2663	0.2586	0.2815	0.2663	0.2815	(22b)
Effective ac	0.5510	0.5440	0.5463	0.5418	0.5418	0.5396	0.5375	0.5354	0.5334	0.5396	0.5354	0.5396	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7557	37.2740	37.4306	37.1213	37.1213	36.9726	36.8279	36.6871	36.5503	36.9726	36.6871	36.9726	(38)
Heat transfer coeff	98.0826	97.6008	97.7574	97.4481	97.4481	97.2994	97.1547	97.0140	96.8772	97.2994	97.0140	97.2994	(39)
Average = Sum(39)m / 12 =												97.3579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2151	1.2171	1.2132	1.2132	1.2114	1.2096	1.2078	1.2061	1.2114	1.2078	1.2114	(40)
HLP (average)												1.2121	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
RHI water heating demand												1599 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
South	2.4600	56.7559	0.7200	0.7000	0.7700	48.7652	(78)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	150.6581	237.2831	367.4945	509.2669	575.2644	633.0034	600.5129	540.3629	440.0677	295.6059	184.1832	123.8324	(83)
Total gains	705.8362	788.0927	896.9017	1005.4877	1037.5110	1064.8051	1014.5102	962.6155	881.4076	770.3443	696.0448	663.7767	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8682	57.1489	57.0573	57.2384	57.2384	57.3259	57.4113	57.4946	57.5758	57.3259	57.4946	57.3259	
alpha	4.7912	4.8099	4.8038	4.8159	4.8159	4.8217	4.8274	4.8330	4.8384	4.8217	4.8330	4.8217	
util living area													
	0.9882	0.9797	0.9505	0.8697	0.7238	0.5099	0.3715	0.3904	0.6517	0.8974	0.9746	0.9905	(86)
MIT	19.9823	20.1215	20.4038	20.7154	20.9106	20.9865	20.9976	20.9971	20.9584	20.7192	20.3144	19.9601	(87)
Th 2	19.9031	19.9079	19.9063	19.9094	19.9094	19.9109	19.9123	19.9137	19.9151	19.9109	19.9137	19.9109	(88)
util rest of house													
	0.9844	0.9733	0.9349	0.8317	0.6539	0.4175	0.2690	0.2831	0.5560	0.8567	0.9649	0.9874	(89)
MIT 2	18.5899	18.7931	19.1904	19.6078	19.8356	19.9040	19.9117	19.9130	19.8893	19.6262	19.0768	18.5637	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9673	0.9277	0.8308	0.6673	0.4405	0.2948	0.3102	0.5785	0.8563	0.9588	0.9833	(94)
Useful gains	691.5423	762.2925	832.0558	835.3157	692.3500	469.0353	299.0796	298.5799	509.9369	659.6343	667.3358	652.7187	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1377.0386	1349.4962	1221.4873	1012.0924	741.1460	474.4182	299.6661	299.3092	528.7376	827.1086	1114.4528	1353.8617	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	510.0093	394.6009	289.7370	127.2792	36.3042	0.0000	0.0000	0.0000	0.0000	124.6009	321.9243	521.6504	(98)
Space heating												2326.1062	(98)
RHI space heating demand												2326	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600 (1b)	x	2.5400 (2b)	=	102.0064	(1b) - (3b)
First floor	40.1600 (1c)	x	2.6300 (2c)	=	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3580	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3880	0.3804	0.3728	0.3347	0.3271	0.2891	0.2891	0.2815	0.3043	0.3271	0.3423	0.3575	(22b)
Effective ac	0.5753	0.5723	0.5695	0.5560	0.5535	0.5418	0.5418	0.5396	0.5463	0.5535	0.5586	0.5639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4151	39.2149	39.0186	38.0967	37.9242	37.1213	37.1213	36.9726	37.4306	37.9242	38.2732	38.6380	(38)
Heat transfer coeff	99.7420	99.5417	99.3455	98.4236	98.2511	97.4481	97.4481	97.2994	97.7574	98.2511	98.6000	98.9648	(39)
Average = Sum(39)m / 12 =												98.4227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2418	1.2393	1.2369	1.2254	1.2232	1.2132	1.2132	1.2114	1.2171	1.2232	1.2276	1.2321	(40)
HLP (average)												1.2254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
South	2.4600	46.7521	0.7200	0.7000	0.7700	40.1698	(78)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	119.6062	221.1823	339.7145	467.9477	556.1096	563.2256	538.5902	473.0494	385.1780	255.3469	146.6628	100.0350	(83)
Total gains	674.7843	771.9918	869.1217	964.1684	1018.3562	995.0273	952.5875	895.3020	826.5179	730.0853	658.5244	639.9793	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9221	56.0346	56.1453	56.6712	56.7707	57.2384	57.2384	57.3259	57.0573	56.7707	56.5697	56.3612	
alpha	4.7281	4.7356	4.7430	4.7781	4.7847	4.8159	4.8159	4.8217	4.8038	4.7847	4.7713	4.7574	
util living area													
	0.9917	0.9834	0.9618	0.9015	0.7795	0.6004	0.4448	0.4909	0.7345	0.9333	0.9840	0.9934	(86)
MIT	19.8539	20.0296	20.3041	20.6290	20.8616	20.9696	20.9941	20.9907	20.9221	20.6072	20.1669	19.8170	(87)
Th 2	19.8867	19.8887	19.8906	19.8997	19.9014	19.9094	19.9094	19.9109	19.9063	19.9014	19.8980	19.8944	(88)
util rest of house													
	0.9890	0.9782	0.9496	0.8711	0.7186	0.5090	0.3373	0.3793	0.6469	0.9055	0.9780	0.9913	(89)
MIT 2	18.3921	18.6470	19.0393	19.4897	19.7765	19.8910	19.9075	19.9074	19.8506	19.4743	18.8546	18.3441	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7592	18.9942	19.3569	19.7758	20.0490	20.1618	20.1803	20.1795	20.1196	19.7588	19.1842	18.7140	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7592	18.9942	19.3569	19.7758	20.0490	20.1618	20.1803	20.1795	20.1196	19.7588	19.1842	18.7140	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9725	0.9422	0.8672	0.7275	0.5310	0.3644	0.4074	0.6654	0.9011	0.9727	0.9880	(94)
Useful gains	664.7567	750.7912	818.8900	836.0818	740.8873	528.3607	347.1384	364.7546	549.9579	657.8917	640.5408	632.3261	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1442.1898	1402.9604	1277.2729	1070.4344	820.2933	541.9916	348.8969	367.7403	588.4652	899.8606	1191.5011	1436.3724	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	578.4102	438.2577	341.0369	168.7338	59.0781	0.0000	0.0000	0.0000	0.0000	180.0248	396.6914	598.2105	(98)
Space heating												2760.4434	(98)
Space heating per m2											(98) / (4) =	34.3681	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2971.4138	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	578.4102	438.2577	341.0369	168.7338	59.0781	0.0000	0.0000	0.0000	0.0000	180.0248	396.6914	598.2105	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	622.6160	471.7521	367.1010	181.6295	63.5932	0.0000	0.0000	0.0000	0.0000	193.7834	427.0090	643.9295	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1755	89.0906	88.9048	88.4756	87.6960	86.7000	86.7000	86.7000	86.7000	88.4974	89.0141	89.2104	(217)
Fuel for water heating, kWh/month													
	183.0708	160.6362	166.9855	147.5367	143.7599	126.8734	118.9465	134.5283	135.5512	153.0980	164.5450	177.6347	(219)
Water heating fuel used												1813.1661	(219)
Annual totals kWh/year													
Space heating fuel - main system												2971.4138	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4626.9571	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2971.4138	3.4800	103.4052	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1813.1661	3.4800	63.0982	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			265.7129	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8905	(257)
SAP value		87.5773	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2971.4138	0.2160	641.8254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1813.1661	0.2160	391.6439	(264)
Space and water heating			1033.4693	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			951.6630	(272)
CO2 emissions per m2			11.8500	(273)
EI value			89.8242	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8807 = 3.951, stars = 4
Water heating environmental impact	0.216 / 0.8807 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3580	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3195	0.2967	0.3043	0.2891	0.2891	0.2815	0.2739	0.2663	0.2586	0.2815	0.2663	0.2815	(22b)
Effective ac	0.5510	0.5440	0.5463	0.5418	0.5418	0.5396	0.5375	0.5354	0.5334	0.5396	0.5354	0.5396	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7557	37.2740	37.4306	37.1213	37.1213	36.9726	36.8279	36.6871	36.5503	36.9726	36.6871	36.9726	(38)
Heat transfer coeff	98.0826	97.6008	97.7574	97.4481	97.4481	97.2994	97.1547	97.0140	96.8772	97.2994	97.0140	97.2994	(39)
Average = Sum(39)m / 12 =												97.3579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2151	1.2171	1.2132	1.2132	1.2114	1.2096	1.2078	1.2061	1.2114	1.2078	1.2114	(40)
HLP (average)												1.2121	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (64)
								Total per year (kWh/year) = Sum(64)m =				1599.1392 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
South	2.4600	56.7559	0.7200	0.7000	0.7700	48.7652	(78)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	150.6581	237.2831	367.4945	509.2669	575.2644	633.0034	600.5129	540.3629	440.0677	295.6059	184.1832	123.8324	(83)
Total gains	705.8362	788.0927	896.9017	1005.4877	1037.5110	1064.8051	1014.5102	962.6155	881.4076	770.3443	696.0448	663.7767	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8682	57.1489	57.0573	57.2384	57.2384	57.3259	57.4113	57.4946	57.5758	57.3259	57.4946	57.3259	
alpha	4.7912	4.8099	4.8038	4.8159	4.8159	4.8217	4.8274	4.8330	4.8384	4.8217	4.8330	4.8217	
util living area													
	0.9882	0.9797	0.9505	0.8697	0.7238	0.5099	0.3715	0.3904	0.6517	0.8974	0.9746	0.9905	(86)
MIT	19.9823	20.1215	20.4038	20.7154	20.9106	20.9865	20.9976	20.9971	20.9584	20.7192	20.3144	19.9601	(87)
Th 2	19.9031	19.9079	19.9063	19.9094	19.9094	19.9109	19.9123	19.9137	19.9151	19.9109	19.9137	19.9109	(88)
util rest of house													
	0.9844	0.9733	0.9349	0.8317	0.6539	0.4175	0.2690	0.2831	0.5560	0.8567	0.9649	0.9874	(89)
MIT 2	18.5899	18.7931	19.1904	19.6078	19.8356	19.9040	19.9117	19.9130	19.8893	19.6262	19.0768	18.5637	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9673	0.9277	0.8308	0.6673	0.4405	0.2948	0.3102	0.5785	0.8563	0.9588	0.9833	(94)
Useful gains	691.5423	762.2925	832.0558	835.3157	692.3500	469.0353	299.0796	298.5799	509.9369	659.6343	667.3358	652.7187	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1377.0386	1349.4962	1221.4873	1012.0924	741.1460	474.4182	299.6661	299.3092	528.7376	827.1086	1114.4528	1353.8617	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	510.0093	394.6009	289.7370	127.2792	36.3042	0.0000	0.0000	0.0000	0.0000	124.6009	321.9243	521.6504	(98)
Space heating												2326.1062	(98)
Space heating per m2											(98) / (4) =	28.9605	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2503.8818	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	510.0093	394.6009	289.7370	127.2792	36.3042	0.0000	0.0000	0.0000	0.0000	124.6009	321.9243	521.6504	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	548.9874	424.7587	311.8806	137.0067	39.0788	0.0000	0.0000	0.0000	0.0000	134.1237	346.5277	561.5182	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1026	89.0255	88.7897	88.2508	87.3955	86.7000	86.7000	86.7000	86.7000	88.2041	88.8743	89.1335	(217)
Fuel for water heating, kWh/month													
	183.2207	160.7536	167.2019	147.9125	144.2542	126.8734	118.9465	134.5283	135.5512	153.6070	164.8038	177.7881	(219)
Water heating fuel used												1815.4413	(219)
Annual totals kWh/year													
Space heating fuel - main system												2503.8818	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4081.8905	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2503.8818	7.3800	184.7865	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1815.4413	7.3800	133.9796	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			357.7179	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2503.8818	0.2160	540.8385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.4413	0.2160	392.1353	(264)
Space and water heating			932.9738	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			809.7463	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2503.8818	1.2200	3054.7358	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.4413	1.2200	2214.8383	(264)
Space and water heating			5269.5741	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4540.6562	(272)
Primary energy kWh/m2/year			56.5321	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-186 kg (22.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.31 kg/m²	B 89	A 92
Total Savings	£58	2.31 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£123	£138	-£14
Mains gas	£426	£353	£72
Space heating	£313	£313	£0
Water heating	£134	£76	£58
Lighting	£102	£102	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£358	£300	£58
Total cost of uses	£358	£300	£58
Delivered energy	51 kWh/m²	39 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	44 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Measured/design AP50		4.2700	
Infiltration rate		0.3580	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3880	0.3804	0.3728	0.3347	0.3271	0.2891	0.2891	0.2815	0.3043	0.3271	0.3423	0.3575	(22b)
Effective ac	0.5753	0.5723	0.5695	0.5560	0.5535	0.5418	0.5418	0.5396	0.5463	0.5535	0.5586	0.5639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.4151	39.2149	39.0186	38.0967	37.9242	37.1213	37.1213	36.9726	37.4306	37.9242	38.2732	38.6380	(38)
Heat transfer coeff	99.7420	99.5417	99.3455	98.4236	98.2511	97.4481	97.4481	97.2994	97.7574	98.2511	98.6000	98.9648	(39)
Average = Sum(39)m / 12 =												98.4227	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2418	1.2393	1.2369	1.2254	1.2232	1.2132	1.2132	1.2114	1.2171	1.2232	1.2276	1.2321	(40)
HLP (average)												1.2254	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059	(61)
Total heat required for water heating calculated for each month													
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2416	(H8)
Utilisation factor												0.5531	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												92.8365	(H14)
Volume ratio Veff/V												0.8079	(H15)
Solar storage volume factor												0.9573	(H16)
Solar input												-844.3736	(H17)
Solar input	-24.4852	-40.8587	-69.5870	-93.2603	-115.2152	-113.2749	-111.7780	-97.6610	-76.4881	-52.2324	-29.0429	-20.4899	(63)
								Solar input (sum of months) = Sum(63)m =				-844.3736	(63)
Output from w/h													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
								Total per year (kWh/year) = Sum(64)m =				766.6927	(64)
Heat gains from water heating, kWh/month													
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	19.6403	0.7200	0.7000	0.7700	24.7639	(76)
South	2.4600	46.7521	0.7200	0.7000	0.7700	40.1698	(78)
West	7.9700	19.6403	0.7200	0.7000	0.7700	54.6726	(80)

Solar gains	119.6062	221.1823	339.7145	467.9477	556.1096	563.2256	538.5902	473.0494	385.1780	255.3469	146.6628	100.0350	(83)
Total gains	674.7843	771.9918	869.1217	964.1684	1018.3562	995.0273	952.5875	895.3020	826.5179	730.0853	658.5244	639.9793	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9221	56.0346	56.1453	56.6712	56.7707	57.2384	57.2384	57.3259	57.0573	56.7707	56.5697	56.3612	
alpha	4.7281	4.7356	4.7430	4.7781	4.7847	4.8159	4.8159	4.8217	4.8038	4.7847	4.7713	4.7574	
util living area													
	0.9917	0.9834	0.9618	0.9015	0.7795	0.6004	0.4448	0.4909	0.7345	0.9333	0.9840	0.9934	(86)
MIT	19.8539	20.0296	20.3041	20.6290	20.8616	20.9696	20.9941	20.9907	20.9221	20.6072	20.1669	19.8170	(87)
Th 2	19.8867	19.8887	19.8906	19.8997	19.9014	19.9094	19.9094	19.9109	19.9063	19.9014	19.8980	19.8944	(88)
util rest of house													
	0.9890	0.9782	0.9496	0.8711	0.7186	0.5090	0.3373	0.3793	0.6469	0.9055	0.9780	0.9913	(89)
MIT 2	18.3921	18.6470	19.0393	19.4897	19.7765	19.8910	19.9075	19.9074	19.8506	19.4743	18.8546	18.3441	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.7592	18.9942	19.3569	19.7758	20.0490	20.1618	20.1803	20.1795	20.1196	19.7588	19.1842	18.7140	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7592	18.9942	19.3569	19.7758	20.0490	20.1618	20.1803	20.1795	20.1196	19.7588	19.1842	18.7140	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9851	0.9725	0.9422	0.8672	0.7275	0.5310	0.3644	0.4074	0.6654	0.9011	0.9727	0.9880	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	664.7567	750.7912	818.8900	836.0818	740.8873	528.3607	347.1384	364.7546	549.9579	657.8917	640.5408	632.3261	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1442.1898	1402.9604	1277.2729	1070.4344	820.2933	541.9916	348.8969	367.7403	588.4652	899.8606	1191.5011	1436.3724	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	578.4102	438.2577	341.0369	168.7338	59.0781	0.0000	0.0000	0.0000	0.0000	180.0248	396.6914	598.2105	(98)
Space heating												2760.4434	(98)
Space heating per m2											(98) / (4) =	34.3681	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2971.4138	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	578.4102	438.2577	341.0369	168.7338	59.0781	0.0000	0.0000	0.0000	0.0000	180.0248	396.6914	598.2105	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	622.6160	471.7521	367.1010	181.6295	63.5932	0.0000	0.0000	0.0000	0.0000	193.7834	427.0090	643.9295	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	138.7692	102.2530	78.8711	37.2737	10.8565	0.0000	0.0000	18.9751	41.0348	83.2553	117.4252	137.9788	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2625	89.2766	89.2811	89.3036	89.3878	86.7000	86.7000	86.7000	86.7000	88.8628	89.1485	89.2824	(217)
Fuel for water heating, kWh/month													
	155.4618	114.5350	88.3403	41.7382	12.1454	0.0000	0.0000	21.8859	47.3296	93.6897	131.7187	154.5420	(219)
Water heating fuel used												861.3866	(219)
Annual totals kWh/year													
Space heating fuel - main system												2971.4138	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												355.6668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												3725.1776	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2971.4138	3.4800	103.4052	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	861.3866	3.4800	29.9763	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	355.6668	13.1900	46.9124	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			239.1860	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8016	(257)
SAP value		88.8175	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2971.4138	0.2160	641.8254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	861.3866	0.2160	186.0595	(264)
Space and water heating			827.8849	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	355.6668	0.5190	184.5910 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			772.0286 (272)
CO2 emissions per m2			9.6100 (273)
EI value			91.7450
EI rating			92 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.1600	(1b)	x 2.5400	(2b) =	102.0064	(1b) - (3b)
First floor	40.1600	(1c)	x 2.6300	(2c) =	105.6208	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.3200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		207.6272	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1445	(8)
Pressure test			Yes	
Measured/design AP50			4.2700	
Infiltration rate			0.3580	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3043	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3195	0.2967	0.3043	0.2891	0.2891	0.2815	0.2739	0.2663	0.2586	0.2815	0.2663	0.2815	(22b)
Effective ac	0.5510	0.5440	0.5463	0.5418	0.5418	0.5396	0.5375	0.5354	0.5334	0.5396	0.5354	0.5396	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			14.0400	1.2357	17.3498			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			40.1600	0.1900	7.6304			(28a)
External Wall	92.5200	16.1600	76.3600	0.2700	20.6172			(29a)
Main Roof	40.1600		40.1600	0.1600	6.4256			(30)
Total net area of external elements Aum(A, m2)			172.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2030			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1238	(36)
Total fabric heat loss (33) + (36) =	60.3268	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.7557	37.2740	37.4306	37.1213	37.1213	36.9726	36.8279	36.6871	36.5503	36.9726	36.6871	36.9726	(38)
Heat transfer coeff	98.0826	97.6008	97.7574	97.4481	97.4481	97.2994	97.1547	97.0140	96.8772	97.2994	97.0140	97.2994	(39)
Average = Sum(39)m / 12 =												97.3579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2211	1.2151	1.2171	1.2132	1.2132	1.2114	1.2096	1.2078	1.2061	1.2114	1.2078	1.2114	(40)
HLP (average)												1.2121	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4689 (42)
Average daily hot water use (litres/day)	92.8365 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.1201	98.4067	94.6932	90.9798	87.2663	83.5528	83.5528	87.2663	90.9798	94.6932	98.4067	102.1201	(44)
Energy conte	151.4412	132.4515	136.6780	119.1592	114.3361	98.6634	91.4261	104.9128	106.1658	123.7260	135.0566	146.6627	(45)
Energy content (annual)										Total = Sum(45)m =		1460.6794	(45)
Distribution loss (46)m = 0.15 x (45)m	22.7162	19.8677	20.5017	17.8739	17.1504	14.7995	13.7139	15.7369	15.9249	18.5589	20.2585	21.9994	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8131	10.6602	11.7801	11.3748	11.7356	11.3359	11.7005	11.7233	11.3571	11.7617	11.4116	11.8059 (61)
Total heat required for water heating calculated for each month												
	163.2543	143.1117	148.4581	130.5340	126.0717	109.9992	103.1266	116.6361	117.5229	135.4877	146.4682	158.4687 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3896 (H8)
Utilisation factor												0.5131 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.8365 (H14)
Volume ratio Veff/V												0.8079 (H15)
Solar storage volume factor												0.9573 (H16)
Solar input												-876.6189 (H17)
Solar input	-28.5974	-40.6637	-69.8912	-94.2994	-110.7603	-118.3095	-115.8214	-103.6637	-81.1615	-56.1123	-33.8232	-23.5154 (63)
								Solar input (sum of months) = Sum(63)m =				-876.6189 (63)
Output from w/h												
	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533 (64)
								Total per year (kWh/year) = Sum(64)m =				743.5253 (64)
Heat gains from water heating, kWh/month												
	53.3075	46.7052	48.3905	42.4641	40.9507	35.6395	33.3243	37.8143	38.1394	44.0793	47.7592	51.7168 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	148.1343	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.3483	44.7189	36.3679	27.5328	20.5811	17.3754	18.7748	24.4042	32.7552	41.5903	48.5420	51.7476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	328.5195	331.9285	323.3379	305.0496	281.9638	260.2665	245.7713	242.3623	250.9529	269.2413	292.3270	314.0243	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	52.2823	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	-98.7562	(71)
Water heating gains (Table 5)													
	71.6498	69.5017	65.0409	58.9780	55.0412	49.4994	44.7907	50.8257	52.9714	59.2464	66.3322	69.5119	(72)
Total internal gains													
	555.1780	550.8096	529.4071	496.2208	462.2466	431.8017	413.9973	422.2526	441.3399	474.7383	511.8616	539.9443	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.6100	25.1925	0.7200	0.7000	0.7700	31.7646	(76)
South	2.4600	56.7559	0.7200	0.7000	0.7700	48.7652	(78)
West	7.9700	25.1925	0.7200	0.7000	0.7700	70.1284	(80)

Solar gains	150.6581	237.2831	367.4945	509.2669	575.2644	633.0034	600.5129	540.3629	440.0677	295.6059	184.1832	123.8324	(83)
Total gains	705.8362	788.0927	896.9017	1005.4877	1037.5110	1064.8051	1014.5102	962.6155	881.4076	770.3443	696.0448	663.7767	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8682	57.1489	57.0573	57.2384	57.2384	57.3259	57.4113	57.4946	57.5758	57.3259	57.4946	57.3259	
alpha	4.7912	4.8099	4.8038	4.8159	4.8159	4.8217	4.8274	4.8330	4.8384	4.8217	4.8330	4.8217	
util living area													
	0.9882	0.9797	0.9505	0.8697	0.7238	0.5099	0.3715	0.3904	0.6517	0.8974	0.9746	0.9905	(86)
MIT	19.9823	20.1215	20.4038	20.7154	20.9106	20.9865	20.9976	20.9971	20.9584	20.7192	20.3144	19.9601	(87)
Th 2	19.9031	19.9079	19.9063	19.9094	19.9094	19.9109	19.9123	19.9137	19.9151	19.9109	19.9137	19.9109	(88)
util rest of house													
	0.9844	0.9733	0.9349	0.8317	0.6539	0.4175	0.2690	0.2831	0.5560	0.8567	0.9649	0.9874	(89)
MIT 2	18.5899	18.7931	19.1904	19.6078	19.8356	19.9040	19.9117	19.9130	19.8893	19.6262	19.0768	18.5637	(90)
Living area fraction									fLA = Living area / (4) =			0.2511	(91)
MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9396	19.1267	19.4951	19.8860	20.1055	20.1759	20.1844	20.1852	20.1578	19.9007	19.3876	18.9144	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9673	0.9277	0.8308	0.6673	0.4405	0.2948	0.3102	0.5785	0.8563	0.9588	0.9833	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	691.5423	762.2925	832.0558	835.3157	692.3500	469.0353	299.0796	298.5799	509.9369	659.6343	667.3358	652.7187 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1377.0386	1349.4962	1221.4873	1012.0924	741.1460	474.4182	299.6661	299.3092	528.7376	827.1086	1114.4528	1353.8617 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	510.0093	394.6009	289.7370	127.2792	36.3042	0.0000	0.0000	0.0000	0.0000	124.6009	321.9243	521.6504 (98)

Space heating 2326.1062 (98)
Space heating per m2 (98) / (4) = 28.9605 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2503.8818 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	510.0093	394.6009	289.7370	127.2792	36.3042	0.0000	0.0000	0.0000	0.0000	124.6009	321.9243	521.6504	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	548.9874	424.7587	311.8806	137.0067	39.0788	0.0000	0.0000	0.0000	0.0000	134.1237	346.5277	561.5182	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	134.6569	102.4480	78.5669	36.2347	15.3114	0.0000	0.0000	12.9724	36.3614	79.3754	112.6449	134.9533	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2122	89.2213	89.1977	89.1707	88.9264	86.7000	86.7000	86.7000	86.7000	88.6271	89.0481	89.2232	(217)
Fuel for water heating, kWh/month	150.9400	114.8246	88.0818	40.6352	17.2181	0.0000	0.0000	14.9624	41.9393	89.5611	126.4990	151.2536	(219)

Water heating fuel used 835.9152 (219)
Annual totals kWh/year
Space heating fuel - main system 2503.8818 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 355.6668 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) = -668.0993 -668.0993 (233)
Total delivered energy for all uses 3152.3644 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2503.8818	7.3800	184.7865	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	835.9152	7.3800	61.6905	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	355.6668	28.6600	101.9341	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			299.7588	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2503.8818	0.2160	540.8385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.9152	0.2160	180.5577	(264)
Space and water heating			721.3961	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	355.6668	0.5190	184.5910	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			624.1187	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2503.8818	1.2200	3054.7358	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	835.9152	1.2200	1019.8165	(264)
Space and water heating			4074.5523	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	355.6668	3.0700	1091.8969	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			3499.1344	(272)
Primary energy kWh/m2/year			43.5649	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	548.14	(P1)
Transmission heat loss coefficient	60.33	(37)
Summer heat loss coefficient	608.46	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.6100	125.2818	0.7200	0.7000	0.7650	156.9385
South	2.4600	118.5567	0.7200	0.7000	0.7650	101.2035
West	7.9700	125.2818	0.7200	0.7000	0.7650	346.4820
total:						604.6241

	Jun	Jul	Aug	
Solar gains	648	605	542	(P3)
Internal gains	429	411	419	
Total summer gains	1077	1016	962	(P5)
Summer gain/loss ratio	1.77	1.67	1.58	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.42	19.22	19.13	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 433 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	8 Blackcap Walk, Boorley Green , SOUTHAMPTON, SO32 2DZ		

SAP Rating	88 B	**DER**	13.71	**TER**	18.57
Environmental	90 B	**% DER<TER**	26.16		
CO_2 Emissions (t/year)	0.78	**DFEE**	47.82	**TFEE**	53.23
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.57	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.71	$kgCO_2/m^2$	Pass
	-4.86 (-26.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.23	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.82	$kWh/m^2/yr$	
	-5.4 (-10.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	3.61 m², No overhang 2.46 m², No overhang 7.97 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.27 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.030	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 434 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.81	**TER**	17.95
Environmental	89 B	**% DER<TER**	23.06		
CO_2 Emissions (t/year)	0.92	**DFEE**	47.61	**TFEE**	52.92
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.04		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.95 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.81 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.85 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.53 m², No overhang
Windows facing East: 4.09 m², No overhang
Windows facing West: 7.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			3.8500	
Infiltration rate			0.3169	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3435	0.3368	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.4708	44.2885	44.1099	43.2709	43.1139	42.3832	42.3832	42.2478	42.6646	43.1139	43.4315	43.7635	(38)
Heat transfer coeff	108.0150	107.8327	107.6541	106.8151	106.6581	105.9274	105.9274	105.7920	106.2088	106.6581	106.9757	107.3077	(39)
Average = Sum(39)m / 12 =												106.8143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1563	1.1543	1.1453	1.1437	1.1358	1.1358	1.1344	1.1388	1.1437	1.1471	1.1506	(40)
HLP (average)												1.1453	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	409.3549	407.0363	392.0821	367.9868	343.4203	319.9353	304.8265	311.2313	323.7551	348.0732	375.9466	396.9478	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.7200	0.7000	0.7700	5.6823	(74)
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	87.1767	170.2795	280.9949	412.5419	509.1884	523.1156	497.2404	424.5038	327.5336	202.0921	108.6238	71.7541	(83)
Total gains	496.5316	577.3157	673.0770	780.5288	852.6088	843.0509	802.0668	735.7351	651.2887	550.1652	484.5704	468.7018	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9582	60.0596	60.1592	60.6318	60.7210	61.1399	61.1399	61.2181	60.9779	60.7210	60.5408	60.3535	
alpha	4.9972	5.0040	5.0106	5.0421	5.0481	5.0760	5.0760	5.0812	5.0652	5.0481	5.0361	5.0236	
util living area													
	0.9989	0.9973	0.9915	0.9673	0.8909	0.7332	0.5650	0.6316	0.8802	0.9852	0.9976	0.9991	(86)
MIT	19.6849	19.8328	20.1008	20.4583	20.7658	20.9396	20.9870	20.9778	20.8390	20.4281	19.9889	19.6563	(87)
Th 2	19.9536	19.9552	19.9567	19.9640	19.9653	19.9717	19.9717	19.9729	19.9692	19.9653	19.9626	19.9597	(88)
util rest of house													
	0.9985	0.9963	0.9884	0.9543	0.8483	0.6421	0.4412	0.5051	0.8163	0.9773	0.9966	0.9989	(89)
MIT 2	18.1936	18.4108	18.8021	19.3190	19.7316	19.9307	19.9668	19.9635	19.8337	19.2842	18.6447	18.1561	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.5793	18.7786	19.1380	19.6137	19.9990	20.1917	20.2307	20.2258	20.0937	19.5801	18.9923	18.5441	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5793	18.7786	19.1380	19.6137	19.9990	20.1917	20.2307	20.2258	20.0937	19.5801	18.9923	18.5441	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9948	0.9849	0.9487	0.8499	0.6631	0.4734	0.5379	0.8254	0.9731	0.9952	0.9982	(94)
Useful gains	495.3625	574.2880	662.9263	740.5214	724.6235	559.0573	379.7331	395.7651	537.6012	535.3922	482.2406	467.8714	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1542.3740	1496.5668	1360.5337	1144.3816	885.1591	592.3103	384.5871	404.7415	636.5820	957.7991	1272.1886	1539.2307	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	778.9766	619.7714	519.0199	290.7793	119.4385	0.0000	0.0000	0.0000	0.0000	314.2707	568.7626	797.0914	(98)
Space heating												4008.1103	(98)
Space heating per m2											(98) / (4) =	42.9778	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4314.4352 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	778.9766	619.7714	519.0199	290.7793	119.4385	0.0000	0.0000	0.0000	0.0000	314.2707	568.7626	797.0914	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	838.5109	667.1382	558.6867	313.0025	128.5667	0.0000	0.0000	0.0000	0.0000	338.2893	612.2310	858.0101	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3068	89.2585	89.1418	88.8518	88.1918	86.7000	86.7000	86.7000	86.7000	88.8800	89.2008	89.3319	(217)
Fuel for water heating, kWh/month													
	191.4416	167.8980	174.3646	153.7539	149.5650	132.6776	124.3250	140.7009	141.7982	159.5413	171.9183	185.7580	(219)
Water heating fuel used												1893.7425	(219)
Annual totals kWh/year													
Space heating fuel - main system												4314.4352	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6106.2403	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4314.4352	0.2160	931.9180	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.7425	0.2160	409.0484	(264)
Space and water heating			1340.9664	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1288.0608	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.8100	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		31.3367	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.3367	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.0733	(36)
Total fabric heat loss	(33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.6300	0.7000	0.7700	4.9720	(74)
East	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495	(76)
West	7.7900	19.6403	0.6300	0.7000	0.7700	46.7581	(80)

Solar gains	76.2796	148.9945	245.8706	360.9742	445.5399	457.7262	435.0853	371.4408	286.5919	176.8306	95.0458	62.7848	(83)
Total gains	498.7845	569.1833	651.0270	741.3768	800.7146	788.7557	751.0110	694.4311	622.7696	537.9849	484.1487	472.8850	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9988	0.9975	0.9924	0.9712	0.9018	0.7473	0.5764	0.6397	0.8850	0.9857	0.9976	0.9991	(86)
MIT	19.7446	19.8819	20.1329	20.4731	20.7685	20.9414	20.9879	20.9797	20.8482	20.4591	20.0420	19.7223	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9984	0.9966	0.9896	0.9597	0.8625	0.6595	0.4554	0.5169	0.8239	0.9782	0.9966	0.9988	(89)
MIT 2	18.3056	18.5078	18.8750	19.3706	19.7705	19.9734	20.0093	20.0068	19.8811	19.3581	18.7498	18.2792	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.6778	18.8632	19.2004	19.6558	20.0286	20.2237	20.2624	20.2584	20.1312	19.6429	19.0840	18.6524	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6778	18.8632	19.2004	19.6558	20.0286	20.2237	20.2624	20.2584	20.1312	19.6429	19.0840	18.6524	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9951	0.9865	0.9546	0.8636	0.6797	0.4869	0.5487	0.8328	0.9743	0.9953	0.9982	(94)
Useful gains	497.6207	566.3924	642.2325	707.7243	691.5192	536.1004	365.6733	381.0484	518.6151	524.1829	481.8528	472.0466	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1495.3937	1448.7222	1314.5326	1100.6629	850.4599	568.5224	370.2406	389.3302	612.0877	923.4014	1229.0416	1488.8885	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	742.3431	592.9256	500.1913	282.9158	118.2519	0.0000	0.0000	0.0000	0.0000	297.0185	537.9759	756.5304	(98)
Space heating												3828.1525	(98)
Space heating per m2											(98) / (4) =	41.0482	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4098.6644	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	742.3431	592.9256	500.1913	282.9158	118.2519	0.0000	0.0000	0.0000	0.0000	297.0185	537.9759	756.5304	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	794.7999	634.8240	535.5367	302.9078	126.6080	0.0000	0.0000	0.0000	0.0000	318.0070	575.9914	809.9897	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9595	87.7722	87.3266	86.2909	84.2015	80.3000	80.3000	80.3000	80.3000	86.2940	87.5133	88.0384	(217)
Fuel for water heating, kWh/month													
	238.8651	211.0202	222.5450	199.7552	198.1974	183.0424	175.3686	195.4949	197.6539	209.4350	218.5297	232.9471	(219)
Water heating fuel used												2482.8546	(219)
Annual totals kWh/year													
Space heating fuel - main system												4098.6644	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												7067.8711	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4098.6644	0.2160	885.3115	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2482.8546	0.2160	536.2966	(264)
Space and water heating			1421.6081	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1674.0248	(272)
Emissions per m2 for space and water heating			15.2435	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2435 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.9500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			3.8500	
Infiltration rate			0.3169	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3435	0.3368	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.4708	44.2885	44.1099	43.2709	43.1139	42.3832	42.3832	42.2478	42.6646	43.1139	43.4315	43.7635	(38)
Heat transfer coeff	108.0150	107.8327	107.6541	106.8151	106.6581	105.9274	105.9274	105.7920	106.2088	106.6581	106.9757	107.3077	(39)
Average = Sum(39)m / 12 =												106.8143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1563	1.1543	1.1453	1.1437	1.1358	1.1358	1.1344	1.1388	1.1437	1.1471	1.1506	(40)
HLP (average)												1.1453	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.7200	0.7000	0.7700	5.6823	(74)
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	87.1767	170.2795	280.9949	412.5419	509.1884	523.1156	497.2404	424.5038	327.5336	202.0921	108.6238	71.7541	(83)
Total gains	463.8896	545.4896	642.9455	752.7031	826.2806	818.8299	779.6348	711.0087	625.7455	522.2359	453.9488	436.8723	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9582	60.0596	60.1592	60.6318	60.7210	61.1399	61.1399	61.2181	60.9779	60.7210	60.5408	60.3535	
alpha	4.9972	5.0040	5.0106	5.0421	5.0481	5.0760	5.0760	5.0812	5.0652	5.0481	5.0361	5.0236	
util living area													
	0.9992	0.9979	0.9931	0.9716	0.9007	0.7479	0.5794	0.6495	0.8935	0.9881	0.9982	0.9994	(86)
MIT	19.6522	19.8012	20.0717	20.4344	20.7503	20.9338	20.9855	20.9749	20.8247	20.4019	19.9584	19.6244	(87)
Th 2	19.9536	19.9552	19.9567	19.9640	19.9653	19.9717	19.9717	19.9729	19.9692	19.9653	19.9626	19.9597	(88)
util rest of house													
	0.9989	0.9972	0.9904	0.9600	0.8605	0.6574	0.4533	0.5213	0.8335	0.9816	0.9975	0.9992	(89)
MIT 2	18.7193	18.8693	19.1398	19.5012	19.7934	19.9407	19.9679	19.9655	19.8665	19.4751	19.0324	18.6964	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9606	19.1103	19.3808	19.7425	20.0409	20.1975	20.2311	20.2266	20.1143	19.7148	19.2719	18.9364	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9606	19.1103	19.3808	19.7425	20.0409	20.1975	20.2311	20.2266	20.1143	19.7148	19.2719	18.9364	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9963	0.9885	0.9569	0.8639	0.6790	0.4863	0.5549	0.8436	0.9794	0.9968	0.9989	(94)
Useful gains	463.1792	543.4854	635.5431	720.2989	713.8092	555.9509	379.1602	394.5198	527.8843	511.4915	452.4802	436.3784	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1583.5655	1532.3384	1386.6711	1158.1472	889.6194	592.9306	384.6327	404.8192	638.7754	972.1648	1302.0961	1581.3290	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	833.5674	664.5092	558.8392	315.2508	130.8028	0.0000	0.0000	0.0000	0.0000	342.7410	611.7235	851.8432	(98)
Space heating												4309.2770	(98)
Space heating per m2											(98) / (4) =	46.2071	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	995.7172	783.8625	804.0195	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9215	0.8908	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	856.2858	722.3373	716.2563	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1058.7999	1010.8841	932.6324	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	145.8102	214.6788	160.9838	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											521.4728	(104)
Cooled fraction								fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.4525	53.6697	40.2459	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											130.3682	(107)
Space cooling per m2											1.3979	(108)
Energy for space heating											46.2071	(99)
Energy for space cooling											1.3979	(108)
Total											47.6050	(109)
Dwelling Fabric Energy Efficiency (DFEE)											47.6	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.6300	0.7000	0.7700	4.9720	(74)
East	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495	(76)
West	7.7900	19.6403	0.6300	0.7000	0.7700	46.7581	(80)

Solar gains	76.2796	148.9945	245.8706	360.9742	445.5399	457.7262	435.0853	371.4408	286.5919	176.8306	95.0458	62.7848	(83)
Total gains	452.9925	524.2047	607.8212	701.1353	762.6321	753.4404	717.4798	657.9458	584.8038	496.9744	440.3708	427.9030	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9993	0.9983	0.9944	0.9770	0.9160	0.7704	0.6000	0.6684	0.9054	0.9899	0.9985	0.9995	(86)
MIT	19.6985	19.8369	20.0907	20.4375	20.7446	20.9321	20.9854	20.9751	20.8260	20.4201	19.9980	19.6768	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9990	0.9977	0.9923	0.9676	0.8805	0.6838	0.4757	0.5432	0.8506	0.9843	0.9978	0.9993	(89)
MIT 2	18.7934	18.9334	19.1879	19.5376	19.8254	19.9812	20.0100	20.0080	19.9062	19.5257	19.1030	18.7787	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0275	19.1670	19.4214	19.7703	20.0631	20.2271	20.2623	20.2581	20.1441	19.7570	19.3345	19.0110	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0275	19.1670	19.4214	19.7703	20.0631	20.2271	20.2623	20.2581	20.1441	19.7570	19.3345	19.0110	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9970	0.9907	0.9648	0.8829	0.7043	0.5083	0.5760	0.8595	0.9825	0.9972	0.9990	(94)
Useful gains	452.3920	522.6072	602.1616	676.4304	673.3451	530.6132	364.6657	378.9625	502.6168	488.2558	439.1473	427.4840	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1531.7635	1480.2454	1337.4118	1112.3866	853.9853	568.8679	370.2338	389.3048	613.3910	935.0530	1254.7256	1525.8298	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	803.0524	643.5328	547.0261	313.8885	134.3963	0.0000	0.0000	0.0000	0.0000	332.4171	587.2164	817.1693	(98)
Space heating												4178.6989	(98)
Space heating per m2											(98) / (4) =	44.8070	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8542	0.9190	0.8889	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	811.6853	687.4968	681.7065	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	982.3707	938.2354	870.6107	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	122.8935	186.5495	140.5447	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												449.9877	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.7234	46.6374	35.1362	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												112.4969 (107)
Space cooling per m2												1.2063 (108)
Energy for space heating												44.8070 (99)
Energy for space cooling												1.2063 (108)
Total												46.0133 (109)
Target Fabric Energy Efficiency (TFEE)												52.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2829	0.2627	0.2694	0.2559	0.2559	0.2492	0.2425	0.2357	0.2290	0.2492	0.2357	0.2492	(22b)
Effective ac	0.5400	0.5345	0.5363	0.5328	0.5328	0.5310	0.5294	0.5278	0.5262	0.5310	0.5278	0.5310	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9606	42.5221	42.6646	42.3832	42.3832	42.2478	42.1161	41.9880	41.8635	42.2478	41.9880	42.2478	(38)
Heat transfer coeff	106.5048	106.0663	106.2088	105.9274	105.9274	105.7920	105.6603	105.5322	105.4077	105.7920	105.5322	105.7920	(39)
Average = Sum(39)m / 12 =												105.8453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1420	1.1373	1.1388	1.1358	1.1358	1.1344	1.1330	1.1316	1.1303	1.1344	1.1316	1.1344	(40)
HLP (average)												1.1349	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)
Total heat required for water heating calculated for each month												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	13.4839	0.7200	0.7000	0.7700	7.2056	(74)
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	111.7383	185.7985	308.5641	454.2085	531.2730	592.1656	558.7514	489.9326	379.3856	237.8226	138.8019	90.3829	(83)
Total gains	720.6917	789.7787	888.6401	997.3420	1036.5379	1063.7527	1010.8775	951.1181	862.0448	757.6472	699.8020	682.5769	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8085	61.0598	60.9779	61.1399	61.1399	61.2181	61.2944	61.3688	61.4413	61.2181	61.3688	61.2181	
alpha	5.0539	5.0707	5.0652	5.0760	5.0760	5.0812	5.0863	5.0913	5.0961	5.0812	5.0913	5.0812	
util living area													
	0.9927	0.9879	0.9690	0.9066	0.7715	0.5527	0.4051	0.4293	0.7116	0.9311	0.9843	0.9941	(86)
MIT	19.9922	20.1067	20.3685	20.6830	20.8984	20.9848	20.9974	20.9967	20.9488	20.6868	20.2991	19.9758	(87)
Th 2	19.9667	19.9705	19.9692	19.9717	19.9717	19.9729	19.9740	19.9751	19.9762	19.9729	19.9751	19.9729	(88)
util rest of house													
	0.9903	0.9839	0.9586	0.8764	0.7066	0.4596	0.2999	0.3184	0.6188	0.9008	0.9781	0.9921	(89)
MIT 2	18.6506	18.8189	19.1924	19.6240	19.8844	19.9648	19.9733	19.9742	19.9426	19.6408	19.1022	18.6315	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9797	0.9525	0.8739	0.7185	0.4834	0.3273	0.3472	0.6408	0.8985	0.9735	0.9893	(94)
Useful gains	711.4043	773.7183	846.4455	871.6142	744.7901	514.2147	330.8114	330.2223	552.3737	680.7792	681.2650	675.2810	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1501.4594	1469.2257	1327.2434	1101.4212	809.9865	521.4070	331.5808	331.2283	580.0386	900.4305	1214.8639	1478.8840	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	587.8010	467.3810	357.7136	165.4610	48.5061	0.0000	0.0000	0.0000	0.0000	163.4206	384.1912	597.8807	(98)
Space heating												2772.3551	(98)
RHI space heating demand												2772	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3435	0.3368	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.4708	44.2885	44.1099	43.2709	43.1139	42.3832	42.3832	42.2478	42.6646	43.1139	43.4315	43.7635	(38)
Heat transfer coeff	108.0150	107.8327	107.6541	106.8151	106.6581	105.9274	105.9274	105.7920	106.2088	106.6581	106.9757	107.3077	(39)
Average = Sum(39)m / 12 =												106.8143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1563	1.1543	1.1453	1.1437	1.1358	1.1358	1.1344	1.1388	1.1437	1.1471	1.1506	(40)
HLP (average)												1.1453	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)
Total heat required for water heating calculated for each month												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243 (64)
Heat gains from water heating, kWh/month												
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.7200	0.7000	0.7700	5.6823	(74)
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	87.1767	170.2795	280.9949	412.5419	509.1884	523.1156	497.2404	424.5038	327.5336	202.0921	108.6238	71.7541	(83)
Total gains	696.1300	774.2597	861.0710	955.6755	1014.4533	994.7027	949.3664	885.6892	810.1928	721.9166	669.6239	663.9481	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9582	60.0596	60.1592	60.6318	60.7210	61.1399	61.1399	61.2181	60.9779	60.7210	60.5408	60.3535	
alpha	4.9972	5.0040	5.0106	5.0421	5.0481	5.0760	5.0760	5.0812	5.0652	5.0481	5.0361	5.0236	
util living area													
	0.9947	0.9902	0.9766	0.9322	0.8251	0.6472	0.4841	0.5373	0.7906	0.9569	0.9900	0.9958	(86)
MIT	19.8825	20.0248	20.2754	20.5952	20.8439	20.9655	20.9934	20.9892	20.9068	20.5781	20.1697	19.8505	(87)
Th 2	19.9536	19.9552	19.9567	19.9640	19.9653	19.9717	19.9717	19.9729	19.9692	19.9653	19.9626	19.9597	(88)
util rest of house													
	0.9930	0.9870	0.9687	0.9093	0.7711	0.5572	0.3746	0.4235	0.7103	0.9374	0.9862	0.9944	(89)
MIT 2	18.4815	18.6892	19.0510	19.5022	19.8186	19.9498	19.9694	19.9686	19.8985	19.4896	18.9065	18.4394	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8438	19.0347	19.3677	19.7849	20.0838	20.2125	20.2342	20.2325	20.1593	19.7711	19.2332	18.8043	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8438	19.0347	19.3677	19.7849	20.0838	20.2125	20.2342	20.2325	20.1593	19.7711	19.2332	18.8043	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9831	0.9629	0.9046	0.7779	0.5792	0.4030	0.4531	0.7267	0.9328	0.9824	0.9922	(94)
Useful gains	689.4407	761.1842	829.1546	864.4625	789.1717	576.1700	382.6116	401.2687	588.7624	673.3772	657.8392	658.8006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1570.9484	1524.1792	1385.2573	1162.6696	894.2008	594.5172	384.9641	405.4530	643.5497	978.1741	1297.9597	1567.1575	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	655.8417	512.7326	413.7404	214.7091	78.1417	0.0000	0.0000	0.0000	0.0000	226.7689	460.8867	675.8175	(98)
Space heating												3238.6387	(98)
Space heating per m2											(98) / (4) =	34.7270	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3486.1558	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	655.8417	512.7326	413.7404	214.7091	78.1417	0.0000	0.0000	0.0000	0.0000	226.7689	460.8867	675.8175	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	705.9653	551.9189	445.3611	231.1185	84.1138	0.0000	0.0000	0.0000	0.0000	244.1000	496.1106	727.4678	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2191	89.1557	89.0029	88.6280	87.8635	86.7000	86.7000	86.7000	86.7000	88.6413	89.0792	89.2506	(217)
Fuel for water heating, kWh/month													
	191.6297	168.0915	174.6366	154.1421	150.1238	132.6776	124.3250	140.7009	141.7982	159.9711	172.1531	185.9272	(219)
Water heating fuel used												1896.1768	(219)
Annual totals kWh/year													
Space heating fuel - main system												3486.1558	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5280.3951	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3486.1558	3.4800	121.3182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1896.1768	3.4800	65.9870	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			293.8596	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8927	(257)
SAP value		87.5472	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3486.1558	0.2160	753.0097	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1896.1768	0.2160	409.5742	(264)
Space and water heating			1162.5838	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1109.6783	(272)
CO2 emissions per m2			11.9000	(273)
EI value			89.2451	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8814 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8814 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2829	0.2627	0.2694	0.2559	0.2559	0.2492	0.2425	0.2357	0.2290	0.2492	0.2357	0.2492	(22b)
Effective ac	0.5400	0.5345	0.5363	0.5328	0.5328	0.5310	0.5294	0.5278	0.5262	0.5310	0.5278	0.5310	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9606	42.5221	42.6646	42.3832	42.3832	42.2478	42.1161	41.9880	41.8635	42.2478	41.9880	42.2478	(38)
Heat transfer coeff	106.5048	106.0663	106.2088	105.9274	105.9274	105.7920	105.6603	105.5322	105.4077	105.7920	105.5322	105.7920	(39)
Average = Sum(39)m / 12 =												105.8453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1420	1.1373	1.1388	1.1358	1.1358	1.1344	1.1330	1.1316	1.1303	1.1344	1.1316	1.1344	(40)
HLP (average)												1.1349	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	13.4839	0.7200	0.7000	0.7700	7.2056	(74)
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	111.7383	185.7985	308.5641	454.2085	531.2730	592.1656	558.7514	489.9326	379.3856	237.8226	138.8019	90.3829	(83)
Total gains	720.6917	789.7787	888.6401	997.3420	1036.5379	1063.7527	1010.8775	951.1181	862.0448	757.6472	699.8020	682.5769	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8085	61.0598	60.9779	61.1399	61.1399	61.2181	61.2944	61.3688	61.4413	61.2181	61.3688	61.2181	
alpha	5.0539	5.0707	5.0652	5.0760	5.0760	5.0812	5.0863	5.0913	5.0961	5.0812	5.0913	5.0812	
util living area													
	0.9927	0.9879	0.9690	0.9066	0.7715	0.5527	0.4051	0.4293	0.7116	0.9311	0.9843	0.9941	(86)
MIT	19.9922	20.1067	20.3685	20.6830	20.8984	20.9848	20.9974	20.9967	20.9488	20.6868	20.2991	19.9758	(87)
Th 2	19.9667	19.9705	19.9692	19.9717	19.9717	19.9729	19.9740	19.9751	19.9762	19.9729	19.9751	19.9729	(88)
util rest of house													
	0.9903	0.9839	0.9586	0.8764	0.7066	0.4596	0.2999	0.3184	0.6188	0.9008	0.9781	0.9921	(89)
MIT 2	18.6506	18.8189	19.1924	19.6240	19.8844	19.9648	19.9733	19.9742	19.9426	19.6408	19.1022	18.6315	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9797	0.9525	0.8739	0.7185	0.4834	0.3273	0.3472	0.6408	0.8985	0.9735	0.9893	(94)
Useful gains	711.4043	773.7183	846.4455	871.6142	744.7901	514.2147	330.8114	330.2223	552.3737	680.7792	681.2650	675.2810	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1501.4594	1469.2257	1327.2434	1101.4212	809.9865	521.4070	331.5808	331.2283	580.0386	900.4305	1214.8639	1478.8840	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	587.8010	467.3810	357.7136	165.4610	48.5061	0.0000	0.0000	0.0000	0.0000	163.4206	384.1912	597.8807	(98)
Space heating												2772.3551	(98)
Space heating per m2											(98) / (4) =	29.7272	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2984.2359	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	587.8010	467.3810	357.7136	165.4610	48.5061	0.0000	0.0000	0.0000	0.0000	163.4206	384.1912	597.8807	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	632.7244	503.1012	385.0523	178.1066	52.2133	0.0000	0.0000	0.0000	0.0000	175.9102	413.5535	643.5745	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1585	89.1015	88.9061	88.4240	87.5378	86.7000	86.7000	86.7000	86.7000	88.3845	88.9633	89.1849	(217)
Fuel for water heating, kWh/month													
	191.7599	168.1938	174.8269	154.4977	150.6824	132.6776	124.3250	140.7009	141.7982	160.4359	172.3774	186.0642	(219)
Water heating fuel used												1898.3399	(219)
Annual totals kWh/year													
Space heating fuel - main system												2984.2359	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4700.8285	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2984.2359	7.3800	220.2366	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1898.3399	7.3800	140.0975	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			415.2453	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2984.2359	0.2160	644.5950	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.3399	0.2160	410.0414	(264)
Space and water heating			1054.6364	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			960.3095	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2984.2359	1.2200	3640.7678	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.3399	1.2200	2315.9746	(264)
Space and water heating			5956.7424	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			5398.7784	(272)
Primary energy kWh/m2/year			57.8895	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-192 kg (19.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 89	B 91
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£467	£393	£74
Space heating	£349	£349	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£415	£356	£60
Total cost of uses	£416	£356	£60
Delivered energy	50 kWh/m²	40 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	46 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3435	0.3368	0.3300	0.2963	0.2896	0.2559	0.2559	0.2492	0.2694	0.2896	0.3031	0.3165	(22b)
Effective ac	0.5590	0.5567	0.5545	0.5439	0.5419	0.5328	0.5328	0.5310	0.5363	0.5419	0.5459	0.5501	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.4708	44.2885	44.1099	43.2709	43.1139	42.3832	42.3832	42.2478	42.6646	43.1139	43.4315	43.7635	(38)
Heat transfer coeff	108.0150	107.8327	107.6541	106.8151	106.6581	105.9274	105.9274	105.7920	106.2088	106.6581	106.9757	107.3077	(39)
Average = Sum(39)m / 12 =												106.8143	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1582	1.1563	1.1543	1.1453	1.1437	1.1358	1.1358	1.1344	1.1388	1.1437	1.1471	1.1506	(40)
HLP (average)												1.1453	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1815	(H8)
Utilisation factor												0.5710	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-862.7264	(H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352	(63)
								Solar input (sum of months) = Sum(63)m =				-862.7264	(63)
Output from w/h													
	145.9529	108.1165	84.3322	41.3257	14.1845	0.0000	0.0000	22.2040	44.7884	88.4327	123.6783	145.0059	(64)
								Total per year (kWh/year) = Sum(64)m =				818.0212	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.7200	0.7000	0.7700	5.6823	(74)
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	87.1767	170.2795	280.9949	412.5419	509.1884	523.1156	497.2404	424.5038	327.5336	202.0921	108.6238	71.7541	(83)
Total gains	696.1300	774.2597	861.0710	955.6755	1014.4533	994.7027	949.3664	885.6892	810.1928	721.9166	669.6239	663.9481	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9582	60.0596	60.1592	60.6318	60.7210	61.1399	61.1399	61.2181	60.9779	60.7210	60.5408	60.3535	
alpha	4.9972	5.0040	5.0106	5.0421	5.0481	5.0760	5.0760	5.0812	5.0652	5.0481	5.0361	5.0236	
util living area													
	0.9947	0.9902	0.9766	0.9322	0.8251	0.6472	0.4841	0.5373	0.7906	0.9569	0.9900	0.9958	(86)
MIT	19.8825	20.0248	20.2754	20.5952	20.8439	20.9655	20.9934	20.9892	20.9068	20.5781	20.1697	19.8505	(87)
Th 2	19.9536	19.9552	19.9567	19.9640	19.9653	19.9717	19.9717	19.9729	19.9692	19.9653	19.9626	19.9597	(88)
util rest of house													
	0.9930	0.9870	0.9687	0.9093	0.7711	0.5572	0.3746	0.4235	0.7103	0.9374	0.9862	0.9944	(89)
MIT 2	18.4815	18.6892	19.0510	19.5022	19.8186	19.9498	19.9694	19.9686	19.8985	19.4896	18.9065	18.4394	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8438	19.0347	19.3677	19.7849	20.0838	20.2125	20.2342	20.2325	20.1593	19.7711	19.2332	18.8043	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8438	19.0347	19.3677	19.7849	20.0838	20.2125	20.2342	20.2325	20.1593	19.7711	19.2332	18.8043	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9831	0.9629	0.9046	0.7779	0.5792	0.4030	0.4531	0.7267	0.9328	0.9824	0.9922	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	689.4407	761.1842	829.1546	864.4625	789.1717	576.1700	382.6116	401.2687	588.7624	673.3772	657.8392	658.8006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1570.9484	1524.1792	1385.2573	1162.6696	894.2008	594.5172	384.9641	405.4530	643.5497	978.1741	1297.9597	1567.1575	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	655.8417	512.7326	413.7404	214.7091	78.1417	0.0000	0.0000	0.0000	0.0000	226.7689	460.8867	675.8175	(98)
Space heating												3238.6387	(98)
Space heating per m2											(98) / (4) =	34.7270	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3486.1558	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	655.8417	512.7326	413.7404	214.7091	78.1417	0.0000	0.0000	0.0000	0.0000	226.7689	460.8867	675.8175	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	705.9653	551.9189	445.3611	231.1185	84.1138	0.0000	0.0000	0.0000	0.0000	244.1000	496.1106	727.4678	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9529	108.1165	84.3322	41.3257	14.1845	0.0000	0.0000	22.2040	44.7884	88.4327	123.6783	145.0059	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3000	89.3259	89.3417	89.3676	89.3931	86.7000	86.7000	86.7000	86.7000	88.9786	89.2034	89.3176	(217)
Fuel for water heating, kWh/month	163.4410	121.0360	94.3929	46.2424	15.8676	0.0000	0.0000	25.6102	51.6591	99.3865	138.6475	162.3486	(219)
Water heating fuel used												918.6318	(219)
Annual totals kWh/year													
Space heating fuel - main system												3486.1558	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4352.8501	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3486.1558	3.4800	121.3182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	918.6318	3.4800	31.9684	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			266.4361	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8094	(257)
SAP value		88.7093	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3486.1558	0.2160	753.0097	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	918.6318	0.2160	198.4245	(264)
Space and water heating			951.4341	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			924.4786 (272)
CO2 emissions per m2			9.9100 (273)
EI value			91.0401
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2694	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2829	0.2627	0.2694	0.2559	0.2559	0.2492	0.2425	0.2357	0.2290	0.2492	0.2357	0.2492	(22b)
Effective ac	0.5400	0.5345	0.5363	0.5328	0.5328	0.5310	0.5294	0.5278	0.5262	0.5310	0.5278	0.5310	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.9606	42.5221	42.6646	42.3832	42.3832	42.2478	42.1161	41.9880	41.8635	42.2478	41.9880	42.2478	(38)
Heat transfer coeff	106.5048	106.0663	106.2088	105.9274	105.9274	105.7920	105.6603	105.5322	105.4077	105.7920	105.5322	105.7920	(39)
Average = Sum(39)m / 12 =												105.8453	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1420	1.1373	1.1388	1.1358	1.1358	1.1344	1.1330	1.1316	1.1303	1.1344	1.1316	1.1344	(40)
HLP (average)												1.1349	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3223	(H8)
Utilisation factor												0.5306	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-897.1283	(H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656	(63)
								Solar input (sum of months) = Sum(63)m =				-897.1283	(63)
Output from w/h													
	141.7037	108.2482	83.9053	40.1075	18.5524	0.0000	0.0000	15.8987	39.8787	84.3753	118.7380	141.8755	(64)
								Total per year (kWh/year) = Sum(64)m =				793.2834	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	13.4839	0.7200	0.7000	0.7700	7.2056	(74)
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	111.7383	185.7985	308.5641	454.2085	531.2730	592.1656	558.7514	489.9326	379.3856	237.8226	138.8019	90.3829	(83)
Total gains	720.6917	789.7787	888.6401	997.3420	1036.5379	1063.7527	1010.8775	951.1181	862.0448	757.6472	699.8020	682.5769	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8085	61.0598	60.9779	61.1399	61.1399	61.2181	61.2944	61.3688	61.4413	61.2181	61.3688	61.2181	
alpha	5.0539	5.0707	5.0652	5.0760	5.0760	5.0812	5.0863	5.0913	5.0961	5.0812	5.0913	5.0812	
util living area													
	0.9927	0.9879	0.9690	0.9066	0.7715	0.5527	0.4051	0.4293	0.7116	0.9311	0.9843	0.9941	(86)
MIT	19.9922	20.1067	20.3685	20.6830	20.8984	20.9848	20.9974	20.9967	20.9488	20.6868	20.2991	19.9758	(87)
Th 2	19.9667	19.9705	19.9692	19.9717	19.9717	19.9729	19.9740	19.9751	19.9762	19.9729	19.9751	19.9729	(88)
util rest of house													
	0.9903	0.9839	0.9586	0.8764	0.7066	0.4596	0.2999	0.3184	0.6188	0.9008	0.9781	0.9921	(89)
MIT 2	18.6506	18.8189	19.1924	19.6240	19.8844	19.9648	19.9733	19.9742	19.9426	19.6408	19.1022	18.6315	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9976	19.1520	19.4965	19.8979	20.1466	20.2286	20.2382	20.2386	20.2028	19.9113	19.4118	18.9792	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9797	0.9525	0.8739	0.7185	0.4834	0.3273	0.3472	0.6408	0.8985	0.9735	0.9893	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	711.4043	773.7183	846.4455	871.6142	744.7901	514.2147	330.8114	330.2223	552.3737	680.7792	681.2650	675.2810 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1501.4594	1469.2257	1327.2434	1101.4212	809.9865	521.4070	331.5808	331.2283	580.0386	900.4305	1214.8639	1478.8840 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	587.8010	467.3810	357.7136	165.4610	48.5061	0.0000	0.0000	0.0000	0.0000	163.4206	384.1912	597.8807 (98)
Space heating												2772.3551 (98)
Space heating per m2											(98) / (4) =	29.7272 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2984.2359 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	587.8010	467.3810	357.7136	165.4610	48.5061	0.0000	0.0000	0.0000	0.0000	163.4206	384.1912	597.8807 (98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000 (210)
Space heating fuel (main heating system)	632.7244	503.1012	385.0523	178.1066	52.2133	0.0000	0.0000	0.0000	0.0000	175.9102	413.5535	643.5745 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	141.7037	108.2482	83.9053	40.1075	18.5524	0.0000	0.0000	15.8987	39.8787	84.3753	118.7380	141.8755 (64)
Efficiency of water heater												86.7000 (216)
(217)m	89.2601	89.2803	89.2740	89.2572	88.9913	86.7000	86.7000	86.7000	86.7000	88.7842	89.1234	89.2681 (217)
Fuel for water heating, kWh/month	158.7538	121.2453	93.9863	44.9347	20.8474	0.0000	0.0000	18.3376	45.9962	95.0342	133.2287	158.9320 (219)
Water heating fuel used												891.2962 (219)
Annual totals kWh/year												
Space heating fuel - main system												2984.2359 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												411.3521 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993 (233)
Total delivered energy for all uses												3743.7849 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2984.2359	7.3800	220.2366	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	891.2962	7.3800	65.7777	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			355.2555	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2984.2359	0.2160	644.5950	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	891.2962	0.2160	192.5200	(264)
Space and water heating			837.1149	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			768.7381	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2984.2359	1.2200	3640.7678	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	891.2962	1.2200	1087.3814	(264)
Space and water heating			4728.1492	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4323.6851	(272)
Primary energy kWh/m2/year			46.3616	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.5300	87.1704	0.7200	0.7000	0.7650	46.2802
East	4.0900	125.2818	0.7200	0.7000	0.7650	177.8057
West	7.7900	125.2818	0.7200	0.7000	0.7650	338.6569
total:						562.7428

	Jun	Jul	Aug	
Solar gains	606	563	492	(P3)
Internal gains	469	449	458	
Total summer gains	1075	1012	950	(P5)
Summer gain/loss ratio	1.54	1.45	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.19	19.00	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 434 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	6 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.81	**TER**	17.95
Environmental	89 B	**% DER<TER**	23.06		
CO_2 Emissions (t/year)	0.92	**DFEE**	47.61	**TFEE**	52.92
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.04		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.95	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.81	$kgCO_2/m^2$	Pass
	-4.14 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.92	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.61	$kWh/m^2/yr$	
	-5.3 (-10.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.85 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.53 m², No overhang 4.09 m², No overhang 7.79 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.85 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.027	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 435 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	4 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.61	**TER**	17.71
Environmental	89 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.91	**DFEE**	46.80	**TFEE**	51.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.53		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.71 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.61 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.28 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 4.09 m², No overhang
Windows facing South: 1.53 m², No overhang
Windows facing West: 7.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.3384	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3668	0.3596	0.3524	0.3164	0.3093	0.2733	0.2733	0.2661	0.2877	0.3093	0.3236	0.3380	(22b)
Effective ac	0.5673	0.5647	0.5621	0.5501	0.5478	0.5373	0.5373	0.5354	0.5414	0.5478	0.5524	0.5571	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1291	44.9213	44.7176	43.7609	43.5819	42.7487	42.7487	42.5943	43.0696	43.5819	43.9440	44.3226	(38)
Heat transfer coeff	108.6733	108.4655	108.2618	107.3051	107.1261	106.2928	106.2928	106.1385	106.6138	107.1261	107.4882	107.8668	(39)
Average = Sum(39)m / 12 =												107.3042	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1653	1.1630	1.1609	1.1506	1.1487	1.1397	1.1397	1.1381	1.1432	1.1487	1.1526	1.1566	(40)
HLP (average)												1.1506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	409.3549	407.0363	392.0821	367.9868	343.4203	319.9353	304.8265	311.2313	323.7551	348.0732	375.9466	396.9478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
South	1.5300	46.7521	0.7200	0.7000	0.7700	24.9837	(78)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	106.4780	200.3370	314.6632	441.8102	530.6469	539.4477	515.0543	448.8975	359.7940	233.2982	131.2280	88.6052	(83)
Total gains	515.8329	607.3733	706.7453	809.7971	874.0672	859.3830	819.8808	760.1289	683.5491	581.3713	507.1747	485.5529	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5950	59.7092	59.8216	60.3549	60.4558	60.9297	60.9297	61.0183	60.7463	60.4558	60.2521	60.0406	
alpha	4.9730	4.9806	4.9881	5.0237	5.0304	5.0620	5.0620	5.0679	5.0498	5.0304	5.0168	5.0027	
util living area													
	0.9986	0.9966	0.9896	0.9627	0.8836	0.7249	0.5556	0.6162	0.8638	0.9815	0.9971	0.9990	(86)
MIT	19.6948	19.8537	20.1252	20.4776	20.7745	20.9422	20.9878	20.9799	20.8536	20.4525	20.0051	19.6652	(87)
Th 2	19.9479	19.9497	19.9514	19.9597	19.9613	19.9685	19.9685	19.9698	19.9657	19.9613	19.9581	19.9549	(88)
util rest of house													
	0.9982	0.9954	0.9858	0.9483	0.8393	0.6334	0.4330	0.4910	0.7955	0.9719	0.9958	0.9986	(89)
MIT 2	18.2040	18.4374	18.8334	19.3420	19.7379	19.9296	19.9640	19.9615	19.8452	19.3154	18.6652	18.1656	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.5896	18.8037	19.1675	19.6357	20.0060	20.1915	20.2288	20.2249	20.1060	19.6095	19.0117	18.5535	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5896	18.8037	19.1675	19.6357	20.0060	20.1915	20.2288	20.2249	20.1060	19.6095	19.0117	18.5535	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9935	0.9819	0.9426	0.8415	0.6547	0.4649	0.5235	0.8063	0.9674	0.9942	0.9979	(94)
Useful gains	514.3957	603.4438	693.9548	763.2859	735.5446	562.5959	381.1726	397.9118	551.1392	562.4274	504.2227	484.5441	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1552.8929	1508.0682	1371.4049	1151.9945	889.7911	594.3341	385.7115	405.9675	640.3221	965.1503	1280.3694	1548.2626	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	772.6419	607.9076	504.0228	279.8702	114.7594	0.0000	0.0000	0.0000	0.0000	299.6258	558.8257	791.4066	(98)
Space heating												3929.0600	(98)
Space heating per m2											(98) / (4) =	42.1302	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4229.3434	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	772.6419	607.9076	504.0228	279.8702	114.7594	0.0000	0.0000	0.0000	0.0000	299.6258	558.8257	791.4066	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	831.6921	654.3677	542.5434	301.2596	123.5301	0.0000	0.0000	0.0000	0.0000	322.5251	601.5346	851.8908	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3028	89.2485	89.1247	88.8246	88.1600	86.7000	86.7000	86.7000	86.7000	88.8466	89.1911	89.3285	(217)
Fuel for water heating, kWh/month													
	191.4500	167.9168	174.3980	153.8009	149.6190	132.6776	124.3250	140.7009	141.7982	159.6014	171.9369	185.7650	(219)
Water heating fuel used												1893.9897	(219)
Annual totals kWh/year													
Space heating fuel - main system												4229.3434	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6021.3956	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4229.3434	0.2160	913.5382	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.9897	0.2160	409.1018	(264)
Space and water heating			1322.6400	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1269.7344	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6100	ZC1
Total Floor Area	TFA	93.2600	
Assumed number of occupants	N	2.6678	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5642	ZC2
CO2 emissions from cooking, equation (L16)		1.9625	ZC3
Total CO2 emissions		31.1367	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.1367	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7095	47.1493	46.7323	43.3003	44.7437	46.7323	47.1493	50.7095	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
								Total per year (kWh/year) = Sum(64)m =				2109.4760	(64)
Heat gains from water heating, kWh/month													
	65.6556	57.7874	60.4348	53.4234	51.6339	45.2996	43.1316	48.3412	48.8833	55.9092	59.5196	63.9860	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	88.2468	85.9932	81.2296	74.1992	69.4004	62.9161	57.9726	64.9748	67.8935	75.1467	82.6662	86.0026	(72)
Total internal gains													
	422.5049	420.1888	405.1564	380.4026	355.1747	331.0296	315.9256	322.9903	336.1777	361.1543	389.1029	410.1002	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495	(76)
South	1.5300	46.7521	0.6300	0.7000	0.7700	21.8607	(78)
West	7.7900	19.6403	0.6300	0.7000	0.7700	46.7581	(80)

Solar gains	93.1683	175.2949	275.3303	386.5840	464.3160	472.0168	450.6725	392.7853	314.8197	204.1359	114.8245	77.5295	(83)
Total gains	515.6731	595.4837	680.4867	766.9866	819.4908	803.0463	766.5982	715.7756	650.9974	565.2902	503.9274	487.6298	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9986	0.9969	0.9908	0.9671	0.8944	0.7381	0.5659	0.6237	0.8691	0.9823	0.9971	0.9990	(86)
MIT	19.7616	19.9082	20.1615	20.4952	20.7796	20.9447	20.9888	20.9819	20.8630	20.4846	20.0619	19.7372	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9982	0.9958	0.9874	0.9542	0.8535	0.6499	0.4465	0.5025	0.8038	0.9733	0.9959	0.9987	(89)
MIT 2	18.3304	18.5460	18.9161	19.4009	19.7835	19.9760	20.0097	20.0079	19.8963	19.3938	18.7786	18.3009	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	18.7006	18.8983	19.2382	19.6839	20.0411	20.2265	20.2629	20.2598	20.1463	19.6759	19.1105	18.6724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7006	18.8983	19.2382	19.6839	20.0411	20.2265	20.2629	20.2598	20.1463	19.6759	19.1105	18.6724	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9839	0.9490	0.8552	0.6704	0.4776	0.5339	0.8143	0.9692	0.9944	0.9980	(94)
Useful gains	514.2789	591.9439	669.5351	727.8897	700.8213	538.3631	366.1198	382.1625	530.0902	547.8591	501.0877	486.6368	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1497.7653	1452.3665	1318.4499	1103.5469	851.7412	568.8069	370.2969	389.4690	613.6205	926.7740	1231.7587	1490.9480	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	731.7138	578.2040	482.7926	270.4732	112.2844	0.0000	0.0000	0.0000	0.0000	281.9127	526.0831	747.2075	(98)
Space heating												3730.6713	(98)
Space heating per m2											(98) / (4) =	40.0029	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3994.2948	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	731.7138	578.2040	482.7926	270.4732	112.2844	0.0000	0.0000	0.0000	0.0000	281.9127	526.0831	747.2075	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	783.4195	619.0621	516.9086	289.5859	120.2188	0.0000	0.0000	0.0000	0.0000	301.8337	563.2581	800.0081	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.1045	185.2171	194.3409	172.3706	166.8851	146.9831	140.8210	156.9824	158.7161	180.7299	191.2425	205.0829	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.9327	87.7231	87.2503	86.1808	84.0782	80.3000	80.3000	80.3000	80.3000	86.1662	87.4670	88.0159	(217)
Fuel for water heating, kWh/month													
	238.9379	211.1385	222.7394	200.0104	198.4879	183.0424	175.3686	195.4949	197.6539	209.7456	218.6454	233.0067	(219)
Water heating fuel used												2484.2716	(219)
Annual totals kWh/year													
Space heating fuel - main system												3994.2948	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Total delivered energy for all uses												6964.9184	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3994.2948	0.2160	862.7677	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2484.2716	0.2160	536.6027	(264)
Space and water heating			1399.3703	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Total CO2, kg/m2/year			1651.7871	(272)
Emissions per m2 for space and water heating			15.0050	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2892	(272b)
Emissions per m2 for pumps and fans			0.4174	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0050 * 1.00) + 2.2892 + 0.4174, rounded to 2 d.p.			17.7100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.3384	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3668	0.3596	0.3524	0.3164	0.3093	0.2733	0.2733	0.2661	0.2877	0.3093	0.3236	0.3380	(22b)
Effective ac	0.5673	0.5647	0.5621	0.5501	0.5478	0.5373	0.5373	0.5354	0.5414	0.5478	0.5524	0.5571	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1291	44.9213	44.7176	43.7609	43.5819	42.7487	42.7487	42.5943	43.0696	43.5819	43.9440	44.3226	(38)
Heat transfer coeff	108.6733	108.4655	108.2618	107.3051	107.1261	106.2928	106.2928	106.1385	106.6138	107.1261	107.4882	107.8668	(39)
Average = Sum(39)m / 12 =												107.3042	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1653	1.1630	1.1609	1.1506	1.1487	1.1397	1.1397	1.1381	1.1432	1.1487	1.1526	1.1566	(40)
HLP (average)												1.1506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
South	1.5300	46.7521	0.7200	0.7000	0.7700	24.9837	(78)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	106.4780	200.3370	314.6632	441.8102	530.6469	539.4477	515.0543	448.8975	359.7940	233.2982	131.2280	88.6052	(83)
Total gains	483.1909	575.5472	676.6138	781.9714	847.7391	835.1620	797.4488	735.4025	658.0059	553.4420	476.5531	453.7234	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5950	59.7092	59.8216	60.3549	60.4558	60.9297	60.9297	61.0183	60.7463	60.4558	60.2521	60.0406	
alpha	4.9730	4.9806	4.9881	5.0237	5.0304	5.0620	5.0620	5.0679	5.0498	5.0304	5.0168	5.0027	
util living area													
	0.9990	0.9973	0.9914	0.9673	0.8936	0.7394	0.5695	0.6334	0.8775	0.9849	0.9978	0.9993	(86)
MIT	19.6622	19.8223	20.0965	20.4543	20.7596	20.9367	20.9864	20.9773	20.8405	20.4268	19.9747	19.6333	(87)
Th 2	19.9479	19.9497	19.9514	19.9597	19.9613	19.9685	19.9685	19.9698	19.9657	19.9613	19.9581	19.9549	(88)
util rest of house													
	0.9986	0.9964	0.9882	0.9544	0.8516	0.6483	0.4447	0.5064	0.8128	0.9768	0.9969	0.9990	(89)
MIT 2	18.7247	18.8859	19.1598	19.5162	19.7970	19.9391	19.9650	19.9633	19.8744	19.4957	19.0451	18.7015	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.9672	19.1280	19.4021	19.7588	20.0460	20.1971	20.2292	20.2256	20.1243	19.7365	19.2856	18.9425	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9672	19.1280	19.4021	19.7588	20.0460	20.1971	20.2292	20.2256	20.1243	19.7365	19.2856	18.9425	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9954	0.9859	0.9512	0.8555	0.6701	0.4773	0.5396	0.8244	0.9745	0.9960	0.9987	(94)
Useful gains	482.3000	572.8858	667.1050	743.8391	725.2823	559.6814	380.6497	396.8261	542.4858	539.3247	474.6484	453.1120	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1593.9326	1543.2517	1396.7996	1165.2050	894.0698	594.9287	385.7551	406.0391	642.2696	978.7587	1309.8041	1590.2219	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	827.0546	652.0859	542.8928	303.3834	125.5779	0.0000	0.0000	0.0000	0.0000	326.9389	601.3121	846.0097	(98)
Space heating												4225.2553	(98)
Space heating per m2											(98) / (4) =	45.3062	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	999.1527	786.5670	806.6529	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8650	0.9254	0.8990	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	864.2795	727.9035	725.1641	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1077.8894	1031.7056	961.1445	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	153.7991	226.0288	175.5695	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												555.3973 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	38.4498	56.5072	43.8924	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												138.8493 (107)
Space cooling per m2												1.4888 (108)
Energy for space heating												45.3062 (99)
Energy for space cooling												1.4888 (108)
Total												46.7950 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.8 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3183	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4058	0.3978	0.3899	0.3501	0.3421	0.3024	0.3024	0.2944	0.3183	0.3421	0.3581	0.3740	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			13.4100	1.3258	17.7784			(27)
Ground floor			46.6300	0.1300	6.0619			(28a)
External Wall	99.7500	15.5300	84.2200	0.1800	15.1596			(29a)
Main Roof	46.6300		46.6300	0.1300	6.0619			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.6058			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.0733	(36)
Total fabric heat loss (33) + (36) =	57.6791	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3281	46.0737	45.8244	44.6534	44.4343	43.4143	43.4143	43.2254	43.8072	44.4343	44.8775	45.3409	(38)
Heat transfer coeff	104.0072	103.7529	103.5036	102.3325	102.1134	101.0934	101.0934	100.9046	101.4863	102.1134	102.5566	103.0200	(39)
Average = Sum(39)m / 12 =												102.3315	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1152	1.1125	1.1098	1.0973	1.0949	1.0840	1.0840	1.0820	1.0882	1.0949	1.0997	1.1047	(40)
HLP (average)												1.0973	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678	(42)
Average daily hot water use (litres/day)	97.5594	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.8184	29.5778	30.5217	26.6095	25.5325	22.0326	20.4164	23.4281	23.7080	27.6293	30.1596	32.7513	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	133.3883	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.2925	20.6882	16.8247	12.7374	9.5214	8.0383	8.6857	11.2900	15.1534	19.2408	22.4568	23.9398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.9491	247.4909	241.0856	227.4496	210.2365	194.0587	183.2509	180.7090	187.1143	200.7504	217.9634	234.1413	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	36.3388	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	45.4549	44.0146	41.0237	36.9577	34.3178	30.6008	27.4414	31.4894	32.9277	37.1362	41.8883	44.0206	(72)
Total internal gains													
	376.7129	375.2102	361.9506	340.1611	317.0922	295.7143	282.3945	286.5050	298.2119	320.1438	345.3250	365.1182	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495	(76)
South	1.5300	46.7521	0.6300	0.7000	0.7700	21.8607	(78)
West	7.7900	19.6403	0.6300	0.7000	0.7700	46.7581	(80)

Solar gains	93.1683	175.2949	275.3303	386.5840	464.3160	472.0168	450.6725	392.7853	314.8197	204.1359	114.8245	77.5295	(83)
Total gains	469.8812	550.5051	637.2809	726.7451	781.4082	767.7310	733.0670	679.2903	613.0317	524.2797	460.1496	442.6478	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2686	62.4213	62.5717	63.2877	63.4235	64.0634	64.0634	64.1833	63.8154	63.4235	63.1494	62.8653	
alpha	5.1512	5.1614	5.1714	5.2192	5.2282	5.2709	5.2709	5.2789	5.2544	5.2282	5.2100	5.1910	
util living area													
	0.9991	0.9978	0.9931	0.9734	0.9091	0.7610	0.5889	0.6514	0.8904	0.9872	0.9981	0.9994	(86)
MIT	19.7155	19.8632	20.1195	20.4603	20.7566	20.9360	20.9866	20.9779	20.8427	20.4462	20.0180	19.6918	(87)
Th 2	19.9884	19.9906	19.9928	20.0031	20.0050	20.0139	20.0139	20.0156	20.0105	20.0050	20.0011	19.9970	(88)
util rest of house													
	0.9988	0.9971	0.9905	0.9627	0.8717	0.6738	0.4661	0.5275	0.8308	0.9804	0.9973	0.9992	(89)
MIT 2	18.8104	18.9596	19.2164	19.5592	19.8352	19.9834	20.0104	20.0090	19.9183	19.5509	19.1228	18.7936	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0445	19.1933	19.4500	19.7922	20.0735	20.2297	20.2629	20.2596	20.1574	19.7825	19.3543	19.0259	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0445	19.1933	19.4500	19.7922	20.0735	20.2297	20.2629	20.2596	20.1574	19.7825	19.3543	19.0259	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9962	0.9887	0.9599	0.8747	0.6946	0.4982	0.5599	0.8413	0.9783	0.9966	0.9989	(94)
Useful gains	469.1447	548.4210	630.0577	697.5711	683.5187	533.2452	365.2132	380.3587	515.7306	512.9132	458.5923	442.1402	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1533.5334	1482.9737	1340.3715	1114.6282	855.0483	569.1307	370.2917	389.4486	614.7410	937.6513	1256.7610	1527.3657	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	791.9052	628.0194	528.4735	300.2811	127.6181	0.0000	0.0000	0.0000	0.0000	316.0052	574.6815	807.4077	(98)
Space heating												4074.3916	(98)
Space heating per m2											(98) / (4) =	43.6885	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	950.2784	748.0915	766.8747	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8608	0.9241	0.8982	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	818.0053	691.2914	688.8153	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	999.0740	956.4542	895.5589	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	130.3695	197.2811	153.8172	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												481.4677	(104)

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   32.5924   49.3203   38.4543    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        120.3669 (107)
Space cooling per m2                                                                                                   1.2907 (108)
Energy for space heating                                                                                              43.6885 (99)
Energy for space cooling                                                                                               1.2907 (108)
Total                                                                                                                 44.9792 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                  51.7 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.2800	
Infiltration rate			0.3384	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3021	0.2805	0.2877	0.2733	0.2733	0.2661	0.2589	0.2517	0.2445	0.2661	0.2517	0.2661	(22b)
Effective ac	0.5456	0.5393	0.5414	0.5373	0.5373	0.5354	0.5335	0.5317	0.5299	0.5354	0.5317	0.5354	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4070	42.9071	43.0696	42.7487	42.7487	42.5943	42.4442	42.2981	42.1561	42.5943	42.2981	42.5943	(38)
Heat transfer coeff	106.9512	106.4513	106.6138	106.2928	106.2928	106.1385	105.9883	105.8423	105.7003	106.1385	105.8423	106.1385	(39)
Average = Sum(39)m / 12 =												106.1992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1468	1.1414	1.1432	1.1397	1.1397	1.1381	1.1365	1.1349	1.1334	1.1381	1.1349	1.1381	(40)
HLP (average)												1.1387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)
Total heat required for water heating calculated for each month												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243 (64)
RHI water heating demand												1674 (64)
Heat gains from water heating, kWh/month												
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
South	1.5300	56.7559	0.7200	0.7000	0.7700	30.3295	(78)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	134.8623	216.0690	341.9601	482.4273	550.1729	607.3740	575.4236	514.2470	412.7638	271.4669	165.7063	110.2889	(83)
Total gains	743.8156	820.0492	922.0362	1025.5609	1055.4378	1078.9611	1027.5496	975.4325	895.4230	791.2914	726.7065	702.4829	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5546	60.8390	60.7463	60.9297	60.9297	61.0183	61.1047	61.1891	61.2712	61.0183	61.1891	61.0183	
alpha	5.0370	5.0559	5.0498	5.0620	5.0620	5.0679	5.0736	5.0793	5.0847	5.0679	5.0793	5.0679	
util living area													
	0.9917	0.9859	0.9645	0.8989	0.7641	0.5472	0.3999	0.4201	0.6930	0.9209	0.9818	0.9933	(86)
MIT	20.0082	20.1298	20.3917	20.6968	20.9021	20.9853	20.9975	20.9969	20.9542	20.7071	20.3203	19.9903	(87)
Th 2	19.9628	19.9671	19.9657	19.9685	19.9685	19.9698	19.9712	19.9724	19.9737	19.9698	19.9724	19.9698	(88)
util rest of house													
	0.9889	0.9813	0.9528	0.8671	0.6985	0.4545	0.2957	0.3111	0.6002	0.8875	0.9746	0.9910	(89)
MIT 2	18.6709	18.8494	19.2218	19.6383	19.8849	19.9621	19.9705	19.9716	19.9440	19.6634	19.1301	18.6503	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9767	0.9466	0.8651	0.7108	0.4782	0.3228	0.3394	0.6225	0.8861	0.9697	0.9880	(94)
Useful gains	732.9959	800.9165	872.8161	887.2447	750.2205	515.9690	331.6580	331.0837	557.3584	701.1523	704.6958	694.0732	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1509.8019	1477.6039	1335.2682	1106.7319	812.9223	522.9144	332.3918	332.0035	581.9117	905.7159	1221.2028	1485.6068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	577.9437	454.7340	344.0644	158.0308	46.6502	0.0000	0.0000	0.0000	0.0000	152.1953	371.8850	588.9009	(98)
Space heating												2694.4043	(98)
RHI space heating demand												2694	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300 (1b)	x	2.5400 (2b)	=	118.4402	(1b) - (3b)
First floor	46.6300 (1c)	x	2.6300 (2c)	=	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.3384	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3668	0.3596	0.3524	0.3164	0.3093	0.2733	0.2733	0.2661	0.2877	0.3093	0.3236	0.3380	(22b)
Effective ac	0.5673	0.5647	0.5621	0.5501	0.5478	0.5373	0.5373	0.5354	0.5414	0.5478	0.5524	0.5571	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1291	44.9213	44.7176	43.7609	43.5819	42.7487	42.7487	42.5943	43.0696	43.5819	43.9440	44.3226	(38)
Heat transfer coeff	108.6733	108.4655	108.2618	107.3051	107.1261	106.2928	106.2928	106.1385	106.6138	107.1261	107.4882	107.8668	(39)
Average = Sum(39)m / 12 =												107.3042	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1653	1.1630	1.1609	1.1506	1.1487	1.1397	1.1397	1.1381	1.1432	1.1487	1.1526	1.1566	(40)
HLP (average)												1.1506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)
Total heat required for water heating calculated for each month												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243 (64)
Heat gains from water heating, kWh/month												
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
South	1.5300	46.7521	0.7200	0.7000	0.7700	24.9837	(78)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	106.4780	200.3370	314.6632	441.8102	530.6469	539.4477	515.0543	448.8975	359.7940	233.2982	131.2280	88.6052	(83)
Total gains	715.4314	804.3172	894.7392	984.9438	1035.9118	1011.0348	967.1804	910.0830	842.4532	753.1227	692.2282	680.7992	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5950	59.7092	59.8216	60.3549	60.4558	60.9297	60.9297	61.0183	60.7463	60.4558	60.2521	60.0406	
alpha	4.9730	4.9806	4.9881	5.0237	5.0304	5.0620	5.0620	5.0679	5.0498	5.0304	5.0168	5.0027	
util living area													
	0.9941	0.9885	0.9730	0.9257	0.8175	0.6403	0.4772	0.5256	0.7735	0.9501	0.9886	0.9953	(86)
MIT	19.8917	20.0444	20.2973	20.6107	20.8495	20.9668	20.9938	20.9900	20.9153	20.5985	20.1849	19.8589	(87)
Th 2	19.9479	19.9497	19.9514	19.9597	19.9613	19.9685	19.9685	19.9698	19.9657	19.9613	19.9581	19.9549	(88)
util rest of house													
	0.9921	0.9848	0.9641	0.9012	0.7624	0.5504	0.3687	0.4135	0.6915	0.9283	0.9842	0.9938	(89)
MIT 2	18.4907	18.7133	19.0776	19.5185	19.8208	19.9475	19.9663	19.9660	19.9024	19.5132	18.9250	18.4480	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8530	19.0576	19.3930	19.8010	20.0868	20.2112	20.2321	20.2308	20.1644	19.7939	19.2508	18.8129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8530	19.0576	19.3930	19.8010	20.0868	20.2112	20.2321	20.2308	20.1644	19.7939	19.2508	18.8129	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9806	0.9580	0.8968	0.7697	0.5725	0.3969	0.4426	0.7087	0.9239	0.9801	0.9914	(94)
Useful gains	707.7818	788.7003	857.1725	883.2550	797.3490	578.7951	383.8320	402.7791	597.0632	695.7973	678.4640	674.9615	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1581.5263	1535.6066	1395.8210	1169.7324	898.4467	596.4253	386.0610	406.5987	646.5472	984.9052	1306.0710	1576.2481	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	650.0659	501.9210	400.7545	206.2638	75.2167	0.0000	0.0000	0.0000	0.0000	215.0963	451.8770	670.5572	(98)
Space heating												3171.7524	(98)
Space heating per m2										(98) / (4) =		34.0098	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3414.1576	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	650.0659	501.9210	400.7545	206.2638	75.2167	0.0000	0.0000	0.0000	0.0000	215.0963	451.8770	670.5572	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	699.7480	540.2810	431.3826	222.0277	80.9652	0.0000	0.0000	0.0000	0.0000	231.5353	486.4123	721.8054	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2143	89.1435	88.9822	88.5971	87.8354	86.7000	86.7000	86.7000	86.7000	88.6007	89.0671	89.2466	(217)
Fuel for water heating, kWh/month													
	191.6399	168.1146	174.6773	154.1958	150.1718	132.6776	124.3250	140.7009	141.7982	160.0443	172.1765	185.9356	(219)
Water heating fuel used												1896.4576	(219)
Annual totals kWh/year													
Space heating fuel - main system												3414.1576	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5208.6778	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3414.1576	3.4800	118.8127	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1896.4576	3.4800	65.9967	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			291.3639	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8851	(257)
SAP value		87.6530	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3414.1576	0.2160	737.4580	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1896.4576	0.2160	409.6349	(264)
Space and water heating			1147.0929	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1094.1873	(272)
CO2 emissions per m2			11.7300	(273)
EI value			89.3953	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8812 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8812 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							3 * 10 =		30.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1244	(8)
Pressure test			Yes	
Measured/design AP50			4.2800	
Infiltration rate			0.3384	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3021	0.2805	0.2877	0.2733	0.2733	0.2661	0.2589	0.2517	0.2445	0.2661	0.2517	0.2661	(22b)
Effective ac	0.5456	0.5393	0.5414	0.5373	0.5373	0.5354	0.5335	0.5317	0.5299	0.5354	0.5317	0.5354	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4070	42.9071	43.0696	42.7487	42.7487	42.5943	42.4442	42.2981	42.1561	42.5943	42.2981	42.5943	(38)
Heat transfer coeff	106.9512	106.4513	106.6138	106.2928	106.2928	106.1385	105.9883	105.8423	105.7003	106.1385	105.8423	106.1385	(39)
Average = Sum(39)m / 12 =												106.1992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1468	1.1414	1.1432	1.1397	1.1397	1.1381	1.1365	1.1349	1.1334	1.1381	1.1349	1.1381	(40)
HLP (average)												1.1387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
								Total per year (kWh/year) = Sum(64)m =				1673.6243	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
South	1.5300	56.7559	0.7200	0.7000	0.7700	30.3295	(78)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	134.8623	216.0690	341.9601	482.4273	550.1729	607.3740	575.4236	514.2470	412.7638	271.4669	165.7063	110.2889	(83)
Total gains	743.8156	820.0492	922.0362	1025.5609	1055.4378	1078.9611	1027.5496	975.4325	895.4230	791.2914	726.7065	702.4829	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5546	60.8390	60.7463	60.9297	60.9297	61.0183	61.1047	61.1891	61.2712	61.0183	61.1891	61.0183	
alpha	5.0370	5.0559	5.0498	5.0620	5.0620	5.0679	5.0736	5.0793	5.0847	5.0679	5.0793	5.0679	
util living area													
	0.9917	0.9859	0.9645	0.8989	0.7641	0.5472	0.3999	0.4201	0.6930	0.9209	0.9818	0.9933	(86)
MIT	20.0082	20.1298	20.3917	20.6968	20.9021	20.9853	20.9975	20.9969	20.9542	20.7071	20.3203	19.9903	(87)
Th 2	19.9628	19.9671	19.9657	19.9685	19.9685	19.9698	19.9712	19.9724	19.9737	19.9698	19.9724	19.9698	(88)
util rest of house													
	0.9889	0.9813	0.9528	0.8671	0.6985	0.4545	0.2957	0.3111	0.6002	0.8875	0.9746	0.9910	(89)
MIT 2	18.6709	18.8494	19.2218	19.6383	19.8849	19.9621	19.9705	19.9716	19.9440	19.6634	19.1301	18.6503	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9767	0.9466	0.8651	0.7108	0.4782	0.3228	0.3394	0.6225	0.8861	0.9697	0.9880	(94)
Useful gains	732.9959	800.9165	872.8161	887.2447	750.2205	515.9690	331.6580	331.0837	557.3584	701.1523	704.6958	694.0732	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1509.8019	1477.6039	1335.2682	1106.7319	812.9223	522.9144	332.3918	332.0035	581.9117	905.7159	1221.2028	1485.6068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	577.9437	454.7340	344.0644	158.0308	46.6502	0.0000	0.0000	0.0000	0.0000	152.1953	371.8850	588.9009	(98)
Space heating												2694.4043	(98)
Space heating per m2											(98) / (4) =	28.8913	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2900.3275	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	577.9437	454.7340	344.0644	158.0308	46.6502	0.0000	0.0000	0.0000	0.0000	152.1953	371.8850	588.9009	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	622.1137	489.4876	370.3599	170.1085	50.2155	0.0000	0.0000	0.0000	0.0000	163.8270	400.3068	633.9084	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1488	89.0850	88.8792	88.3874	87.5139	86.7000	86.7000	86.7000	86.7000	88.3276	88.9415	89.1764	(217)
Fuel for water heating, kWh/month													
	191.7807	168.2250	174.8797	154.5617	150.7236	132.6776	124.3250	140.7009	141.7982	160.5392	172.4194	186.0818	(219)
Water heating fuel used												1898.7128	(219)
Annual totals kWh/year													
Space heating fuel - main system												2900.3275	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4617.2931	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2900.3275	7.3800	214.0442	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1898.7128	7.3800	140.1250	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			409.0804	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2900.3275	0.2160	626.4707	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.7128	0.2160	410.1220	(264)
Space and water heating			1036.5927	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			942.2659	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2900.3275	1.2200	3538.3996	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1898.7128	1.2200	2316.4297	(264)
Space and water heating			5854.8292	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			5296.8652	(272)
Primary energy kWh/m2/year			56.7968	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 60	-192 kg (20.3%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	2.05 kg/m²	B 89	B 91
Total Savings	£60	2.05 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£139	£154	-£14
Mains gas	£461	£387	£74
Space heating	£343	£343	£0
Water heating	£140	£80	£60
Lighting	£118	£118	£0
Generated (PV)	-£191	-£191	£0
Total cost of fuels	£409	£350	£60
Total cost of uses	£410	£350	£60
Delivered energy	50 kWh/m²	39 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	45 kWh/m²	12 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.3384	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3668	0.3596	0.3524	0.3164	0.3093	0.2733	0.2733	0.2661	0.2877	0.3093	0.3236	0.3380	(22b)
Effective ac	0.5673	0.5647	0.5621	0.5501	0.5478	0.5373	0.5373	0.5354	0.5414	0.5478	0.5524	0.5571	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss (33) + (36) =	63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.1291	44.9213	44.7176	43.7609	43.5819	42.7487	42.7487	42.5943	43.0696	43.5819	43.9440	44.3226	(38)
Heat transfer coeff	108.6733	108.4655	108.2618	107.3051	107.1261	106.2928	106.2928	106.1385	106.6138	107.1261	107.4882	107.8668	(39)
Average = Sum(39)m / 12 =												107.3042	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1653	1.1630	1.1609	1.1506	1.1487	1.1397	1.1397	1.1381	1.1432	1.1487	1.1526	1.1566	(40)
HLP (average)												1.1506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171 (61)
Total heat required for water heating calculated for each month												
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1815 (H8)
Utilisation factor												0.5710 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.5594 (H14)
Volume ratio Veff/V												0.7688 (H15)
Solar storage volume factor												0.9474 (H16)
Solar input												-862.7264 (H17)
Solar input	-25.0173	-41.7468	-71.0995	-95.2874	-117.7195	-115.7370	-114.2075	-99.7837	-78.1506	-53.3677	-29.6742	-20.9352 (63)
								Solar input (sum of months) = Sum(63)m =				-862.7264 (63)
Output from w/h												
	145.9529	108.1165	84.3322	41.3257	14.1845	0.0000	0.0000	22.2040	44.7884	88.4327	123.6783	145.0059 (64)
								Total per year (kWh/year) = Sum(64)m =				818.0212 (64)
Heat gains from water heating, kWh/month												
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	19.6403	0.7200	0.7000	0.7700	28.0566	(76)
South	1.5300	46.7521	0.7200	0.7000	0.7700	24.9837	(78)
West	7.7900	19.6403	0.7200	0.7000	0.7700	53.4378	(80)

Solar gains	106.4780	200.3370	314.6632	441.8102	530.6469	539.4477	515.0543	448.8975	359.7940	233.2982	131.2280	88.6052	(83)
Total gains	715.4314	804.3172	894.7392	984.9438	1035.9118	1011.0348	967.1804	910.0830	842.4532	753.1227	692.2282	680.7992	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5950	59.7092	59.8216	60.3549	60.4558	60.9297	60.9297	61.0183	60.7463	60.4558	60.2521	60.0406	
alpha	4.9730	4.9806	4.9881	5.0237	5.0304	5.0620	5.0620	5.0679	5.0498	5.0304	5.0168	5.0027	
util living area													
	0.9941	0.9885	0.9730	0.9257	0.8175	0.6403	0.4772	0.5256	0.7735	0.9501	0.9886	0.9953	(86)
MIT	19.8917	20.0444	20.2973	20.6107	20.8495	20.9668	20.9938	20.9900	20.9153	20.5985	20.1849	19.8589	(87)
Th 2	19.9479	19.9497	19.9514	19.9597	19.9613	19.9685	19.9685	19.9698	19.9657	19.9613	19.9581	19.9549	(88)
util rest of house													
	0.9921	0.9848	0.9641	0.9012	0.7624	0.5504	0.3687	0.4135	0.6915	0.9283	0.9842	0.9938	(89)
MIT 2	18.4907	18.7133	19.0776	19.5185	19.8208	19.9475	19.9663	19.9660	19.9024	19.5132	18.9250	18.4480	(90)
Living area fraction									fLA = Living area / (4) =			0.2586	(91)
MIT	18.8530	19.0576	19.3930	19.8010	20.0868	20.2112	20.2321	20.2308	20.1644	19.7939	19.2508	18.8129	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8530	19.0576	19.3930	19.8010	20.0868	20.2112	20.2321	20.2308	20.1644	19.7939	19.2508	18.8129	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9806	0.9580	0.8968	0.7697	0.5725	0.3969	0.4426	0.7087	0.9239	0.9801	0.9914	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	707.7818	788.7003	857.1725	883.2550	797.3490	578.7951	383.8320	402.7791	597.0632	695.7973	678.4640	674.9615	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1581.5263	1535.6066	1395.8210	1169.7324	898.4467	596.4253	386.0610	406.5987	646.5472	984.9052	1306.0710	1576.2481	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	650.0659	501.9210	400.7545	206.2638	75.2167	0.0000	0.0000	0.0000	0.0000	215.0963	451.8770	670.5572	(98)
Space heating												3171.7524	(98)
Space heating per m2											(98) / (4) =	34.0098	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3414.1576	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	650.0659	501.9210	400.7545	206.2638	75.2167	0.0000	0.0000	0.0000	0.0000	215.0963	451.8770	670.5572	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	699.7480	540.2810	431.3826	222.0277	80.9652	0.0000	0.0000	0.0000	0.0000	231.5353	486.4123	721.8054	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.9529	108.1165	84.3322	41.3257	14.1845	0.0000	0.0000	22.2040	44.7884	88.4327	123.6783	145.0059	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2957	89.3158	89.3268	89.3496	89.3766	86.7000	86.7000	86.7000	86.7000	88.9436	89.1926	89.3139	(217)
Fuel for water heating, kWh/month	163.4490	121.0497	94.4086	46.2517	15.8705	0.0000	0.0000	25.6102	51.6591	99.4257	138.6644	162.3553	(219)
Water heating fuel used												918.7441	(219)
Annual totals kWh/year													
Space heating fuel - main system												3414.1576	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												411.3521	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4280.9643	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3414.1576	3.4800	118.8127	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	918.7441	3.4800	31.9723	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	411.3521	13.1900	54.2573	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			263.9344	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8018	(257)
SAP value		88.8153	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3414.1576	0.2160	737.4580	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	918.7441	0.2160	198.4487	(264)
Space and water heating			935.9068	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	411.3521	0.5190	213.4917 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			908.9512 (272)
CO2 emissions per m2			9.7500 (273)
EI value			91.1905
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.6300	(1b)	x 2.5400	(2b) =	118.4402	(1b) - (3b)
First floor	46.6300	(1c)	x 2.6300	(2c) =	122.6369	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		241.0771	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1244	(8)
Pressure test		Yes	
Measured/design AP50		4.2800	
Infiltration rate		0.3384	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2877	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3021	0.2805	0.2877	0.2733	0.2733	0.2661	0.2589	0.2517	0.2445	0.2661	0.2517	0.2661	(22b)
Effective ac	0.5456	0.5393	0.5414	0.5373	0.5373	0.5354	0.5335	0.5317	0.5299	0.5354	0.5317	0.5354	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.4100	1.2357	16.5713			(27)
Opening Type 10			2.1200	1.5000	3.1800			(26a)
Ground floor			46.6300	0.1800	8.3934			(28a)
External Wall	99.7500	15.5300	84.2200	0.2700	22.7394			(29a)
Main Roof	46.6300		46.6300	0.1600	7.4608			(30)
Total net area of external elements Aum(A, m2)			193.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.3449			(33)
Party Wall			47.6900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.1993	(36)
Total fabric heat loss	(33) + (36) = 63.5442	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4070	42.9071	43.0696	42.7487	42.7487	42.5943	42.4442	42.2981	42.1561	42.5943	42.2981	42.5943	(38)
Heat transfer coeff	106.9512	106.4513	106.6138	106.2928	106.2928	106.1385	105.9883	105.8423	105.7003	106.1385	105.8423	106.1385	(39)
Average = Sum(39)m / 12 =												106.1992	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1468	1.1414	1.1432	1.1397	1.1397	1.1381	1.1365	1.1349	1.1334	1.1381	1.1349	1.1381	(40)
HLP (average)												1.1387	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6678 (42)
Average daily hot water use (litres/day)	97.5594 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.3154	103.4130	99.5106	95.6082	91.7059	87.8035	87.8035	91.7059	95.6082	99.5106	103.4130	107.3154	(44)
Energy conte	159.1456	139.1897	143.6313	125.2213	120.1528	103.6827	96.0773	110.2501	111.5668	130.0204	141.9274	154.1240	(45)
Energy content (annual)										Total = Sum(45)m =		1534.9896	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8718	20.8785	21.5447	18.7832	18.0229	15.5524	14.4116	16.5375	16.7350	19.5031	21.2891	23.1186	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8247	10.6735	11.8003	11.3918	11.7512	11.3488	11.7125	11.7376	11.3722	11.7800	11.4251	11.8171	(61)
Total heat required for water heating calculated for each month													
	170.9702	149.8632	155.4317	136.6131	131.9040	115.0315	107.7898	121.9877	122.9390	141.8004	153.3525	165.9411	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.3223	(H8)
Utilisation factor												0.5306	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.5594	(H14)
Volume ratio Veff/V												0.7688	(H15)
Solar storage volume factor												0.9474	(H16)
Solar input												-897.1283	(H17)
Solar input	-29.2665	-41.6151	-71.5263	-96.5056	-113.3516	-121.0774	-118.5312	-106.0890	-83.0604	-57.4251	-34.6146	-24.0656	(63)
								Solar input (sum of months) = Sum(63)m =				-897.1283	(63)
Output from w/h													
	141.7037	108.2482	83.9053	40.1075	18.5524	0.0000	0.0000	15.8987	39.8787	84.3753	118.7380	141.8755	(64)
								Total per year (kWh/year) = Sum(64)m =				793.2834	(64)
Heat gains from water heating, kWh/month													
	55.8721	48.9490	50.7075	44.4840	42.8886	37.3117	34.8738	39.5926	39.9390	46.1768	50.0471	54.2005	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	160.0659	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.2311	51.7204	42.0618	31.8435	23.8034	20.0958	21.7143	28.2250	37.8836	48.1019	56.1420	59.8496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	365.5957	369.3894	359.8293	339.4770	313.7858	289.6398	273.5087	269.7150	279.2751	299.6274	325.3186	349.4646	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	53.6744	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	-106.7106	(71)
Water heating gains (Table 5)													
	75.0969	72.8407	68.1552	61.7834	57.6460	51.8218	46.8734	53.2158	55.4709	62.0656	69.5099	72.8501	(72)
Total internal gains													
	608.9533	603.9802	580.0761	543.1335	505.2649	471.5871	452.1261	461.1855	482.6592	519.8245	561.0001	592.1940	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.0900	25.1925	0.7200	0.7000	0.7700	35.9881	(76)
South	1.5300	56.7559	0.7200	0.7000	0.7700	30.3295	(78)
West	7.7900	25.1925	0.7200	0.7000	0.7700	68.5446	(80)

Solar gains	134.8623	216.0690	341.9601	482.4273	550.1729	607.3740	575.4236	514.2470	412.7638	271.4669	165.7063	110.2889	(83)
Total gains	743.8156	820.0492	922.0362	1025.5609	1055.4378	1078.9611	1027.5496	975.4325	895.4230	791.2914	726.7065	702.4829	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5546	60.8390	60.7463	60.9297	60.9297	61.0183	61.1047	61.1891	61.2712	61.0183	61.1891	61.0183	
alpha	5.0370	5.0559	5.0498	5.0620	5.0620	5.0679	5.0736	5.0793	5.0847	5.0679	5.0793	5.0679	
util living area													
	0.9917	0.9859	0.9645	0.8989	0.7641	0.5472	0.3999	0.4201	0.6930	0.9209	0.9818	0.9933	(86)
MIT	20.0082	20.1298	20.3917	20.6968	20.9021	20.9853	20.9975	20.9969	20.9542	20.7071	20.3203	19.9903	(87)
Th 2	19.9628	19.9671	19.9657	19.9685	19.9685	19.9698	19.9712	19.9724	19.9737	19.9698	19.9724	19.9698	(88)
util rest of house													
	0.9889	0.9813	0.9528	0.8671	0.6985	0.4545	0.2957	0.3111	0.6002	0.8875	0.9746	0.9910	(89)
MIT 2	18.6709	18.8494	19.2218	19.6383	19.8849	19.9621	19.9705	19.9716	19.9440	19.6634	19.1301	18.6503	(90)
Living area fraction										fLA = Living area / (4) =		0.2586	(91)
MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0167	19.1806	19.5243	19.9121	20.1479	20.2267	20.2361	20.2368	20.2053	19.9333	19.4380	18.9969	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9767	0.9466	0.8651	0.7108	0.4782	0.3228	0.3394	0.6225	0.8861	0.9697	0.9880	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	732.9959	800.9165	872.8161	887.2447	750.2205	515.9690	331.6580	331.0837	557.3584	701.1523	704.6958	694.0732	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1509.8019	1477.6039	1335.2682	1106.7319	812.9223	522.9144	332.3918	332.0035	581.9117	905.7159	1221.2028	1485.6068	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	577.9437	454.7340	344.0644	158.0308	46.6502	0.0000	0.0000	0.0000	0.0000	152.1953	371.8850	588.9009	(98)
Space heating												2694.4043	(98)
Space heating per m2											(98) / (4) =	28.8913	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2900.3275	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	577.9437	454.7340	344.0644	158.0308	46.6502	0.0000	0.0000	0.0000	0.0000	152.1953	371.8850	588.9009	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	622.1137	489.4876	370.3599	170.1085	50.2155	0.0000	0.0000	0.0000	0.0000	163.8270	400.3068	633.9084	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.7037	108.2482	83.9053	40.1075	18.5524	0.0000	0.0000	15.8987	39.8787	84.3753	118.7380	141.8755	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2514	89.2665	89.2541	89.2333	88.9657	86.7000	86.7000	86.7000	86.7000	88.7319	89.1041	89.2604	(217)
Fuel for water heating, kWh/month	158.7693	121.2640	94.0072	44.9467	20.8534	0.0000	0.0000	18.3376	45.9962	95.0901	133.2576	158.9457	(219)
Water heating fuel used												891.4679	(219)

Annual totals kWh/year		
Space heating fuel - main system	2900.3275	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	411.3521	(232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =	-668.0993		-668.0993 (233)
Total delivered energy for all uses			3660.0482 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2900.3275	7.3800	214.0442	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	891.4679	7.3800	65.7903	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	411.3521	28.6600	117.8935	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	28.6600	-191.4773	(252)
Total energy cost			349.0757	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2900.3275	0.2160	626.4707	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	891.4679	0.2160	192.5571	(264)
Space and water heating			819.0278	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	411.3521	0.5190	213.4917	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			750.6510	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2900.3275	1.2200	3538.3996	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	891.4679	1.2200	1087.5909	(264)
Space and water heating			4625.9905	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	411.3521	3.0700	1262.8508	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4221.5264	(272)
Primary energy kWh/m2/year			45.2662	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	636.44	(P1)
Transmission heat loss coefficient	63.54	(37)
Summer heat loss coefficient	699.99	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.0900	125.2818	0.7200	0.7000	0.7650	177.8057
South	1.5300	118.5567	0.7200	0.7000	0.7650	62.9436
West	7.7900	125.2818	0.7200	0.7000	0.7650	338.6569
total:						579.4062

	Jun	Jul	Aug	
Solar gains	622	579	516	(P3)
Internal gains	469	449	458	
Total summer gains	1090	1029	974	(P5)
Summer gain/loss ratio	1.56	1.47	1.39	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.21	19.02	18.94	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 435 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	4 Blackcap Walk, Boorley Green, Southampton, SO32 2DZ		

SAP Rating	88 B	**DER**	13.61	**TER**	17.71
Environmental	89 B	**% DER<TER**	23.16		
CO_2 Emissions (t/year)	0.91	**DFEE**	46.80	**TFEE**	51.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.53		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.71	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.61	$kgCO_2/m^2$	Pass
	-4.10 (-23.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.80	$kWh/m^2/yr$	
	-4.9 (-9.5%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	4.09 m², No overhang 1.53 m², No overhang 7.79 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.28 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Property Reference	Plot 436 - BG2	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	43 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.61	**TER**	16.80
Environmental	88 B	**% DER<TER**	19.00		
CO_2 Emissions (t/year)	1.27	**DFEE**	52.08	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

Regs Region: England
Elmhurst Energy Systems SAP2012 Calculator (Design System) version 4.14r19

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.80 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.61 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 10.75 m², No overhang
Windows facing South: 4.26 m², No overhang
Windows facing West: 7.62 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4040	0.3961	0.3882	0.3486	0.3407	0.3011	0.3011	0.2931	0.3169	0.3407	0.3565	0.3724	(22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.0539	63.7049	63.3627	61.7556	61.4549	60.0551	60.0551	59.7959	60.5943	61.4549	62.0632	62.6991	(38)
Heat transfer coeff	165.2894	164.9403	164.5982	162.9910	162.6904	161.2906	161.2906	161.0314	161.8298	162.6904	163.2987	163.9346	(39)
Average = Sum(39)m / 12 =												162.9896	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2803	1.2776	1.2750	1.2625	1.2602	1.2493	1.2493	1.2473	1.2535	1.2602	1.2649	1.2698	(40)
HLP (average)												1.2625	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	472.1445	469.8098	452.6118	424.6201	395.6659	368.2038	350.6500	357.2951	371.9298	400.1567	432.5989	457.4405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	19.6403	0.7200	0.7000	0.7700	73.7428	(76)
South	4.2600	46.7521	0.7200	0.7000	0.7700	69.5623	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)

Solar gains	195.5768	360.4361	551.0889	756.0983	896.5337	907.2822	867.8850	763.5246	623.7535	415.3850	239.5803	163.7364	(83)
Total gains	667.7212	830.2459	1003.7007	1180.7185	1292.1995	1275.4860	1218.5350	1120.8198	995.6833	815.5417	672.1791	621.1769	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2399	54.3547	54.4677	55.0047	55.1064	55.5846	55.5846	55.6741	55.3994	55.1064	54.9011	54.6881	
alpha	4.6160	4.6236	4.6312	4.6670	4.6738	4.7056	4.7056	4.7116	4.6933	4.6738	4.6601	4.6459	
util living area													
	0.9989	0.9968	0.9894	0.9613	0.8820	0.7280	0.5624	0.6258	0.8681	0.9826	0.9976	0.9992	(86)
MIT	19.5125	19.7004	20.0088	20.4032	20.7337	20.9259	20.9826	20.9718	20.8199	20.3649	19.8604	19.4812	(87)
Th 2	19.8563	19.8584	19.8605	19.8703	19.8722	19.8807	19.8807	19.8823	19.8774	19.8722	19.8684	19.8645	(88)
util rest of house													
	0.9985	0.9957	0.9854	0.9459	0.8353	0.6309	0.4294	0.4906	0.7975	0.9733	0.9965	0.9990	(89)
MIT 2	17.8741	18.1501	18.5999	19.1695	19.6108	19.8315	19.8745	19.8709	19.7300	19.1256	18.3914	17.8339	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.1820	18.4414	18.8647	19.4013	19.8218	20.0372	20.0827	20.0778	19.9348	19.3585	18.6675	18.1435	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1820	18.4414	18.8647	19.4013	19.8218	20.0372	20.0827	20.0778	19.9348	19.3585	18.6675	18.1435	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9935	0.9804	0.9376	0.8328	0.6458	0.4544	0.5157	0.8018	0.9671	0.9948	0.9983	(94)
Useful gains	666.1326	824.8526	984.0732	1106.9917	1076.1556	823.6690	553.7153	578.0352	798.3433	788.7130	668.6588	620.1127	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2294.5400	2233.5287	2035.2034	1711.6201	1321.3441	876.9645	561.7290	592.2347	944.2478	1424.9157	1888.9553	2285.8154	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1211.5351	946.6304	782.0408	435.3325	182.4203	0.0000	0.0000	0.0000	0.0000	473.3348	878.6134	1239.2828	(98)
Space heating												6149.1901	(98)
Space heating per m2											(98) / (4) =	47.6312	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6619.1497	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1211.5351	946.6304	782.0408	435.3325	182.4203	0.0000	0.0000	0.0000	0.0000	473.3348	878.6134	1239.2828	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1304.1282	1018.9778	841.8093	468.6033	196.3620	0.0000	0.0000	0.0000	0.0000	509.5100	945.7626	1333.9965	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4735	89.4292	89.3304	89.0849	88.4905	86.7000	86.7000	86.7000	86.7000	89.1128	89.3887	89.4925	(217)
Fuel for water heating, kWh/month													
	200.8358	176.1100	182.8120	161.0666	156.5136	139.2414	130.4073	147.6813	148.8611	167.1243	180.2611	194.8658	(219)
Water heating fuel used												1985.7805	(219)
Annual totals kWh/year													
Space heating fuel - main system												6619.1497	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												8408.3558	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6619.1497	0.2160	1429.7363	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.7805	0.2160	428.9286	(264)
Space and water heating			1858.6649	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1756.6428	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.6100	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		28.6852	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6852	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3699	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3144	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4008	0.3930	0.3851	0.3458	0.3380	0.2987	0.2987	0.2908	0.3144	0.3380	0.3537	0.3694	(22b)
Effective ac	0.5803	0.5772	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5625	0.5682	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			22.6300	1.3258	30.0019			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	167.8800	26.8700	141.0100	0.1800	25.3818			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.2547			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.9445	(36)
Total fabric heat loss (33) + (36) =	90.1992	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9115	63.5680	63.2312	61.6496	61.3536	59.9761	59.9761	59.7209	60.5067	61.3536	61.9523	62.5782	(38)
Heat transfer coeff	154.1107	153.7672	153.4304	151.8488	151.5529	150.1753	150.1753	149.9202	150.7059	151.5529	152.1515	152.7774	(39)
Average = Sum(39)m / 12 =												151.8474	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1937	1.1911	1.1885	1.1762	1.1739	1.1632	1.1632	1.1613	1.1674	1.1739	1.1786	1.1834	(40)
HLP (average)												1.1762	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	485.2900	482.9580	465.7656	437.7815	408.2736	380.1158	362.5674	369.9079	385.0987	413.3178	445.7511	470.5887	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	19.6403	0.6300	0.7000	0.7700	64.5249	(76)
South	4.2600	46.7521	0.6300	0.7000	0.7700	60.8670	(78)
West	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(80)

Solar gains	171.1297	315.3816	482.2028	661.5861	784.4670	793.8719	759.3994	668.0841	545.7843	363.4619	209.6327	143.2693	(83)
Total gains	656.4197	798.3396	947.9684	1099.3676	1192.7405	1173.9877	1121.9668	1037.9920	930.8830	776.7797	655.3838	613.8581	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1743	58.3042	58.4322	59.0408	59.1561	59.6988	59.6988	59.8003	59.4886	59.1561	58.9234	58.6820	
alpha	4.8783	4.8869	4.8955	4.9361	4.9437	4.9799	4.9799	4.9867	4.9659	4.9437	4.9282	4.9121	
util living area													
	0.9991	0.9973	0.9911	0.9666	0.8930	0.7401	0.5708	0.6326	0.8749	0.9844	0.9979	0.9993	(86)
MIT	19.6158	19.7873	20.0716	20.4391	20.7506	20.9331	20.9853	20.9761	20.8365	20.4122	19.9427	19.5877	(87)
Th 2	19.9250	19.9272	19.9292	19.9391	19.9409	19.9495	19.9495	19.9511	19.9462	19.9409	19.9372	19.9333	(88)
util rest of house													
	0.9987	0.9964	0.9878	0.9533	0.8503	0.6479	0.4437	0.5038	0.8087	0.9761	0.9969	0.9991	(89)
MIT 2	18.0726	18.3247	18.7399	19.2729	19.6919	19.9041	19.9440	19.9410	19.8100	19.2435	18.5594	18.0372	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.3626	18.5995	18.9902	19.4920	19.8908	20.0974	20.1397	20.1355	20.0029	19.4631	18.8194	18.3286	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3626	18.5995	18.9902	19.4920	19.8908	20.0974	20.1397	20.1355	20.0029	19.4631	18.8194	18.3286	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9946	0.9836	0.9460	0.8479	0.6621	0.4677	0.5278	0.8130	0.9707	0.9954	0.9985	(94)
Useful gains	655.0694	793.9999	932.4518	1039.9727	1011.3488	777.2561	524.7181	547.8431	756.7627	754.0543	652.3884	612.9449	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2167.1999	2106.5371	1916.3709	1608.3832	1241.3447	825.5764	531.5758	560.0334	889.5975	1343.2305	1783.1195	2158.5250	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1125.0251	882.0250	732.0358	409.2556	171.1170	0.0000	0.0000	0.0000	0.0000	438.3470	814.1263	1149.9116	(98)
Space heating												5721.8434	(98)
Space heating per m2											(98) / (4) =	44.3210	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6126.1706	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1125.0251	882.0250	732.0358	409.2556	171.1170	0.0000	0.0000	0.0000	0.0000	438.3470	814.1263	1149.9116	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1204.5236	944.3523	783.7642	438.1751	183.2087	0.0000	0.0000	0.0000	0.0000	469.3223	871.6556	1231.1687	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5857	88.4051	88.0020	87.0380	84.9802	80.3000	80.3000	80.3000	80.3000	87.1102	88.2204	88.6537	(217)
Fuel for water heating, kWh/month													
	247.0103	218.1279	230.0544	208.4042	207.1309	193.0620	184.9681	206.1960	207.9563	215.9294	225.5845	240.8465	(219)
Water heating fuel used												2585.2704	(219)
Annual totals kWh/year													
Space heating fuel - main system												6126.1706	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Total delivered energy for all uses												9265.5330	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6126.1706	0.2160	1323.2529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.2704	0.2160	558.4184	(264)
Space and water heating			1881.6713	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Total CO2, kg/m2/year			2169.2450	(272)
Emissions per m2 for space and water heating			14.5753	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9260	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5753 * 1.00) + 1.9260 + 0.3015, rounded to 2 d.p.			16.8000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3429	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2914	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3716	0.3643	0.3570	0.3206	0.3133	0.2769	0.2769	0.2696	0.2914	0.3133	0.3279	0.3424	(22b)
Effective ac	0.5690	0.5664	0.5637	0.5514	0.5491	0.5383	0.5383	0.5363	0.5425	0.5491	0.5537	0.5586	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.6670	62.3718	62.0824	60.7232	60.4689	59.2851	59.2851	59.0659	59.7411	60.4689	60.9834	61.5212	(38)
Heat transfer coeff	163.9025	163.6072	163.3179	161.9587	161.7044	160.5206	160.5206	160.3014	160.9766	161.7044	162.2188	162.7567	(39)
Average = Sum(39)m / 12 =												161.9575	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2696	1.2673	1.2650	1.2545	1.2526	1.2434	1.2434	1.2417	1.2469	1.2526	1.2565	1.2607	(40)
HLP (average)												1.2545	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6696	31.1969	32.1924	28.0661	26.9301	23.2386	21.5340	24.7106	25.0057	29.1417	31.8105	34.5441	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	47.9430	46.4239	43.2693	38.9807	36.1964	32.2759	28.9435	33.2131	34.7301	39.1690	44.1812	46.4303	(72)
Total internal gains													
	438.0930	436.6189	421.2079	395.6456	368.2707	343.0316	327.3650	331.5897	345.3631	371.0755	400.6784	424.2460	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	19.6403	0.7200	0.7000	0.7700	73.7428	(76)
South	4.2600	46.7521	0.7200	0.7000	0.7700	69.5623	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)

Solar gains	195.5768	360.4361	551.0889	756.0983	896.5337	907.2822	867.8850	763.5246	623.7535	415.3850	239.5803	163.7364	(83)
Total gains	633.6698	797.0550	972.2968	1151.7440	1264.8043	1250.3137	1195.2500	1095.1143	969.1166	786.4605	640.2586	587.9824	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6989	54.7976	54.8947	55.3553	55.4424	55.8513	55.8513	55.9276	55.6931	55.4424	55.2666	55.0839	
alpha	4.6466	4.6532	4.6596	4.6904	4.6962	4.7234	4.7234	4.7285	4.7129	4.6962	4.6844	4.6723	
util living area													
	0.9991	0.9973	0.9906	0.9642	0.8875	0.7358	0.5697	0.6355	0.8761	0.9848	0.9980	0.9994	(86)
MIT	19.5020	19.6901	19.9989	20.3938	20.7277	20.9232	20.9819	20.9704	20.8129	20.3521	19.8469	19.4692	(87)
Th 2	19.8647	19.8665	19.8683	19.8766	19.8782	19.8855	19.8855	19.8868	19.8827	19.8782	19.8750	19.8717	(88)
util rest of house													
	0.9988	0.9964	0.9871	0.9498	0.8423	0.6394	0.4360	0.4998	0.8079	0.9765	0.9972	0.9992	(89)
MIT 2	18.4991	18.6881	18.9965	19.3884	19.6946	19.8504	19.8810	19.8785	19.7769	19.3552	18.8518	18.4718	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.6875	18.8764	19.1849	19.5774	19.8887	20.0520	20.0879	20.0837	19.9716	19.5425	19.0388	18.6593	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6875	18.8764	19.1849	19.5774	19.8887	20.0520	20.0879	20.0837	19.9716	19.5425	19.0388	18.6593	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9952	0.9841	0.9449	0.8428	0.6552	0.4614	0.5254	0.8145	0.9730	0.9962	0.9988	(94)
Useful gains	632.6362	793.1942	956.8840	1088.2927	1065.9734	819.2028	551.4872	575.3905	789.3358	765.2601	637.8542	587.3056	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2358.1543	2286.6424	2071.6647	1729.2909	1324.1527	875.1590	559.8743	590.4964	945.1941	1446.0474	1936.6948	2353.3400	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1283.7855	1003.5972	829.3968	461.5187	192.0855	0.0000	0.0000	0.0000	0.0000	506.5058	935.1652	1313.9296	(98)
Space heating												6525.9843	(98)
Space heating per m2											(98) / (4) =	50.5498	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1508.8937	1187.8525	1218.2905	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8437	0.9086	0.8771	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1273.0855	1079.2410	1068.5350	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1579.9942	1512.9635	1398.2422	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	220.9743	322.6896	245.3022	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												788.9660	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	55.2436	80.6724	61.3255	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												197.2415 (107)
Space cooling per m2												1.5278 (108)
Energy for space heating												50.5498 (99)
Energy for space cooling												1.5278 (108)
Total												52.0777 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3699 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3144 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4008	0.3930	0.3851	0.3458	0.3380	0.2987	0.2987	0.2908	0.3144	0.3380	0.3537	0.3694	(22b)
Effective ac	0.5803	0.5772	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5625	0.5682	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			22.6300	1.3258	30.0019			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	167.8800	26.8700	141.0100	0.1800	25.3818			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.2547			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.9445 (36)
Total fabric heat loss	(33) + (36) =	90.1992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9115	63.5680	63.2312	61.6496	61.3536	59.9761	59.9761	59.7209	60.5067	61.3536	61.9523	62.5782	(38)
Heat transfer coeff	154.1107	153.7672	153.4304	151.8488	151.5529	150.1753	150.1753	149.9202	150.7059	151.5529	152.1515	152.7774	(39)
Average = Sum(39)m / 12 =												151.8474	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1937	1.1911	1.1885	1.1762	1.1739	1.1632	1.1632	1.1613	1.1674	1.1739	1.1786	1.1834	(40)
HLP (average)												1.1762	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6696	31.1969	32.1924	28.0661	26.9301	23.2386	21.5340	24.7106	25.0057	29.1417	31.8105	34.5441	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	47.9430	46.4239	43.2693	38.9807	36.1964	32.2759	28.9435	33.2131	34.7301	39.1690	44.1812	46.4303	(72)
Total internal gains													
	438.0930	436.6189	421.2079	395.6456	368.2707	343.0316	327.3650	331.5897	345.3631	371.0755	400.6784	424.2460	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	19.6403	0.6300	0.7000	0.7700	64.5249	(76)
South	4.2600	46.7521	0.6300	0.7000	0.7700	60.8670	(78)
West	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	171.1297	315.3816	482.2028	661.5861	784.4670	793.8719	759.3994	668.0841	545.7843	363.4619	209.6327	143.2693	(83)
Total gains	609.2227	752.0005	903.4106	1057.2317	1152.7376	1136.9035	1086.7644	999.6737	891.1474	734.5374	610.3111	567.5154	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1743	58.3042	58.4322	59.0408	59.1561	59.6988	59.6988	59.8003	59.4886	59.1561	58.9234	58.6820	
alpha	4.8783	4.8869	4.8955	4.9361	4.9437	4.9799	4.9799	4.9867	4.9659	4.9437	4.9282	4.9121	
util living area													
	0.9993	0.9979	0.9928	0.9712	0.9033	0.7560	0.5869	0.6522	0.8896	0.9876	0.9984	0.9995	(86)
MIT	19.5819	19.7543	20.0407	20.4131	20.7334	20.9263	20.9834	20.9727	20.8208	20.3838	19.9104	19.5543	(87)
Th 2	19.9250	19.9272	19.9292	19.9391	19.9409	19.9495	19.9495	19.9511	19.9462	19.9409	19.9372	19.9333	(88)
util rest of house													
	0.9991	0.9972	0.9900	0.9594	0.8633	0.6646	0.4574	0.5215	0.8276	0.9808	0.9978	0.9994	(89)
MIT 2	18.6264	18.8002	19.0869	19.4598	19.7571	19.9148	19.9452	19.9431	19.8421	19.4374	18.9644	18.6054	(90)
Living area fraction									fLA = Living area / (4) =			0.1879	(91)
MIT	18.8060	18.9795	19.2661	19.6390	19.9405	20.1049	20.1403	20.1366	20.0260	19.6152	19.1421	18.7837	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8060	18.9795	19.2661	19.6390	19.9405	20.1049	20.1403	20.1366	20.0260	19.6152	19.1421	18.7837	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9963	0.9877	0.9552	0.8632	0.6795	0.4820	0.5462	0.8333	0.9779	0.9970	0.9991	(94)
Useful gains	608.4419	749.1981	892.2792	1009.8276	995.0858	772.4829	523.8398	546.0343	742.5789	718.3365	608.5024	567.0038	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2235.5265	2164.9584	1958.7101	1630.6974	1248.8758	826.6982	531.6691	560.1896	893.0863	1366.2857	1832.2298	2228.0560	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1210.5509	951.3909	793.4246	447.0263	188.8198	0.0000	0.0000	0.0000	0.0000	482.0742	881.0838	1235.8228	(98)
Space heating												6190.1932	(98)
Space heating per m2											(98) / (4) =	47.9488	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1411.6475	1111.2970	1139.3932	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8430	0.9100	0.8792	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1190.0511	1011.3286	1001.8110	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1447.4367	1386.1622	1286.6883	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	185.3177	278.8762	211.9487	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												676.1425	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   46.3294   69.7190   52.9872    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        169.0356 (107)
Space cooling per m2                                                                                                   1.3093 (108)
Energy for space heating                                                                                              47.9488 (99)
Energy for space cooling                                                                                               1.3093 (108)
Total                                                                                                                 49.2582 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                  56.6 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3327	0.3090	0.3169	0.3011	0.3011	0.2931	0.2852	0.2773	0.2694	0.2931	0.2773	0.2931	(22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5384	0.5363	0.5430	0.5384	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.1611	60.3212	60.5943	60.0551	60.0551	59.7959	59.5436	59.2982	59.0597	59.7959	59.2982	59.7959	(38)
Heat transfer coeff	162.3966	161.5567	161.8298	161.2906	161.2906	161.0314	160.7791	160.5337	160.2952	161.0314	160.5337	161.0314	(39)
Average = Sum(39)m / 12 =												161.1333	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2579	1.2514	1.2535	1.2493	1.2493	1.2473	1.2454	1.2435	1.2416	1.2473	1.2435	1.2473	(40)
HLP (average)												1.2481	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
RHI water heating demand												1758	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	25.1925	0.7200	0.7000	0.7700	94.5898	(76)
South	4.2600	56.7559	0.7200	0.7000	0.7700	84.4470	(78)
West	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(80)

Solar gains	246.0855	386.2607	595.5906	822.2832	926.9649	1019.2913	967.2526	871.6419	712.0306	480.3775	300.5454	202.4698	(83)
Total gains	951.7362	1086.5430	1268.1050	1451.5320	1511.3741	1563.9980	1489.0902	1403.1582	1268.7514	1080.5993	949.0947	888.1012	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2061	55.4931	55.3994	55.5846	55.5846	55.6741	55.7615	55.8467	55.9298	55.6741	55.8467	55.6741	
alpha	4.6804	4.6995	4.6933	4.7056	4.7056	4.7116	4.7174	4.7231	4.7287	4.7116	4.7231	4.7116	
util living area													
	0.9944	0.9893	0.9700	0.9089	0.7823	0.5662	0.4169	0.4407	0.7203	0.9360	0.9871	0.9957	(86)
MIT	19.8098	19.9561	20.2606	20.6174	20.8652	20.9769	20.9956	20.9945	20.9313	20.6180	20.1658	19.7904	(87)
Th 2	19.8739	19.8791	19.8774	19.8807	19.8807	19.8823	19.8839	19.8854	19.8868	19.8823	19.8854	19.8823	(88)
util rest of house													
	0.9924	0.9856	0.9596	0.8780	0.7145	0.4645	0.2999	0.3177	0.6217	0.9061	0.9817	0.9941	(89)
MIT 2	18.3199	18.5354	18.9706	19.4623	19.7651	19.8703	19.8827	19.8839	19.8422	19.4774	18.8457	18.2977	(90)
Living area fraction									fLA = Living area / (4) =			0.1879	(91)
MIT	18.5999	18.8023	19.2130	19.6794	19.9718	20.0783	20.0919	20.0926	20.0468	19.6917	19.0938	18.5782	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5999	18.8023	19.2130	19.6794	19.9718	20.0783	20.0919	20.0926	20.0468	19.6917	19.0938	18.5782	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9807	0.9515	0.8714	0.7206	0.4830	0.3220	0.3410	0.6372	0.8997	0.9762	0.9914	(94)
Useful gains	941.4192	1065.5327	1206.5638	1264.8897	1089.1207	755.3800	479.4490	478.4114	808.4144	972.1757	926.5476	880.4969	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2224.8157	2181.3952	1976.4325	1641.8348	1205.1292	769.4484	481.0278	480.4158	857.0713	1335.2302	1796.9842	2186.5105	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	954.8470	749.8596	572.7823	271.4005	86.3103	0.0000	0.0000	0.0000	0.0000	270.1126	626.7144	971.6741	(98)
Space heating												4503.7008	(98)
RHI space heating demand												4504	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4040	0.3961	0.3882	0.3486	0.3407	0.3011	0.3011	0.2931	0.3169	0.3407	0.3565	0.3724	(22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.0539	63.7049	63.3627	61.7556	61.4549	60.0551	60.0551	59.7959	60.5943	61.4549	62.0632	62.6991	(38)
Heat transfer coeff	165.2894	164.9403	164.5982	162.9910	162.6904	161.2906	161.2906	161.0314	161.8298	162.6904	163.2987	163.9346	(39)
Average = Sum(39)m / 12 =												162.9896	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2803	1.2776	1.2750	1.2625	1.2602	1.2493	1.2493	1.2473	1.2535	1.2602	1.2649	1.2698	(40)
HLP (average)												1.2625	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	19.6403	0.7200	0.7000	0.7700	73.7428	(76)
South	4.2600	46.7521	0.7200	0.7000	0.7700	69.5623	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)

Solar gains	195.5768	360.4361	551.0889	756.0983	896.5337	907.2822	867.8850	763.5246	623.7535	415.3850	239.5803	163.7364	(83)
Total gains	901.2275	1060.7185	1223.6034	1385.3472	1480.9428	1451.9889	1389.7225	1295.0409	1180.4744	1015.6068	888.1296	849.3677	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2399	54.3547	54.4677	55.0047	55.1064	55.5846	55.5846	55.6741	55.3994	55.1064	54.9011	54.6881	
alpha	4.6160	4.6236	4.6312	4.6670	4.6738	4.7056	4.7056	4.7116	4.6933	4.6738	4.6601	4.6459	
util living area													
	0.9962	0.9913	0.9774	0.9338	0.8325	0.6628	0.4999	0.5536	0.8007	0.9611	0.9923	0.9971	(86)
MIT	19.6765	19.8596	20.1531	20.5163	20.8002	20.9501	20.9893	20.9830	20.8776	20.4894	20.0106	19.6422	(87)
Th 2	19.8563	19.8584	19.8605	19.8703	19.8722	19.8807	19.8807	19.8823	19.8774	19.8722	19.8684	19.8645	(88)
util rest of house													
	0.9948	0.9884	0.9695	0.9105	0.7766	0.5659	0.3782	0.4282	0.7170	0.9425	0.9892	0.9961	(89)
MIT 2	18.1133	18.3810	18.8054	19.3203	19.6848	19.8493	19.8771	19.8758	19.7848	19.2963	18.6092	18.0690	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.4070	18.6589	19.0586	19.5451	19.8944	20.0561	20.0861	20.0839	19.9901	19.5205	18.8725	18.3647	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4070	18.6589	19.0586	19.5451	19.8944	20.0561	20.0861	20.0839	19.9901	19.5205	18.8725	18.3647	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9840	0.9620	0.9022	0.7779	0.5821	0.4012	0.4517	0.7265	0.9348	0.9851	0.9941	(94)
Useful gains	894.3244	1043.7033	1177.1507	1249.8400	1151.9765	845.1689	557.5051	585.0028	857.6548	949.3793	874.8887	844.3142	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2331.7429	2269.3916	2067.1267	1735.0517	1333.1447	880.0235	562.2696	593.2187	953.2001	1451.2819	1922.4405	2322.0789	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1069.4393	823.6626	662.1421	349.3524	134.7891	0.0000	0.0000	0.0000	0.0000	373.4155	754.2373	1099.4569	(98)
Space heating												5266.4954	(98)
Space heating per m2											(98) / (4) =	40.7939	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5668.9939	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1069.4393	823.6626	662.1421	349.3524	134.7891	0.0000	0.0000	0.0000	0.0000	373.4155	754.2373	1099.4569	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1151.1726	886.6120	712.7472	376.0521	145.0906	0.0000	0.0000	0.0000	0.0000	401.9543	811.8809	1183.4843	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4252	89.3705	89.2483	88.9442	88.2493	86.7000	86.7000	86.7000	86.7000	88.9638	89.3197	89.4480	(217)
Fuel for water heating, kWh/month													
	200.9442	176.2256	182.9802	161.3214	156.9413	139.2414	130.4073	147.6813	148.8611	167.4043	180.4004	194.9627	(219)
Water heating fuel used												1987.3714	(219)
Annual totals kWh/year													
Space heating fuel - main system												5668.9939	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												7459.7909	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5668.9939	3.4800	197.2810	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1987.3714	3.4800	69.1605	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	479.0919	13.1900	63.1922	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			360.5133	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8697	(257)
SAP value		87.8676	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5668.9939	0.2160	1224.5027	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.3714	0.2160	429.2722	(264)
Space and water heating			1653.7749	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1551.7528	(272)
CO2 emissions per m2			12.0200	(273)
EI value			88.0566	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8831 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8831 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3728	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3169	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3327	0.3090	0.3169	0.3011	0.3011	0.2931	0.2852	0.2773	0.2694	0.2931	0.2773	0.2931	(22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5384	0.5363	0.5430	0.5384	0.5430	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.1611	60.3212	60.5943	60.0551	60.0551	59.7959	59.5436	59.2982	59.0597	59.7959	59.2982	59.7959	(38)
Heat transfer coeff	162.3966	161.5567	161.8298	161.2906	161.2906	161.0314	160.7791	160.5337	160.2952	161.0314	160.5337	161.0314	(39)
Average = Sum(39)m / 12 =												161.1333	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2579	1.2514	1.2535	1.2493	1.2493	1.2473	1.2454	1.2435	1.2416	1.2473	1.2435	1.2473	(40)
HLP (average)												1.2481	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.7500	25.1925	0.7200	0.7000	0.7700	94.5898	(76)
South	4.2600	56.7559	0.7200	0.7000	0.7700	84.4470	(78)
West	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(80)

Solar gains	246.0855	386.2607	595.5906	822.2832	926.9649	1019.2913	967.2526	871.6419	712.0306	480.3775	300.5454	202.4698	(83)
Total gains	951.7362	1086.5430	1268.1050	1451.5320	1511.3741	1563.9980	1489.0902	1403.1582	1268.7514	1080.5993	949.0947	888.1012	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2061	55.4931	55.3994	55.5846	55.5846	55.6741	55.7615	55.8467	55.9298	55.6741	55.8467	55.6741	
alpha	4.6804	4.6995	4.6933	4.7056	4.7056	4.7116	4.7174	4.7231	4.7287	4.7116	4.7231	4.7116	
util living area													
	0.9944	0.9893	0.9700	0.9089	0.7823	0.5662	0.4169	0.4407	0.7203	0.9360	0.9871	0.9957	(86)
MIT	19.8098	19.9561	20.2606	20.6174	20.8652	20.9769	20.9956	20.9945	20.9313	20.6180	20.1658	19.7904	(87)
Th 2	19.8739	19.8791	19.8774	19.8807	19.8807	19.8823	19.8839	19.8854	19.8868	19.8823	19.8854	19.8823	(88)
util rest of house													
	0.9924	0.9856	0.9596	0.8780	0.7145	0.4645	0.2999	0.3177	0.6217	0.9061	0.9817	0.9941	(89)
MIT 2	18.3199	18.5354	18.9706	19.4623	19.7651	19.8703	19.8827	19.8839	19.8422	19.4774	18.8457	18.2977	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.5999	18.8023	19.2130	19.6794	19.9718	20.0783	20.0919	20.0926	20.0468	19.6917	19.0938	18.5782	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5999	18.8023	19.2130	19.6794	19.9718	20.0783	20.0919	20.0926	20.0468	19.6917	19.0938	18.5782	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9807	0.9515	0.8714	0.7206	0.4830	0.3220	0.3410	0.6372	0.8997	0.9762	0.9914	(94)
Useful gains	941.4192	1065.5327	1206.5638	1264.8897	1089.1207	755.3800	479.4490	478.4114	808.4144	972.1757	926.5476	880.4969	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2224.8157	2181.3952	1976.4325	1641.8348	1205.1292	769.4484	481.0278	480.4158	857.0713	1335.2302	1796.9842	2186.5105	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	954.8470	749.8596	572.7823	271.4005	86.3103	0.0000	0.0000	0.0000	0.0000	270.1126	626.7144	971.6741	(98)
Space heating												4503.7008	(98)
Space heating per m2											(98) / (4) =	34.8854	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4847.9018	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	954.8470	749.8596	572.7823	271.4005	86.3103	0.0000	0.0000	0.0000	0.0000	270.1126	626.7144	971.6741	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1027.8224	807.1686	616.5579	292.1426	92.9067	0.0000	0.0000	0.0000	0.0000	290.7563	674.6118	1045.9356	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3775	89.3277	89.1698	88.7669	87.9012	86.7000	86.7000	86.7000	86.7000	88.7360	89.2265	89.3979	(217)
Fuel for water heating, kWh/month													
	201.0514	176.3100	183.1412	161.6436	157.5628	139.2414	130.4073	147.6813	148.8611	167.8340	180.5889	195.0720	(219)
Water heating fuel used												1989.3952	(219)
Annual totals kWh/year													
Space heating fuel - main system												4847.9018	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												6540.6138	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4847.9018	7.3800	357.7752	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1989.3952	7.3800	146.8174	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	479.0919	28.6600	137.3077	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			526.5631	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4847.9018	0.2160	1047.1468	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1989.3952	0.2160	429.7094	(264)
Space and water heating			1476.8561	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1322.8776	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4847.9018	1.2200	5914.4402	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1989.3952	1.2200	2427.0621	(264)
Space and water heating			8341.5023	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	479.0919	3.0700	1470.8122	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			7430.6849	(272)
Primary energy kWh/m2/year			57.5576	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 1.0	-£ 62	-198 kg (14.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£159	£0
Mains gas	£612	£612	£0
Space heating	£486	£486	£0
Water heating	£147	£147	£0
Lighting	£137	£137	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£527	£527	£0
Total cost of uses	£526	£526	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	58 kWh/m²	58 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		881.03 (P1)
Transmission heat loss coefficient		101.24 (37)
Summer heat loss coefficient		982.27 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	10.7500	125.2818	0.7200	0.7000	0.7650	467.3378
South	4.2600	118.5567	0.7200	0.7000	0.7650	175.2549
West	7.6200	125.2818	0.7200	0.7000	0.7650	331.2664
total:						973.8590

	Jun	Jul	Aug	
Solar gains	1043	974	875	(P3)
Internal gains	542	519	529	
Total summer gains	1585	1493	1403	(P5)
Summer gain/loss ratio	1.61	1.52	1.43	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.26	19.07	18.98	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 436 - BG2	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	43 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.61	**TER**	16.80
Environmental	88 B	**% DER<TER**	19.00		
CO_2 Emissions (t/year)	1.27	**DFEE**	52.08	**TFEE**	56.65
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.07		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.80	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.61	$kgCO_2/m^2$	Pass
	-3.19 (-19.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.65	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.08	$kWh/m^2/yr$	
	-4.5 (-8.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing East	10.75 m², No overhang
Windows facing South	4.26 m², No overhang
Windows facing West	7.62 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 437 - BG2	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	41 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.23	**TER**	16.95
Environmental	88 B	**% DER<TER**	21.93		
CO_2 Emissions (t/year)	1.22	**DFEE**	52.61	**TFEE**	57.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 129 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.95 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.23 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.42 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 10.75 m², No overhang
Windows facing South East: 4.26 m², No overhang
Windows facing South West: 7.62 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2916	0.3152	0.3388	0.3546	0.3704	(22b)
Effective ac	0.5808	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9577	63.6124	63.2739	61.6840	61.3865	60.0017	60.0017	59.7453	60.5351	61.3865	61.9883	62.6174	(38)
Heat transfer coeff	165.1932	164.8479	164.5094	162.9195	162.6220	161.2372	161.2372	160.9808	161.7706	162.6220	163.2238	163.8529	(39)
Average = Sum(39)m / 12 =												162.9180	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2796	1.2769	1.2743	1.2620	1.2597	1.2489	1.2489	1.2469	1.2531	1.2597	1.2643	1.2692	(40)
HLP (average)												1.2620	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	472.1445	469.8098	452.6118	424.6201	395.6659	368.2038	350.6500	357.2951	371.9298	400.1567	432.5989	457.4405	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	11.2829	0.7200	0.7000	0.7700	42.3638	(75)
Southeast	4.2600	36.7938	0.7200	0.7000	0.7700	54.7455	(77)
Southwest	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(79)

Solar gains	195.0343	346.2871	511.1816	696.0276	836.7917	855.8933	814.7050	705.8432	574.5887	392.7987	236.1687	165.2506	(83)
Total gains	667.1788	816.0969	963.7934	1120.6477	1232.4576	1224.0971	1165.3551	1063.1384	946.5185	792.9554	668.7676	622.6911	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2715	54.3852	54.4971	55.0289	55.1296	55.6030	55.6030	55.6916	55.4197	55.1296	54.9263	54.7154	
alpha	4.6181	4.6257	4.6331	4.6686	4.6753	4.7069	4.7069	4.7128	4.6946	4.6753	4.6618	4.6477	
util living area													
	0.9989	0.9970	0.9910	0.9678	0.8965	0.7479	0.5843	0.6525	0.8849	0.9844	0.9976	0.9992	(86)
MIT	19.5130	19.6914	19.9826	20.3678	20.7094	20.9168	20.9796	20.9665	20.8010	20.3505	19.8586	19.4830	(87)
Th 2	19.8569	19.8590	19.8610	19.8707	19.8726	19.8811	19.8811	19.8826	19.8778	19.8726	19.8689	19.8650	(88)
util rest of house													
	0.9985	0.9960	0.9876	0.9546	0.8534	0.6517	0.4479	0.5148	0.8192	0.9759	0.9966	0.9990	(89)
MIT 2	17.8753	18.1374	18.5626	19.1215	19.5829	19.8248	19.8736	19.8687	19.7112	19.1057	18.3892	17.8370	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.1831	18.4294	18.8294	19.3557	19.7946	20.0300	20.0815	20.0750	19.9160	19.3396	18.6653	18.1463	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1831	18.4294	18.8294	19.3557	19.7946	20.0300	20.0815	20.0750	19.9160	19.3396	18.6653	18.1463	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9939	0.9830	0.9466	0.8498	0.6659	0.4735	0.5403	0.8219	0.9700	0.9949	0.9983	(94)
Useful gains	665.5976	811.1338	947.4471	1060.7924	1047.3287	815.1165	551.8473	574.4294	777.9551	769.1849	665.3347	621.6143	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2293.3858	2230.2936	2028.3095	1703.4304	1316.3587	875.5216	561.3406	591.6006	940.8520	1421.2564	1887.7333	2285.1453	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1211.0745	953.6754	804.1616	462.6994	200.1583	0.0000	0.0000	0.0000	0.0000	485.1412	880.1270	1237.6670	(98)
Space heating												6234.7044	(98)
Space heating per m2											(98) / (4) =	48.2936	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6711.1996	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1211.0745	953.6754	804.1616	462.6994	200.1583	0.0000	0.0000	0.0000	0.0000	485.1412	880.1270	1237.6670	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1303.6324	1026.5612	865.6207	498.0617	215.4557	0.0000	0.0000	0.0000	0.0000	522.2188	947.3918	1332.2573	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4733	89.4321	89.3434	89.1214	88.5632	86.7000	86.7000	86.7000	86.7000	89.1273	89.3894	89.4921	(217)
Fuel for water heating, kWh/month													
	200.8361	176.1042	182.7855	161.0007	156.3851	139.2414	130.4073	147.6813	148.8611	167.0971	180.2597	194.8668	(219)
Water heating fuel used												1985.5263	(219)
Annual totals kWh/year													
Space heating fuel - main system												6711.1996	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1004 * 1.00) =										-883.5167		-883.5167	(233)
Total delivered energy for all uses												8367.3012	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6711.1996	0.2160	1449.6191	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.5263	0.2160	428.8737	(264)
Space and water heating			1878.4928	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-883.5167	0.5190	-458.5451	(269)
Total CO2, kg/year			1707.5214	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.2300	ZC1
Total Floor Area	TFA	129.1000	
Assumed number of occupants	N	2.8926	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6157	ZC2
CO2 emissions from cooking, equation (L16)		1.4595	ZC3
Total CO2 emissions		28.3052	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3052	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3699	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3144	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4008	0.3930	0.3851	0.3458	0.3380	0.2987	0.2987	0.2908	0.3144	0.3380	0.3537	0.3694	(22b)
Effective ac	0.5803	0.5772	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5625	0.5682	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			22.6300	1.3258	30.0019			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	167.8800	26.8700	141.0100	0.1800	25.3818			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.2547			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.9445	(36)
Total fabric heat loss (33) + (36) =	90.1992	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9115	63.5680	63.2312	61.6496	61.3536	59.9761	59.9761	59.7209	60.5067	61.3536	61.9523	62.5782	(38)
Heat transfer coeff	154.1107	153.7672	153.4304	151.8488	151.5529	150.1753	150.1753	149.9202	150.7059	151.5529	152.1515	152.7774	(39)
Average = Sum(39)m / 12 =												151.8474	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1937	1.1911	1.1885	1.1762	1.1739	1.1632	1.1632	1.1613	1.1674	1.1739	1.1786	1.1834	(40)
HLP (average)												1.1762	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2904	45.6706	47.1929	49.2904	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
								Total per year (kWh/year) = Sum(64)m =				2208.2654	(64)
Heat gains from water heating, kWh/month													
	68.5522	60.3208	63.1113	56.2440	54.4603	47.7792	45.4926	50.9874	51.4553	58.3380	62.1028	66.7911	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	92.1400	89.7631	84.8271	78.1166	73.1993	66.3601	61.1460	68.5314	71.4657	78.4112	86.2539	89.7730	(72)
Total internal gains													
	485.2900	482.9580	465.7656	437.7815	408.2736	380.1158	362.5674	369.9079	385.0987	413.3178	445.7511	470.5887	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	11.2829	0.6300	0.7000	0.7700	37.0683	(75)
Southeast	4.2600	36.7938	0.6300	0.7000	0.7700	47.9023	(77)
Southwest	7.6200	36.7938	0.6300	0.7000	0.7700	85.6844	(79)

Solar gains	170.6550	303.0012	447.2839	609.0241	732.1928	748.9067	712.8669	617.6128	502.7651	343.6988	206.6476	144.5942	(83)
Total gains	655.9450	785.9592	913.0495	1046.8056	1140.4663	1129.0224	1075.4343	987.5208	887.8638	757.0166	652.3987	615.1830	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1743	58.3042	58.4322	59.0408	59.1561	59.6988	59.6988	59.8003	59.4886	59.1561	58.9234	58.6820	
alpha	4.8783	4.8869	4.8955	4.9361	4.9437	4.9799	4.9799	4.9867	4.9659	4.9437	4.9282	4.9121	
util living area													
	0.9991	0.9975	0.9924	0.9722	0.9064	0.7594	0.5923	0.6586	0.8908	0.9860	0.9979	0.9993	(86)
MIT	19.6155	19.7785	20.0474	20.4066	20.7279	20.9247	20.9827	20.9715	20.8194	20.3990	19.9406	19.5886	(87)
Th 2	19.9250	19.9272	19.9292	19.9391	19.9409	19.9495	19.9495	19.9511	19.9462	19.9409	19.9372	19.9333	(88)
util rest of house													
	0.9987	0.9966	0.9896	0.9609	0.8672	0.6682	0.4620	0.5274	0.8292	0.9784	0.9970	0.9991	(89)
MIT 2	18.0721	18.3118	18.7051	19.2281	19.6651	19.8975	19.9430	19.9388	19.7923	19.2249	18.5563	18.0386	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.3621	18.5874	18.9574	19.4496	19.8649	20.0905	20.1384	20.1329	19.9853	19.4455	18.8164	18.3299	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3621	18.5874	18.9574	19.4496	19.8649	20.0905	20.1384	20.1329	19.9853	19.4455	18.8164	18.3299	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9949	0.9858	0.9539	0.8638	0.6817	0.4865	0.5517	0.8320	0.9733	0.9955	0.9985	(94)
Useful gains	654.5999	781.9494	900.0675	998.5277	985.1138	769.6726	523.2242	544.8593	738.6621	736.7985	649.4726	614.2593	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2167.1277	2104.6784	1911.3380	1601.9405	1237.4066	824.5398	531.3741	559.6333	886.9550	1340.5617	1782.6739	2158.7256	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1125.3207	888.8739	752.3852	434.4571	187.7058	0.0000	0.0000	0.0000	0.0000	449.1998	815.9049	1149.0830	(98)
Space heating												5802.9305	(98)
Space heating per m2											(98) / (4) =	44.9491	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6212.9877	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1125.3207	888.8739	752.3852	434.4571	187.7058	0.0000	0.0000	0.0000	0.0000	449.1998	815.9049	1149.0830	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1204.8401	951.6851	805.5517	465.1575	200.9699	0.0000	0.0000	0.0000	0.0000	480.9420	873.5599	1230.2815	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.8159	192.8362	202.4524	181.3908	176.0202	155.0288	148.5294	165.5754	166.9889	188.0965	199.0114	213.5195	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5861	88.4175	88.0518	87.1706	85.2132	80.3000	80.3000	80.3000	80.3000	87.1642	88.2241	88.6527	(217)
Fuel for water heating, kWh/month													
	247.0092	218.0974	229.9243	208.0871	206.5645	193.0620	184.9681	206.1960	207.9563	215.7956	225.5749	240.8493	(219)
Water heating fuel used												2584.0847	(219)
Annual totals kWh/year													
Space heating fuel - main system												6212.9877	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Total delivered energy for all uses												9351.1644	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6212.9877	0.2160	1342.0053	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2584.0847	0.2160	558.1623	(264)
Space and water heating			1900.1676	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Total CO2, kg/m2/year			2187.7414	(272)
Emissions per m2 for space and water heating			14.7186	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9260	(272b)
Emissions per m2 for pumps and fans			0.3015	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7186 * 1.00) + 1.9260 + 0.3015, rounded to 2 d.p.			16.9500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3409	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2897	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3694	0.3622	0.3549	0.3187	0.3115	0.2752	0.2752	0.2680	0.2897	0.3115	0.3259	0.3404	(22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5579	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.5785	62.2868	62.0007	60.6574	60.4060	59.2360	59.2360	59.0193	59.6867	60.4060	60.9145	61.4461	(38)
Heat transfer coeff	163.8140	163.5222	163.2362	161.8929	161.6415	160.4715	160.4715	160.2548	160.9222	161.6415	162.1500	162.6816	(39)
Average = Sum(39)m / 12 =												161.8917	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2689	1.2666	1.2644	1.2540	1.2521	1.2430	1.2430	1.2413	1.2465	1.2521	1.2560	1.2601	(40)
HLP (average)												1.2540	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6696	31.1969	32.1924	28.0661	26.9301	23.2386	21.5340	24.7106	25.0057	29.1417	31.8105	34.5441	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	47.9430	46.4239	43.2693	38.9807	36.1964	32.2759	28.9435	33.2131	34.7301	39.1690	44.1812	46.4303	(72)
Total internal gains													
	438.0930	436.6189	421.2079	395.6456	368.2707	343.0316	327.3650	331.5897	345.3631	371.0755	400.6784	424.2460	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	11.2829	0.7200	0.7000	0.7700	42.3638	(75)
Southeast	4.2600	36.7938	0.7200	0.7000	0.7700	54.7455	(77)
Southwest	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(79)

Solar gains	195.0343	346.2871	511.1816	696.0276	836.7917	855.8933	814.7050	705.8432	574.5887	392.7987	236.1687	165.2506	(83)
Total gains	633.1273	782.9059	932.3895	1091.6732	1205.0624	1198.9249	1142.0701	1037.4329	919.9517	763.8742	636.8471	589.4966	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7284	54.8260	54.9221	55.3778	55.4640	55.8683	55.8683	55.9439	55.7119	55.4640	55.2900	55.1094	
alpha	4.6486	4.6551	4.6615	4.6919	4.6976	4.7246	4.7246	4.7296	4.7141	4.6976	4.6860	4.6740	
util living area													
	0.9991	0.9975	0.9921	0.9704	0.9020	0.7560	0.5922	0.6630	0.8927	0.9864	0.9981	0.9994	(86)
MIT	19.5025	19.6809	19.9725	20.3578	20.7027	20.9137	20.9788	20.9647	20.7933	20.3375	19.8451	19.4710	(87)
Th 2	19.8653	19.8671	19.8688	19.8770	19.8786	19.8858	19.8858	19.8871	19.8830	19.8786	19.8755	19.8722	(88)
util rest of house													
	0.9988	0.9966	0.9890	0.9582	0.8604	0.6607	0.4552	0.5249	0.8297	0.9789	0.9972	0.9992	(89)
MIT 2	18.5000	18.6795	18.9708	19.3551	19.6749	19.8456	19.8804	19.8769	19.7634	19.3415	18.8503	18.4740	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.6884	18.8677	19.1591	19.5435	19.8680	20.0463	20.0868	20.0813	19.9569	19.5287	19.0372	18.6614	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6884	18.8677	19.1591	19.5435	19.8680	20.0463	20.0868	20.0813	19.9569	19.5287	19.0372	18.6614	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9955	0.9864	0.9535	0.8599	0.6759	0.4812	0.5510	0.8348	0.9757	0.9963	0.9988	(94)
Useful gains	632.0989	779.3751	919.7210	1040.8946	1036.2416	810.3701	549.5611	571.5977	768.0081	745.2752	634.5072	588.8110	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2357.0175	2284.0230	2066.4173	1723.1089	1320.2926	873.9802	559.5347	589.9480	942.5083	1443.2423	1935.6198	2352.5969	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1283.3394	1011.1234	853.1421	491.1943	211.3339	0.0000	0.0000	0.0000	0.0000	519.2875	936.8011	1312.2567	(98)
Space heating												6618.4784	(98)
Space heating per m2											(98) / (4) =	51.2663	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1508.4321	1187.4891	1217.9367	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8284	0.8967	0.8599	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1249.6341	1064.8545	1047.3473	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1519.9293	1450.8051	1330.8224	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	194.6125	287.1472	210.9055	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												692.6652	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	48.6531	71.7868	52.7264	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												173.1663 (107)
Space cooling per m2												1.3413 (108)
Energy for space heating												51.2663 (99)
Energy for space cooling												1.3413 (108)
Total												52.6076 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1199 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3699 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3144 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4008	0.3930	0.3851	0.3458	0.3380	0.2987	0.2987	0.2908	0.3144	0.3380	0.3537	0.3694	(22b)
Effective ac	0.5803	0.5772	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5625	0.5682	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			22.6300	1.3258	30.0019			(27)
Ground floor			64.5500	0.1300	8.3915			(28a)
External Wall	167.8800	26.8700	141.0100	0.1800	25.3818			(29a)
Main Roof	64.5500		64.5500	0.1300	8.3915			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		77.2547			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.9445 (36)
Total fabric heat loss	(33) + (36) =	90.1992 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9115	63.5680	63.2312	61.6496	61.3536	59.9761	59.9761	59.7209	60.5067	61.3536	61.9523	62.5782	(38)
Heat transfer coeff	154.1107	153.7672	153.4304	151.8488	151.5529	150.1753	150.1753	149.9202	150.7059	151.5529	152.1515	152.7774	(39)
Average = Sum(39)m / 12 =												151.8474	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1937	1.1911	1.1885	1.1762	1.1739	1.1632	1.1632	1.1613	1.1674	1.1739	1.1786	1.1834	(40)
HLP (average)												1.1762	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926 (42)
Average daily hot water use (litres/day)	102.8997 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.6696	31.1969	32.1924	28.0661	26.9301	23.2386	21.5340	24.7106	25.0057	29.1417	31.8105	34.5441	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	144.6309	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.1282	24.0950	19.5954	14.8350	11.0893	9.3621	10.1160	13.1492	17.6488	22.4092	26.1549	27.8821	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	296.6325	299.7107	291.9539	275.4407	254.5957	235.0044	221.9162	218.8380	226.5948	243.1080	263.9530	283.5443	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	37.4631	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	47.9430	46.4239	43.2693	38.9807	36.1964	32.2759	28.9435	33.2131	34.7301	39.1690	44.1812	46.4303	(72)
Total internal gains													
	438.0930	436.6189	421.2079	395.6456	368.2707	343.0316	327.3650	331.5897	345.3631	371.0755	400.6784	424.2460	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	11.2829	0.6300	0.7000	0.7700	37.0683	(75)
Southeast	4.2600	36.7938	0.6300	0.7000	0.7700	47.9023	(77)
Southwest	7.6200	36.7938	0.6300	0.7000	0.7700	85.6844	(79)

Solar gains	170.6550	303.0012	447.2839	609.0241	732.1928	748.9067	712.8669	617.6128	502.7651	343.6988	206.6476	144.5942	(83)
Total gains	608.7480	739.6201	868.4918	1004.6697	1100.4634	1091.9382	1040.2319	949.2025	848.1282	714.7744	607.3260	568.8402	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1743	58.3042	58.4322	59.0408	59.1561	59.6988	59.6988	59.8003	59.4886	59.1561	58.9234	58.6820	
alpha	4.8783	4.8869	4.8955	4.9361	4.9437	4.9799	4.9799	4.9867	4.9659	4.9437	4.9282	4.9121	
util living area													
	0.9993	0.9981	0.9939	0.9763	0.9163	0.7756	0.6093	0.6791	0.9048	0.9889	0.9985	0.9995	(86)
MIT	19.5816	19.7454	20.0164	20.3799	20.7095	20.9171	20.9804	20.9673	20.8024	20.3704	19.9083	19.5552	(87)
Th 2	19.9250	19.9272	19.9292	19.9391	19.9409	19.9495	19.9495	19.9511	19.9462	19.9409	19.9372	19.9333	(88)
util rest of house													
	0.9991	0.9974	0.9915	0.9664	0.8797	0.6855	0.4768	0.5467	0.8478	0.9828	0.9978	0.9994	(89)
MIT 2	18.6261	18.7914	19.0628	19.4284	19.7375	19.9098	19.9444	19.9413	19.8287	19.4244	18.9622	18.6063	(90)
Living area fraction									fLA = Living area / (4) =			0.1879	(91)
MIT	18.8056	18.9706	19.2420	19.6072	19.9202	20.0990	20.1391	20.1341	20.0117	19.6021	19.1400	18.7846	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8056	18.9706	19.2420	19.6072	19.9202	20.0990	20.1391	20.1341	20.0117	19.6021	19.1400	18.7846	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9965	0.9894	0.9623	0.8789	0.6998	0.5019	0.5716	0.8522	0.9801	0.9971	0.9991	(94)
Useful gains	607.9706	737.0498	859.3251	966.8341	967.1584	764.1364	522.1411	542.5859	722.7615	700.5393	605.5635	568.3222	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2235.4739	2163.6029	1955.0154	1625.8718	1245.7884	825.8204	531.4826	559.8193	890.9270	1364.3011	1831.9049	2228.2018	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1210.8625	958.6437	815.1936	474.5072	207.3007	0.0000	0.0000	0.0000	0.0000	493.8388	882.9658	1234.9505	(98)
Space heating												6278.2627	(98)
Space heating per m2											(98) / (4) =	48.6310	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1411.6475	1111.2970	1139.3932	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8278	0.8983	0.8624	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1168.5040	998.3112	982.6629	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1394.8800	1331.7736	1227.6959	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	162.9907	248.0960	182.3046	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												593.3912	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	40.7477	62.0240	45.5761	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												148.3478 (107)
Space cooling per m2												1.1491 (108)
Energy for space heating												48.6310 (99)
Energy for space cooling												1.1491 (108)
Total												49.7801 (109)
Target Fabric Energy Efficiency (TFEE)												57.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3310	0.3073	0.3152	0.2994	0.2994	0.2916	0.2837	0.2758	0.2679	0.2916	0.2758	0.2916	(22b)
Effective ac	0.5548	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.0959	60.2650	60.5351	60.0017	60.0017	59.7453	59.4957	59.2529	59.0170	59.7453	59.2529	59.7453	(38)
Heat transfer coeff	162.3313	161.5005	161.7706	161.2372	161.2372	160.9808	160.7312	160.4884	160.2525	160.9808	160.4884	160.9808	(39)
Average = Sum(39)m / 12 =												161.0816	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2574	1.2510	1.2531	1.2489	1.2489	1.2469	1.2450	1.2431	1.2413	1.2469	1.2431	1.2469	(40)
HLP (average)												1.2477	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8926	(42)
Average daily hot water use (litres/day)												102.8997	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
RHI water heating demand												1758	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	14.6176	0.7200	0.7000	0.7700	54.8845	(75)
Southeast	4.2600	45.1778	0.7200	0.7000	0.7700	67.2200	(77)
Southwest	7.6200	45.1778	0.7200	0.7000	0.7700	120.2386	(79)

Solar gains	242.3432	367.3984	550.0672	758.7462	870.3838	968.1613	913.9383	809.1833	654.9043	450.5721	292.7423	201.7017	(83)
Total gains	947.9939	1067.6808	1222.5817	1387.9951	1454.7929	1512.8680	1435.7759	1340.6996	1211.6251	1050.7939	941.2916	887.3330	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2283	55.5124	55.4197	55.6030	55.6030	55.6916	55.7781	55.8625	55.9447	55.6916	55.8625	55.6916	
alpha	4.6819	4.7008	4.6946	4.7069	4.7069	4.7128	4.7185	4.7242	4.7296	4.7128	4.7242	4.7128	
util living area													
	0.9945	0.9900	0.9738	0.9204	0.7993	0.5825	0.4316	0.4600	0.7428	0.9416	0.9875	0.9957	(86)
MIT	19.8079	19.9438	20.2329	20.5879	20.8516	20.9741	20.9949	20.9934	20.9216	20.6025	20.1610	19.7903	(87)
Th 2	19.8743	19.8794	19.8778	19.8811	19.8811	19.8826	19.8842	19.8856	19.8871	19.8826	19.8856	19.8826	(88)
util rest of house													
	0.9925	0.9866	0.9644	0.8923	0.7333	0.4790	0.3108	0.3322	0.6451	0.9136	0.9823	0.9941	(89)
MIT 2	18.3174	18.5180	18.9322	19.4254	19.7520	19.8690	19.8828	19.8839	19.8351	19.4580	18.8390	18.2978	(90)
Living area fraction									fLA = Living area / (4) =			0.1879	(91)
MIT	18.5975	18.7860	19.1766	19.6438	19.9586	20.0766	20.0918	20.0924	20.0392	19.6731	19.0874	18.5783	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5975	18.7860	19.1766	19.6438	19.9586	20.0766	20.0918	20.0924	20.0392	19.6731	19.0874	18.5783	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9818	0.9567	0.8850	0.7384	0.4978	0.3336	0.3564	0.6598	0.9069	0.9769	0.9915	(94)
Useful gains	937.8668	1048.2759	1169.6723	1228.4207	1074.1780	753.0372	479.0403	477.8249	799.4698	952.9629	919.5591	879.7605	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2223.5261	2177.9893	1969.8191	1635.5657	1202.6020	768.9487	480.8776	480.2443	855.6267	1331.8125	1795.4537	2185.8421	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	956.5305	759.1674	595.3092	293.1444	95.5474	0.0000	0.0000	0.0000	0.0000	281.8641	630.6441	971.7247	(98)
Space heating												4583.9319	(98)
RHI space heating demand												4584	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2916	0.3152	0.3388	0.3546	0.3704	(22b)
Effective ac	0.5808	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9577	63.6124	63.2739	61.6840	61.3865	60.0017	60.0017	59.7453	60.5351	61.3865	61.9883	62.6174	(38)
Heat transfer coeff	165.1932	164.8479	164.5094	162.9195	162.6220	161.2372	161.2372	160.9808	161.7706	162.6220	163.2238	163.8529	(39)
Average = Sum(39)m / 12 =												162.9180	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2796	1.2769	1.2743	1.2620	1.2597	1.2489	1.2489	1.2469	1.2531	1.2597	1.2643	1.2692	(40)
HLP (average)												1.2620	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	11.2829	0.7200	0.7000	0.7700	42.3638	(75)
Southeast	4.2600	36.7938	0.7200	0.7000	0.7700	54.7455	(77)
Southwest	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(79)

Solar gains	195.0343	346.2871	511.1816	696.0276	836.7917	855.8933	814.7050	705.8432	574.5887	392.7987	236.1687	165.2506	(83)
Total gains	900.6850	1046.5695	1183.6961	1325.2764	1421.2009	1400.6001	1336.5425	1237.3595	1131.3095	993.0205	884.7180	850.8819	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2715	54.3852	54.4971	55.0289	55.1296	55.6030	55.6030	55.6916	55.4197	55.1296	54.9263	54.7154	
alpha	4.6181	4.6257	4.6331	4.6686	4.6753	4.7069	4.7069	4.7128	4.6946	4.6753	4.6618	4.6477	
util living area													
	0.9962	0.9918	0.9800	0.9426	0.8484	0.6810	0.5178	0.5759	0.8188	0.9640	0.9924	0.9970	(86)
MIT	19.6770	19.8509	20.1283	20.4852	20.7813	20.9441	20.9876	20.9800	20.8644	20.4765	20.0089	19.6441	(87)
Th 2	19.8569	19.8590	19.8610	19.8707	19.8726	19.8811	19.8811	19.8826	19.8778	19.8726	19.8689	19.8650	(88)
util rest of house													
	0.9949	0.9890	0.9729	0.9216	0.7951	0.5836	0.3928	0.4471	0.7378	0.9466	0.9893	0.9960	(89)
MIT 2	18.1145	18.3688	18.7708	19.2798	19.6646	19.8454	19.8768	19.8748	19.7732	19.2793	18.6071	18.0721	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.4082	18.6473	19.0259	19.5063	19.8745	20.0519	20.0855	20.0825	19.9782	19.5043	18.8705	18.3675	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4082	18.6473	19.0259	19.5063	19.8745	20.0519	20.0855	20.0825	19.9782	19.5043	18.8705	18.3675	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9924	0.9847	0.9659	0.9132	0.7952	0.5996	0.4163	0.4712	0.7461	0.9390	0.9853	0.9940	(94)
Useful gains	893.8028	1030.5630	1143.3049	1210.2152	1130.1441	839.7497	556.4357	583.0410	844.1216	932.4005	871.7085	845.7855	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2330.5735	2266.2162	2060.6349	1727.9784	1329.3507	879.0438	561.9939	592.8162	950.9280	1448.0272	1921.2251	2321.3914	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1068.9574	830.3589	682.4935	372.7895	148.2097	0.0000	0.0000	0.0000	0.0000	383.6262	755.6519	1097.8507	(98)
Space heating												5339.9378	(98)
Space heating per m2											(98) / (4) =	41.3628	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5748.0493	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1068.9574	830.3589	682.4935	372.7895	148.2097	0.0000	0.0000	0.0000	0.0000	383.6262	755.6519	1097.8507	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1150.6538	893.8201	734.6540	401.2804	159.5368	0.0000	0.0000	0.0000	0.0000	412.9453	813.4036	1181.7554	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4250	89.3741	89.2639	88.9872	88.3252	86.7000	86.7000	86.7000	86.7000	88.9816	89.3206	89.4475	(217)
Fuel for water heating, kWh/month													
	200.9446	176.2186	182.9483	161.2435	156.8065	139.2414	130.4073	147.6813	148.8611	167.3708	180.3986	194.9640	(219)
Water heating fuel used												1987.0861	(219)
Annual totals kWh/year													
Space heating fuel - main system												5748.0493	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1004 * 1.00) =										-883.5167		-883.5167	(233)
Total delivered energy for all uses												7405.7107	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5748.0493	3.4800	200.0321	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1987.0861	3.4800	69.1506	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	479.0919	13.1900	63.1922	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-883.5167	13.1900	-116.5358	(252)
Total energy cost			345.7316	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8340	(257)
SAP value		88.3651	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5748.0493	0.2160	1241.5786	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.0861	0.2160	429.2106	(264)
Space and water heating			1670.7892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-883.5167	0.5190	-458.5451	(269)
Total kg/year			1499.8178	(272)
CO2 emissions per m2			11.6200	(273)
EI value			88.4563	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8833 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8833 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.5500 (1b)	x	2.5400 (2b)	=	163.9570	(1b) - (3b)
First floor	64.5500 (1c)	x	2.6300 (2c)	=	169.7665	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	129.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	333.7235	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1498	(8)
Pressure test		Yes	
Measured/design AP50		4.4200	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3310	0.3073	0.3152	0.2994	0.2994	0.2916	0.2837	0.2758	0.2679	0.2916	0.2758	0.2916	(22b)
Effective ac	0.5548	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6300	1.2357	27.9648			(27)
Opening Type 13			4.2400	1.5000	6.3600			(26a)
Ground floor			64.5500	0.1900	12.2645			(28a)
External Wall	167.8800	26.8700	141.0100	0.2700	38.0727			(29a)
Main Roof	64.5500		64.5500	0.1600	10.3280			(30)
Total net area of external elements Aum(A, m2)			296.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		94.9900			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2455	(36)
Total fabric heat loss					(33) + (36) =		101.2355	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.0959	60.2650	60.5351	60.0017	60.0017	59.7453	59.4957	59.2529	59.0170	59.7453	59.2529	59.7453	(38)
Heat transfer coeff	162.3313	161.5005	161.7706	161.2372	161.2372	160.9808	160.7312	160.4884	160.2525	160.9808	160.4884	160.9808	(39)
Average = Sum(39)m / 12 =												161.0816	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2574	1.2510	1.2531	1.2489	1.2489	1.2469	1.2450	1.2431	1.2413	1.2469	1.2431	1.2469	(40)
HLP (average)												1.2477	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8926	(42)
Average daily hot water use (litres/day)	102.8997	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1897	109.0737	104.9577	100.8417	96.7257	92.6097	92.6097	96.7257	100.8417	104.9577	109.0737	113.1897	(44)
Energy conte	167.8570	146.8088	151.4935	132.0757	126.7298	109.3582	101.3364	116.2851	117.6739	137.1375	149.6964	162.5606	(45)
Energy content (annual)										Total = Sum(45)m =		1619.0130	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1786	22.0213	22.7240	19.8114	19.0095	16.4037	15.2005	17.4428	17.6511	20.5706	22.4545	24.3841	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8377	10.6849	11.8132	11.4103	11.7698	11.3641	11.7267	11.7547	11.3887	11.7916	11.4367	11.8298	(61)
Total heat required for water heating calculated for each month													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
								Total per year (kWh/year) = Sum(64)m =				1757.8213	(64)
Heat gains from water heating, kWh/month													
	58.7719	51.4852	53.3249	46.7678	45.0801	39.2026	36.6260	41.6034	41.9737	48.5461	52.6332	57.0088	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	173.5571	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.8204	60.2375	48.9884	37.0874	27.7233	23.4051	25.2901	32.8730	44.1221	56.0231	65.3872	69.7054	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	442.7351	447.3293	435.7521	411.1055	379.9936	350.7528	331.2182	326.6239	338.2012	362.8478	393.9597	423.2005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	55.2483	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	-115.7048	(71)
Water heating gains (Table 5)													
	78.9945	76.6148	71.6733	64.9552	60.5916	54.4481	49.2286	55.9186	58.2969	65.2502	73.1017	76.6248	(72)
Total internal gains													
	705.6507	700.2824	672.5145	629.2488	584.4091	544.7068	521.8375	531.5163	556.7208	600.2218	648.5493	685.6313	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.7500	14.6176	0.7200	0.7000	0.7700	54.8845	(75)
Southeast	4.2600	45.1778	0.7200	0.7000	0.7700	67.2200	(77)
Southwest	7.6200	45.1778	0.7200	0.7000	0.7700	120.2386	(79)

Solar gains	242.3432	367.3984	550.0672	758.7462	870.3838	968.1613	913.9383	809.1833	654.9043	450.5721	292.7423	201.7017	(83)
Total gains	947.9939	1067.6808	1222.5817	1387.9951	1454.7929	1512.8680	1435.7759	1340.6996	1211.6251	1050.7939	941.2916	887.3330	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2283	55.5124	55.4197	55.6030	55.6030	55.6916	55.7781	55.8625	55.9447	55.6916	55.8625	55.6916	
alpha	4.6819	4.7008	4.6946	4.7069	4.7069	4.7128	4.7185	4.7242	4.7296	4.7128	4.7242	4.7128	
util living area													
	0.9945	0.9900	0.9738	0.9204	0.7993	0.5825	0.4316	0.4600	0.7428	0.9416	0.9875	0.9957	(86)
MIT	19.8079	19.9438	20.2329	20.5879	20.8516	20.9741	20.9949	20.9934	20.9216	20.6025	20.1610	19.7903	(87)
Th 2	19.8743	19.8794	19.8778	19.8811	19.8811	19.8826	19.8842	19.8856	19.8871	19.8826	19.8856	19.8826	(88)
util rest of house													
	0.9925	0.9866	0.9644	0.8923	0.7333	0.4790	0.3108	0.3322	0.6451	0.9136	0.9823	0.9941	(89)
MIT 2	18.3174	18.5180	18.9322	19.4254	19.7520	19.8690	19.8828	19.8839	19.8351	19.4580	18.8390	18.2978	(90)
Living area fraction										fLA = Living area / (4) =		0.1879	(91)
MIT	18.5975	18.7860	19.1766	19.6438	19.9586	20.0766	20.0918	20.0924	20.0392	19.6731	19.0874	18.5783	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5975	18.7860	19.1766	19.6438	19.9586	20.0766	20.0918	20.0924	20.0392	19.6731	19.0874	18.5783	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9818	0.9567	0.8850	0.7384	0.4978	0.3336	0.3564	0.6598	0.9069	0.9769	0.9915	(94)
Useful gains	937.8668	1048.2759	1169.6723	1228.4207	1074.1780	753.0372	479.0403	477.8249	799.4698	952.9629	919.5591	879.7605	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2223.5261	2177.9893	1969.8191	1635.5657	1202.6020	768.9487	480.8776	480.2443	855.6267	1331.8125	1795.4537	2185.8421	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	956.5305	759.1674	595.3092	293.1444	95.5474	0.0000	0.0000	0.0000	0.0000	281.8641	630.6441	971.7247	(98)
Space heating												4583.9319	(98)
Space heating per m2											(98) / (4) =	35.5068	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4934.2647	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	956.5305	759.1674	595.3092	293.1444	95.5474	0.0000	0.0000	0.0000	0.0000	281.8641	630.6441	971.7247	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1029.6346	817.1878	640.8065	315.5483	102.8498	0.0000	0.0000	0.0000	0.0000	303.4060	678.8418	1045.9900	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6947	157.4937	163.3067	143.4861	138.4996	120.7223	113.0632	128.0397	129.0626	148.9292	161.1331	174.3903	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3783	89.3335	89.1913	88.8227	87.9784	86.7000	86.7000	86.7000	86.7000	88.7674	89.2298	89.3979	(217)
Fuel for water heating, kWh/month													
	201.0497	176.2986	183.0971	161.5422	157.4245	139.2414	130.4073	147.6813	148.8611	167.7747	180.5822	195.0720	(219)
Water heating fuel used												1989.0321	(219)
Annual totals kWh/year													
Space heating fuel - main system												4934.2647	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												479.0919	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1122 * 1.00) =										-987.2902		-987.2902	(233)
Total delivered energy for all uses												6490.0986	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4934.2647	7.3800	364.1487	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1989.0321	7.3800	146.7906	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	479.0919	28.6600	137.3077	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-987.2902	28.6600	-282.9574	(252)
Total energy cost			493.7847	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4934.2647	0.2160	1065.8012	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1989.0321	0.2160	429.6309	(264)
Space and water heating			1495.4321	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.0919	0.5190	248.6487	(268)
Energy saving/generation technologies				
PV Unit	-987.2902	0.5190	-512.4036	(269)
Total kg/year			1270.6022	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4934.2647	1.2200	6019.8029	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1989.0321	1.2200	2426.6192	(264)
Space and water heating			8446.4221	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	479.0919	3.0700	1470.8122	(268)
Energy saving/generation technologies				
PV Unit	-987.2902	3.0700	-3030.9808	(269)
Primary energy kWh/year			7116.5036	(272)
Primary energy kWh/m2/year			55.1240	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 1.0	-£ 62	-198 kg (15.6%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£159	£159	£0
Mains gas	£618	£618	£0
Space heating	£493	£493	£0
Water heating	£147	£147	£0
Lighting	£137	£137	£0
Generated (PV)	-£283	-£283	£0
Total cost of fuels	£494	£494	£0
Total cost of uses	£494	£494	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	881.03 (P1)
Transmission heat loss coefficient	101.24 (37)
Summer heat loss coefficient	982.27 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.850	0.90	1.000	0.765 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	10.7500	106.0502	0.7200	0.7000	0.7650	395.5984
South East	4.2600	127.3119	0.7200	0.7000	0.7650	188.1971
South West	7.6200	127.3119	0.7200	0.7000	0.7650	336.6343
total:						920.4297

	Jun	Jul	Aug	
Solar gains	991	920	812	(P3)
Internal gains	542	519	529	
Total summer gains	1533	1439	1341	(P5)
Summer gain/loss ratio	1.56	1.47	1.36	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.21	19.02	18.91	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 437 - BG2	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	41 Wren Walk, Boorley Green, Southampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.23	**TER**	16.95
Environmental	88 B	**% DER<TER**	21.93		
CO_2 Emissions (t/year)	1.22	**DFEE**	52.61	**TFEE**	57.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.95	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.23	$kgCO_2/m^2$	Pass
	-3.72 (-21.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.25	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.61	$kWh/m^2/yr$	
	-4.6 (-8.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.42 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	10.75 m², No overhang
Windows facing South East	4.26 m², No overhang
Windows facing South West	7.62 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.42 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 438 - New BG	**Issued on Date**	07/08/2024
Assessment Reference	3	**Prop Type Ref**	
Property	39 Wren Walk, Boorley Green, Southhampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.05	**TER**	16.82
Environmental	88 B	**% DER<TER**	22.42		
CO_2 Emissions (t/year)	1.40	**DFEE**	52.87	**TFEE**	60.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 149 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.05 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.25 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 2.04 m², No overhang
Windows facing North East: 14.40 m², No overhang
Windows facing East: 2.04 m², No overhang
Windows facing South East: 0.82 m², No overhang
Windows facing South West: 8.78 m², No overhang
Windows facing North West: 2.79 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.2500	
Infiltration rate		0.3686	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3133	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3994	0.3916	0.3838	0.3446	0.3368	0.2976	0.2976	0.2898	0.3133	0.3368	0.3525	0.3681	(22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5678	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.3762	(36)
Total fabric heat loss (33) + (36) =	117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.5507	73.1577	72.7724	70.9631	70.6246	69.0487	69.0487	68.7569	69.6557	70.6246	71.3094	72.0254	(38)
Heat transfer coeff	190.7078	190.3148	189.9295	188.1202	187.7817	186.2058	186.2058	185.9139	186.8128	187.7817	188.4665	189.1824	(39)
Average = Sum(39)m / 12 =												188.1186	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2796	1.2769	1.2744	1.2622	1.2599	1.2494	1.2494	1.2474	1.2534	1.2599	1.2645	1.2693	(40)
HLP (average)												1.2622	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327 (42)
Average daily hot water use (litres/day)	103.8511 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320	(61)
Total heat required for water heating calculated for each month													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194	(64)
Heat gains from water heating, kWh/month													
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	497.7450	495.4620	477.3786	447.7967	416.9956	387.8749	369.3055	375.9388	391.4347	421.2540	455.5758	482.0518	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	10.6334	0.7200	0.7000	0.7700	7.5764	(74)
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
East	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(76)
Southeast	0.8200	36.7938	0.7200	0.7000	0.7700	10.5379	(77)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
Northwest	2.7900	11.2829	0.7200	0.7000	0.7700	10.9949	(81)

Solar gains	212.6832	389.8912	605.6535	869.5392	1081.3006	1120.3327	1060.6498	895.7454	696.0734	450.4883	259.8021	178.7252	(83)
Total gains	710.4282	885.3532	1083.0321	1317.3359	1498.2962	1508.2076	1429.9553	1271.6842	1087.5081	871.7423	715.3779	660.7770	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2715	54.3836	54.4939	55.0180	55.1172	55.5837	55.5837	55.6709	55.4031	55.1172	54.9169	54.7091	
alpha	4.6181	4.6256	4.6329	4.6679	4.6745	4.7056	4.7056	4.7114	4.6935	4.6745	4.6611	4.6473	
util living area													
	0.9992	0.9977	0.9919	0.9657	0.8805	0.7161	0.5544	0.6346	0.8865	0.9871	0.9983	0.9995	(86)
MIT	19.4764	19.6569	19.9650	20.3799	20.7361	20.9309	20.9836	20.9702	20.7990	20.3251	19.8238	19.4472	(87)
Th 2	19.8569	19.8589	19.8610	19.8706	19.8723	19.8807	19.8807	19.8823	19.8775	19.8723	19.8687	19.8649	(88)
util rest of house													
	0.9990	0.9969	0.9888	0.9517	0.8335	0.6188	0.4227	0.4985	0.8212	0.9799	0.9975	0.9993	(89)
MIT 2	17.8217	18.0870	18.5373	19.1379	19.6138	19.8353	19.8749	19.8700	19.7088	19.0698	18.3383	17.7844	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.0110	18.2666	18.7006	19.2800	19.7421	19.9606	20.0017	19.9959	19.8335	19.2134	18.5082	17.9746	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0110	18.2666	18.7006	19.2800	19.7421	19.9606	20.0017	19.9959	19.8335	19.2134	18.5082	17.9746	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9950	0.9841	0.9419	0.8270	0.6264	0.4376	0.5133	0.8180	0.9736	0.9960	0.9987	(94)
Useful gains	709.1673	880.9655	1065.7864	1240.8586	1239.1021	944.7052	625.6942	652.7975	889.6206	848.7006	712.5460	659.9378	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2614.7983	2543.8584	2317.2544	1952.6860	1510.1682	998.1816	633.4159	668.5241	1071.0946	1617.4467	2150.0625	2605.9201	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1417.7894	1117.4640	931.0922	512.5158	201.6732	0.0000	0.0000	0.0000	0.0000	571.9471	1035.0119	1447.8109	(98)
Space heating												7235.3044	(98)
Space heating per m2											(98) / (4) =	48.5461	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7788.2717	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1417.7894	1117.4640	931.0922	512.5158	201.6732	0.0000	0.0000	0.0000	0.0000	571.9471	1035.0119	1447.8109	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1526.1458	1202.8676	1002.2521	551.6854	217.0864	0.0000	0.0000	0.0000	0.0000	615.6589	1114.1140	1558.4616	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5255	89.4889	89.4040	89.1753	88.5625	86.7000	86.7000	86.7000	86.7000	89.2151	89.4519	89.5420	(217)
Fuel for water heating, kWh/month													
	202.4554	177.5116	184.2307	162.2749	157.7133	140.4110	131.4911	148.9251	150.1179	168.3561	181.6834	196.4393	(219)
Water heating fuel used												2001.6098	(219)
Annual totals kWh/year													
Space heating fuel - main system												7788.2717	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1029 * 1.00) =										-905.6843		-905.6843	(233)
Total delivered energy for all uses												9464.0940	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7788.2717	0.2160	1682.2667	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2001.6098	0.2160	432.3477	(264)
Space and water heating			2114.6144	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-905.6843	0.5190	-470.0502	(269)
Total CO2, kg/year			1945.5307	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.0500	ZC1
Total Floor Area	TFA	149.0400	
Assumed number of occupants	N	2.9327	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.7023	ZC2
CO2 emissions from cooking, equation (L16)		1.2707	ZC3
Total CO2 emissions		27.0230	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.0230	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1041	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3541	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			5.9200	1.2000	7.1040			(26a)
TER Opening Type (Uw = 1.40)			30.8700	1.3258	40.9261			(27)
Ground floor			75.7600	0.1300	9.8488			(28a)
External Wall	195.4300	36.7900	158.6400	0.1800	28.5552			(29a)
Main Roof	73.2800		73.2800	0.1300	9.5264			(30)
Bay Roof	2.4800		2.4800	0.1300	0.3224			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.2829			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5203	(36)
Total fabric heat loss					(33) + (36) =		111.8032	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.7687	72.4060	72.0506	70.3810	70.0687	68.6145	68.6145	68.3453	69.1746	70.0687	70.7006	71.3612	(38)
Heat transfer coeff	184.5719	184.2092	183.8538	182.1842	181.8719	180.4177	180.4177	180.1484	180.9778	181.8719	182.5038	183.1644	(39)
Average = Sum(39)m / 12 =												182.1827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2360	1.2336	1.2224	1.2203	1.2105	1.2105	1.2087	1.2143	1.2203	1.2245	1.2290	(40)
HLP (average)												1.2224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9327	(42)
Average daily hot water use (litres/day)												103.8511	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.7461	46.0928	47.6293	49.7461	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225 (64)
								Total per year (kWh/year) = Sum(64)m =				2225.0055 (64)
Heat gains from water heating, kWh/month												
	69.0682	60.7721	63.5771	56.6500	54.9638	48.2210	45.9132	51.4588	51.8171	58.7596	62.5630	67.2909 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	92.8337	90.4347	85.4531	78.6806	73.8761	66.9736	61.7113	69.1651	71.9682	78.9779	86.8931	90.4447	(72)
Total internal gains													
	510.8898	508.6094	490.5317	460.9574	429.7553	399.9325	381.3686	388.7037	404.6030	434.4144	468.7273	495.1993	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	10.6334	0.6300	0.7000	0.7700	6.6294	(74)
Northeast	14.4000	11.2829	0.6300	0.7000	0.7700	49.6543	(75)
East	2.0400	19.6403	0.6300	0.7000	0.7700	12.2447	(76)
Southeast	0.8200	36.7938	0.6300	0.7000	0.7700	9.2206	(77)
Southwest	8.7800	36.7938	0.6300	0.7000	0.7700	98.7282	(79)
Northwest	2.7900	11.2829	0.6300	0.7000	0.7700	9.6205	(81)

Solar gains	186.0978	341.1548	529.9468	760.8468	946.1381	980.2912	928.0686	783.7772	609.0643	394.1773	227.3268	156.3846 (83)
Total gains	696.9875	849.7643	1020.4785	1221.8042	1375.8934	1380.2236	1309.4372	1172.4809	1013.6672	828.5917	696.0541	651.5838 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0757	56.1861	56.2947	56.8106	56.9082	57.3669	57.3669	57.4526	57.1893	56.9082	56.7112	56.5066	
alpha	4.7384	4.7457	4.7530	4.7874	4.7939	4.8245	4.8245	4.8302	4.8126	4.7939	4.7807	4.7671	
util living area													
	0.9993	0.9981	0.9935	0.9727	0.9006	0.7471	0.5837	0.6621	0.9018	0.9892	0.9985	0.9995	(86)
MIT	19.5204	19.6862	19.9746	20.3681	20.7186	20.9231	20.9816	20.9673	20.7916	20.3331	19.8550	19.4930	(87)
Th 2	19.8894	19.8913	19.8932	19.9021	19.9038	19.9116	19.9116	19.9130	19.9086	19.9038	19.9004	19.8969	(88)
util rest of house													
	0.9991	0.9974	0.9910	0.9613	0.8591	0.6528	0.4506	0.5268	0.8427	0.9831	0.9978	0.9993	(89)
MIT 2	17.9084	18.1521	18.5741	19.1462	19.6213	19.8593	19.9048	19.8991	19.7288	19.1041	18.4057	17.8734	(90)
Living area fraction										fLA = Living area / (4) =		0.1144	(91)
MIT	18.0928	18.3276	18.7343	19.2859	19.7469	19.9810	20.0280	20.0213	19.8504	19.2447	18.5715	18.0587	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0928	18.3276	18.7343	19.2859	19.7469	19.9810	20.0280	20.0213	19.8504	19.2447	18.5715	18.0587	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9959	0.9871	0.9526	0.8519	0.6595	0.4655	0.5414	0.8387	0.9775	0.9965	0.9989	(94)
Useful gains	695.8942	846.2538	1007.3134	1163.8664	1172.1350	910.2955	609.6033	634.7486	850.1319	809.9540	693.6471	650.8427	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2545.7600	2473.4874	2249.3229	1892.1548	1463.4994	970.8332	618.4660	652.3745	1040.6966	1572.2345	2093.5845	2538.4244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1376.3002	1093.5010	924.0551	524.3677	216.7752	0.0000	0.0000	0.0000	0.0000	567.1367	1007.9549	1404.3608	(98)
Space heating												7114.4514	(98)
Space heating per m2											(98) / (4) =	47.7352	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7617.1857	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1376.3002	1093.5010	924.0551	524.3677	216.7752	0.0000	0.0000	0.0000	0.0000	567.1367	1007.9549	1404.3608	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1473.5548	1170.7719	989.3523	561.4215	232.0933	0.0000	0.0000	0.0000	0.0000	607.2127	1079.1809	1503.5982	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.3680	194.1937	203.8532	182.6120	177.6477	156.4622	149.9027	167.1064	168.0770	189.3645	200.3956	215.0225	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.8575	88.7172	88.3906	87.5555	85.5534	80.3000	80.3000	80.3000	80.3000	87.6407	88.5528	88.9150	(217)
Fuel for water heating, kWh/month													
	248.0016	218.8907	230.6276	208.5673	207.6455	194.8471	186.6783	208.1026	209.3113	216.0691	226.3005	241.8292	(219)
Water heating fuel used												2596.8709	(219)
Annual totals kWh/year													
Space heating fuel - main system												7617.1857	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Total delivered energy for all uses												10793.9534	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7617.1857	0.2160	1645.3121	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2596.8709	0.2160	560.9241	(264)
Space and water heating			2206.2362	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Total CO2, kg/m2/year			2507.2027	(272)
Emissions per m2 for space and water heating			14.8030	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7582	(272b)
Emissions per m2 for pumps and fans			0.2612	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8030 * 1.00) + 1.7582 + 0.2612, rounded to 2 d.p.			16.8200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1041	(8)
Pressure test		Yes	
Measured/design AP50		4.2500	
Infiltration rate		0.3166	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2691	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3431	0.3363	0.3296	0.2960	0.2892	0.2556	0.2556	0.2489	0.2691	0.2892	0.3027	0.3162	(22b)
Effective ac	0.5588	0.5566	0.5543	0.5438	0.5418	0.5327	0.5327	0.5310	0.5362	0.5418	0.5458	0.5500	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.8952	70.6053	70.3211	68.9865	68.7368	67.5744	67.5744	67.3592	68.0222	68.7368	69.2420	69.7701	(38)
Heat transfer coeff	188.0523	187.7624	187.4782	186.1436	185.8939	184.7315	184.7315	184.5163	185.1793	185.8939	186.3991	186.9272	(39)
Average = Sum(39)m / 12 =												186.1424	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2618	1.2598	1.2579	1.2490	1.2473	1.2395	1.2395	1.2380	1.2425	1.2473	1.2507	1.2542	(40)
HLP (average)												1.2489	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327	(42)
Average daily hot water use (litres/day)	103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.9994	31.4853	32.4900	28.3256	27.1791	23.4535	21.7331	24.9391	25.2369	29.4112	32.1046	34.8635 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072 (71)

Water heating gains (Table 5)

	48.3863	46.8532	43.6694	39.3411	36.5310	32.5743	29.2112	33.5202	35.0513	39.5312	44.5897	46.8596 (72)

Total internal gains

	463.4424	462.0279	445.7480	418.6180	389.4102	362.5331	345.8684	350.0589	364.6860	391.9677	423.4239	448.6141 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	10.6334	0.7200	0.7000	0.7700	7.5764	(74)
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
East	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(76)
Southeast	0.8200	36.7938	0.7200	0.7000	0.7700	10.5379	(77)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
Northwest	2.7900	11.2829	0.7200	0.7000	0.7700	10.9949	(81)

Solar gains	212.6832	389.8912	605.6535	869.5392	1081.3006	1120.3327	1060.6498	895.7454	696.0734	450.4883	259.8021	178.7252	(83)
Total gains	676.1256	851.9191	1051.4016	1288.1572	1470.7109	1482.8659	1406.5183	1245.8043	1060.7595	842.4560	683.2260	627.3393	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0379	55.1229	55.2064	55.6022	55.6769	56.0273	56.0273	56.0926	55.8918	55.6769	55.5260	55.3692	
alpha	4.6692	4.6749	4.6804	4.7068	4.7118	4.7352	4.7352	4.7395	4.7261	4.7118	4.7017	4.6913	
util living area	0.9994	0.9981	0.9928	0.9678	0.8844	0.7213	0.5589	0.6417	0.8925	0.9886	0.9986	0.9996	(86)
MIT	19.4778	19.6577	19.9651	20.3775	20.7349	20.9301	20.9834	20.9694	20.7949	20.3187	19.8189	19.4458	(87)
Th 2	19.8709	19.8724	19.8740	19.8810	19.8824	19.8885	19.8885	19.8897	19.8862	19.8824	19.8797	19.8769	(88)
util rest of house	0.9992	0.9974	0.9900	0.9547	0.8385	0.6245	0.4273	0.5057	0.8295	0.9822	0.9980	0.9994	(89)
MIT 2	18.4798	18.6606	18.9677	19.3770	19.7041	19.8570	19.8845	19.8810	19.7674	19.3263	18.8276	18.4524	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.5940	18.7747	19.0818	19.4915	19.8221	19.9798	20.0102	20.0056	19.8850	19.4399	18.9410	18.5661	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5940	18.7747	19.0818	19.4915	19.8221	19.9798	20.0102	20.0056	19.8850	19.4399	18.9410	18.5661	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9964	0.9872	0.9487	0.8356	0.6332	0.4423	0.5209	0.8294	0.9786	0.9972	0.9992	(94)
Useful gains	675.3209	848.8300	1037.9912	1222.1012	1228.8904	939.0215	622.1404	648.9846	879.7945	824.4320	681.3214	626.8151	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2688.0132	2605.1440	2358.8135	1971.5330	1509.8419	993.8145	629.9743	665.2833	1071.2569	1643.2747	2207.1469	2685.4064	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1497.4430	1180.2430	982.6918	539.5909	209.0280	0.0000	0.0000	0.0000	0.0000	609.2190	1098.5944	1531.5919	(98)
Space heating												7648.4020	(98)
Space heating per m2										(98) / (4) =		51.3178	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1736.4763	1367.0133	1402.3236	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8525	0.9128	0.8714	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1480.3006	1247.7860	1221.9406	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1858.6670	1766.4920	1581.0990	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	272.4238	385.9173	267.2138	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												925.5549 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	68.1059	96.4793	66.8035	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												231.3887 (107)
Space cooling per m2												1.5525 (108)
Energy for space heating												51.3178 (99)
Energy for space cooling												1.5525 (108)
Total												52.8703 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1041	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3541	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3687	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3386	0.3536	(22b)
Effective ac	0.5736	0.5708	0.5680	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			5.9200	1.2000	7.1040			(26a)
TER Opening Type (Uw = 1.40)			30.8700	1.3258	40.9261			(27)
Ground floor			75.7600	0.1300	9.8488			(28a)
External Wall	195.4300	36.7900	158.6400	0.1800	28.5552			(29a)
Main Roof	73.2800		73.2800	0.1300	9.5264			(30)
Bay Roof	2.4800		2.4800	0.1300	0.3224			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.2829			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.5203	(36)
Total fabric heat loss (33) + (36) =	111.8032	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	72.7687	72.4060	72.0506	70.3810	70.0687	68.6145	68.6145	68.3453	69.1746	70.0687	70.7006	71.3612	(38)
Heat transfer coeff	184.5719	184.2092	183.8538	182.1842	181.8719	180.4177	180.4177	180.1484	180.9778	181.8719	182.5038	183.1644	(39)
Average = Sum(39)m / 12 =												182.1827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2384	1.2360	1.2336	1.2224	1.2203	1.2105	1.2105	1.2087	1.2143	1.2203	1.2245	1.2290	(40)
HLP (average)												1.2224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327 (42)
Average daily hot water use (litres/day)	103.8511 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.9994	31.4853	32.4900	28.3256	27.1791	23.4535	21.7331	24.9391	25.2369	29.4112	32.1046	34.8635 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	146.6340	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	28.5893	25.3928	20.6508	15.6340	11.6866	9.8663	10.6609	13.8574	18.5994	23.6163	27.5637	29.3839 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	319.4766	322.7917	314.4376	296.6527	274.2024	253.1023	239.0062	235.6910	244.0451	261.8300	284.2803	305.3804 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634	37.6634 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072 (71)

Water heating gains (Table 5)

	48.3863	46.8532	43.6694	39.3411	36.5310	32.5743	29.2112	33.5202	35.0513	39.5312	44.5897	46.8596 (72)

Total internal gains

	463.4424	462.0279	445.7480	418.6180	389.4102	362.5331	345.8684	350.0589	364.6860	391.9677	423.4239	448.6141 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	10.6334	0.6300	0.7000	0.7700	6.6294	(74)
Northeast	14.4000	11.2829	0.6300	0.7000	0.7700	49.6543	(75)
East	2.0400	19.6403	0.6300	0.7000	0.7700	12.2447	(76)
Southeast	0.8200	36.7938	0.6300	0.7000	0.7700	9.2206	(77)
Southwest	8.7800	36.7938	0.6300	0.7000	0.7700	98.7282	(79)
Northwest	2.7900	11.2829	0.6300	0.7000	0.7700	9.6205	(81)

Solar gains	186.0978	341.1548	529.9468	760.8468	946.1381	980.2912	928.0686	783.7772	609.0643	394.1773	227.3268	156.3846	(83)
Total gains	649.5402	803.1827	975.6949	1179.4648	1335.5483	1342.8243	1273.9370	1133.8361	973.7503	786.1449	650.7507	604.9987	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0757	56.1861	56.2947	56.8106	56.9082	57.3669	57.3669	57.4526	57.1893	56.9082	56.7112	56.5066	
alpha	4.7384	4.7457	4.7530	4.7874	4.7939	4.8245	4.8245	4.8302	4.8126	4.7939	4.7807	4.7671	
util living area	0.9995	0.9985	0.9946	0.9761	0.9091	0.7604	0.5975	0.6793	0.9130	0.9913	0.9989	0.9997	(86)
MIT	19.4911	19.6575	19.9477	20.3450	20.7030	20.9168	20.9797	20.9636	20.7759	20.3080	19.8270	19.4641	(87)
Th 2	19.8894	19.8913	19.8932	19.9021	19.9038	19.9116	19.9116	19.9130	19.9086	19.9038	19.9004	19.8969	(88)
util rest of house	0.9993	0.9980	0.9926	0.9659	0.8698	0.6670	0.4625	0.5429	0.8580	0.9863	0.9984	0.9995	(89)
MIT 2	18.5075	18.6753	18.9659	19.3641	19.6983	19.8725	19.9064	19.9022	19.7742	19.3334	18.8520	18.4865	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.6201	18.7877	19.0782	19.4763	19.8132	19.9920	20.0292	20.0237	19.8888	19.4449	18.9635	18.5984	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6201	18.7877	19.0782	19.4763	19.8132	19.9920	20.0292	20.0237	19.8888	19.4449	18.9635	18.5984	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9972	0.9904	0.9607	0.8659	0.6747	0.4779	0.5581	0.8568	0.9832	0.9978	0.9993	(94)
Useful gains	648.9061	800.9232	966.2969	1133.1163	1156.4619	905.9822	608.7780	632.7509	834.2867	772.9502	649.2963	604.5812	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2643.0786	2558.2378	2312.5576	1926.8309	1475.5670	972.8087	618.6844	652.7952	1047.6497	1608.6413	2165.1372	2637.2665	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1483.6644	1180.9154	1001.6180	571.4745	237.4142	0.0000	0.0000	0.0000	0.0000	621.7542	1091.4054	1512.3178	(98)
Space heating												7700.5639	(98)
Space heating per m2										(98) / (4) =		51.6678	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1695.9267	1335.0912	1369.1282	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8281	0.8961	0.8514	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1404.3619	1196.3431	1165.6912	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1694.9820	1611.5269	1450.2271	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	209.2465	308.8968	211.6947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												729.8379 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	52.3116	77.2242	52.9237	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												182.4595 (107)
Space cooling per m2												1.2242 (108)
Energy for space heating												51.6678 (99)
Energy for space cooling												1.2242 (108)
Total												52.8920 (109)
Target Fabric Energy Efficiency (TFEE)												60.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1561	(8)
Pressure test			Yes	
Measured/design AP50			4.2500	
Infiltration rate			0.3686	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3133	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3290	0.3055	0.3133	0.2976	0.2976	0.2898	0.2820	0.2741	0.2663	0.2898	0.2741	0.2898	(22b)
Effective ac	0.5541	0.5467	0.5491	0.5443	0.5443	0.5420	0.5398	0.5376	0.5355	0.5420	0.5376	0.5420	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.2938	69.3483	69.6557	69.0487	69.0487	68.7569	68.4728	68.1965	67.9281	68.7569	68.1965	68.7569	(38)
Heat transfer coeff	187.4509	186.5054	186.8128	186.2058	186.2058	185.9139	185.6299	185.3536	185.0851	185.9139	185.3536	185.9139	(39)
Average = Sum(39)m / 12 =												186.0287	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2577	1.2514	1.2534	1.2494	1.2494	1.2474	1.2455	1.2437	1.2418	1.2474	1.2437	1.2474	(40)
HLP (average)												1.2482	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327	(42)
Average daily hot water use (litres/day)	103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
Total per year (kWh/year) = Sum(64)m =												1772.8194 (64)
RHI water heating demand												1773 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	13.4839	0.7200	0.7000	0.7700	9.6075	(74)
Northeast	14.4000	14.6176	0.7200	0.7000	0.7700	73.5197	(75)
East	2.0400	25.1925	0.7200	0.7000	0.7700	17.9501	(76)
Southeast	0.8200	45.1778	0.7200	0.7000	0.7700	12.9391	(77)
Southwest	8.7800	45.1778	0.7200	0.7000	0.7700	138.5427	(79)
Northwest	2.7900	14.6176	0.7200	0.7000	0.7700	14.2444	(81)

Solar gains	266.8034	418.2880	659.5149	957.6384	1133.4727	1275.5324	1198.2556	1036.4108	802.5471	522.8046	325.2896	220.1169	(83)
Total gains	1011.9787	1158.0183	1369.9341	1622.1908	1750.2452	1850.0613	1748.4640	1596.4145	1389.2744	1155.6362	1009.4217	943.8480	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2145	55.4944	55.4031	55.5837	55.5837	55.6709	55.7561	55.8392	55.9202	55.6709	55.8392	55.6709	
alpha	4.6810	4.6996	4.6935	4.7056	4.7056	4.7114	4.7171	4.7226	4.7280	4.7114	4.7226	4.7114	
util living area													
	0.9960	0.9922	0.9765	0.9174	0.7809	0.5543	0.4102	0.4469	0.7463	0.9504	0.9907	0.9969	(86)
MIT	19.7578	19.8992	20.2098	20.5958	20.8663	20.9788	20.9959	20.9941	20.9199	20.5750	20.1152	19.7408	(87)
Th 2	19.8741	19.8791	19.8775	19.8807	19.8807	19.8823	19.8838	19.8852	19.8867	19.8823	19.8852	19.8823	(88)
util rest of house													
	0.9946	0.9895	0.9681	0.8885	0.7130	0.4540	0.2949	0.3223	0.6487	0.9256	0.9867	0.9958	(89)
MIT 2	18.2444	18.4535	18.8996	19.4351	19.7661	19.8713	19.8827	19.8837	19.8333	19.4222	18.7731	18.2256	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.4175	18.6189	19.0495	19.5678	19.8919	19.9980	20.0101	20.0107	19.9576	19.5541	18.9267	18.3989	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4175	18.6189	19.0495	19.5678	19.8919	19.9980	20.0101	20.0107	19.9576	19.5541	18.9267	18.3989	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9850	0.9596	0.8787	0.7137	0.4647	0.3081	0.3366	0.6556	0.9160	0.9816	0.9936	(94)
Useful gains	1003.6565	1140.6767	1314.5309	1425.3558	1249.2194	859.8129	538.7274	537.3833	910.8674	1058.5604	990.8362	937.7664	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2533.8770	2484.0430	2251.0003	1874.6893	1376.4236	873.4295	540.1942	539.5151	973.1121	1515.9631	2043.8338	2491.0421	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1138.4841	902.7421	696.7332	323.5201	94.6399	0.0000	0.0000	0.0000	0.0000	340.3076	758.1583	1155.6371	(98)
Space heating												5410.2225	(98)
RHI space heating demand												5410	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.2500	
Infiltration rate		0.3686	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3133	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3994	0.3916	0.3838	0.3446	0.3368	0.2976	0.2976	0.2898	0.3133	0.3368	0.3525	0.3681	(22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5678	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3762	(36)
Total fabric heat loss					(33) + (36) =		117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	73.5507	73.1577	72.7724	70.9631	70.6246	69.0487	69.0487	68.7569	69.6557	70.6246	71.3094	72.0254	(38)
Heat transfer coeff	190.7078	190.3148	189.9295	188.1202	187.7817	186.2058	186.2058	185.9139	186.8128	187.7817	188.4665	189.1824	(39)
Average = Sum(39)m / 12 =												188.1186	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2796	1.2769	1.2744	1.2622	1.2599	1.2494	1.2494	1.2474	1.2534	1.2599	1.2645	1.2693	(40)
HLP (average)												1.2622	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327	(42)
Average daily hot water use (litres/day)	103.8511	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	10.6334	0.7200	0.7000	0.7700	7.5764	(74)
Northeast	14.4000	11.2829	0.7200	0.7000	0.7700	56.7477	(75)
East	2.0400	19.6403	0.7200	0.7000	0.7700	13.9940	(76)
Southeast	0.8200	36.7938	0.7200	0.7000	0.7700	10.5379	(77)
Southwest	8.7800	36.7938	0.7200	0.7000	0.7700	112.8323	(79)
Northwest	2.7900	11.2829	0.7200	0.7000	0.7700	10.9949	(81)

Solar gains	212.6832	389.8912	605.6535	869.5392	1081.3006	1120.3327	1060.6498	895.7454	696.0734	450.4883	259.8021	178.7252 (83)
Total gains	957.8585	1129.6215	1316.0728	1534.0916	1698.0732	1694.8616	1610.8583	1455.7492	1282.8007	1083.3199	943.9342	902.4563 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2715	54.3836	54.4939	55.0180	55.1172	55.5837	55.5837	55.6709	55.4031	55.1172	54.9169	54.7091	
alpha	4.6181	4.6256	4.6329	4.6679	4.6745	4.7056	4.7056	4.7114	4.6935	4.6745	4.6611	4.6473	
util living area													
	0.9973	0.9937	0.9827	0.9421	0.8351	0.6572	0.4980	0.5667	0.8263	0.9706	0.9945	0.9979	(86)
MIT	19.6275	19.8042	20.0999	20.4869	20.7972	20.9518	20.9894	20.9813	20.8584	20.4431	19.9624	19.5953	(87)
Th 2	19.8569	19.8589	19.8610	19.8706	19.8723	19.8807	19.8807	19.8823	19.8775	19.8723	19.8687	19.8649	(88)
util rest of house													
	0.9963	0.9916	0.9764	0.9210	0.7797	0.5605	0.3768	0.4392	0.7466	0.9559	0.9922	0.9972	(89)
MIT 2	18.0423	18.3012	18.7305	19.2819	19.6817	19.8505	19.8771	19.8750	19.7673	19.2339	18.5398	18.0009	(90)
Living area fraction										fLA = Living area / (4) =		0.1144	(91)
MIT	18.2237	18.4732	18.8872	19.4197	19.8094	19.9765	20.0044	20.0016	19.8922	19.3722	18.7026	18.1833	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2237	18.4732	18.8872	19.4197	19.8094	19.9765	20.0044	20.0016	19.8922	19.3722	18.7026	18.1833	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9942	0.9876	0.9690	0.9103	0.7761	0.5693	0.3905	0.4535	0.7478	0.9468	0.9886	0.9955	(94)
Useful gains	952.3197	1115.6331	1275.2122	1396.5490	1317.9347	964.9273	629.1125	660.1574	959.2838	1025.6821	933.1523	898.4325	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2655.3499	2583.1741	2352.6929	1978.9743	1522.7874	1001.1297	633.9106	669.5837	1082.0485	1647.2626	2186.6960	2645.3951	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1267.0545	986.1876	801.6457	419.3462	152.4104	0.0000	0.0000	0.0000	0.0000	462.4558	902.5515	1299.7402	(98)
Space heating												6291.3919	(98)
Space heating per m2											(98) / (4) =	42.2128	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6772.2195	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1267.0545	986.1876	801.6457	419.3462	152.4104	0.0000	0.0000	0.0000	0.0000	462.4558	902.5515	1299.7402	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1363.8907	1061.5582	862.9125	451.3953	164.0586	0.0000	0.0000	0.0000	0.0000	497.7996	971.5301	1399.0745	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4867	89.4420	89.3380	89.0567	88.3408	86.7000	86.7000	86.7000	86.7000	89.0938	89.3965	89.5062	(217)
Fuel for water heating, kWh/month													
	202.5432	177.6047	184.3668	162.4909	158.1091	140.4110	131.4911	148.9251	150.1179	168.5853	181.7960	196.5178	(219)
Water heating fuel used												2002.9590	(219)
Annual totals kWh/year													
Space heating fuel - main system												6772.2195	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1029 * 1.00) =										-905.6843		-905.6843	(233)
Total delivered energy for all uses												8449.3910	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6772.2195	3.4800	235.6732	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2002.9590	3.4800	69.7030	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	504.8968	13.1900	66.5959	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-905.6843	13.1900	-119.4598	(252)
Total energy cost			382.4048	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8277	(257)
SAP value		88.4534	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6772.2195	0.2160	1462.7994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2002.9590	0.2160	432.6391	(264)
Space and water heating			1895.4385	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-905.6843	0.5190	-470.0502	(269)
Total kg/year			1726.3548	(272)
CO2 emissions per m2			11.5800	(273)
EI value			88.0782	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8837 = 3.938, stars = 4
Water heating environmental impact	0.216 / 0.8837 = 0.2444, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.7600	(1b)	x 2.5400	(2b) =	192.4304	(1b) - (3b)
First floor	73.2800	(1c)	x 2.6200	(2c) =	191.9936	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	149.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	384.4240	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							6 * 10 =	60.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1561	(8)
Pressure test		Yes	
Measured/design AP50		4.2500	
Infiltration rate		0.3686	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3133	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3290	0.3055	0.3133	0.2976	0.2976	0.2898	0.2820	0.2741	0.2663	0.2898	0.2741	0.2898	(22b)
Effective ac	0.5541	0.5467	0.5491	0.5443	0.5443	0.5420	0.5398	0.5376	0.5355	0.5420	0.5376	0.5420	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			30.8700	1.2357	38.1473			(27)
Opening Type 16			5.9200	1.5000	8.8800			(26a)
Ground floor			75.7600	0.1900	14.3944			(28a)
External Wall	195.4300	36.7900	158.6400	0.2700	42.8328			(29a)
Main Roof	73.2800		73.2800	0.0700	5.1296			(30)
Bay Roof	2.4800		2.4800	0.1600	0.3968			(30)
Total net area of external elements Aum(A, m2)			346.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7809			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.3762	(36)
Total fabric heat loss (33) + (36) =	117.1571	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.2938	69.3483	69.6557	69.0487	69.0487	68.7569	68.4728	68.1965	67.9281	68.7569	68.1965	68.7569	(38)
Heat transfer coeff	187.4509	186.5054	186.8128	186.2058	186.2058	185.9139	185.6299	185.3536	185.0851	185.9139	185.3536	185.9139	(39)
Average = Sum(39)m / 12 =												186.0287	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2577	1.2514	1.2534	1.2494	1.2494	1.2474	1.2455	1.2437	1.2418	1.2474	1.2437	1.2474	(40)
HLP (average)												1.2482	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9327 (42)
Average daily hot water use (litres/day)	103.8511 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2363	110.0822	105.9282	101.7741	97.6201	93.4660	93.4660	97.6201	101.7741	105.9282	110.0822	114.2363	(44)
Energy conte	169.4091	148.1663	152.8943	133.2970	127.9016	110.3694	102.2734	117.3603	118.7619	138.4056	151.0805	164.0636	(45)
Energy content (annual)										Total = Sum(45)m =		1633.9829	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4114	22.2249	22.9341	19.9945	19.1852	16.5554	15.3410	17.6040	17.8143	20.7608	22.6621	24.6095	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8401	10.6870	11.8153	11.4121	11.7732	11.3669	11.7293	11.7578	11.3903	11.7935	11.4388	11.8320 (61)
Total heat required for water heating calculated for each month												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957 (64)
								Total per year (kWh/year) = Sum(64)m =				1772.8194 (64)
Heat gains from water heating, kWh/month												
	59.2885	51.9370	53.7912	47.1743	45.4706	39.5395	36.9382	41.9617	42.3359	48.9682	53.0940	57.5092 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	175.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	71.4734	63.4820	51.6270	39.0850	29.2165	24.6658	26.6523	34.6436	46.4986	59.0406	68.9091	73.4598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	476.8307	481.7787	469.3099	442.7652	409.2573	377.7647	356.7256	351.7776	364.2465	390.7911	424.2990	455.7916	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	55.5288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	-117.3072	(71)
Water heating gains (Table 5)													
	79.6889	77.2872	72.3000	65.5198	61.1164	54.9160	49.6482	56.4002	58.7999	65.8175	73.7416	77.2973	(72)
Total internal gains													
	745.1753	739.7303	710.4192	664.5524	616.7726	574.5289	550.2084	560.0038	586.7273	632.8316	684.1321	723.7311	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.0400	13.4839	0.7200	0.7000	0.7700	9.6075	(74)
Northeast	14.4000	14.6176	0.7200	0.7000	0.7700	73.5197	(75)
East	2.0400	25.1925	0.7200	0.7000	0.7700	17.9501	(76)
Southeast	0.8200	45.1778	0.7200	0.7000	0.7700	12.9391	(77)
Southwest	8.7800	45.1778	0.7200	0.7000	0.7700	138.5427	(79)
Northwest	2.7900	14.6176	0.7200	0.7000	0.7700	14.2444	(81)

Solar gains	266.8034	418.2880	659.5149	957.6384	1133.4727	1275.5324	1198.2556	1036.4108	802.5471	522.8046	325.2896	220.1169 (83)
Total gains	1011.9787	1158.0183	1369.9341	1622.1908	1750.2452	1850.0613	1748.4640	1596.4145	1389.2744	1155.6362	1009.4217	943.8480 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2145	55.4944	55.4031	55.5837	55.5837	55.6709	55.7561	55.8392	55.9202	55.6709	55.8392	55.6709	
alpha	4.6810	4.6996	4.6935	4.7056	4.7056	4.7114	4.7171	4.7226	4.7280	4.7114	4.7226	4.7114	
util living area													
	0.9960	0.9922	0.9765	0.9174	0.7809	0.5543	0.4102	0.4469	0.7463	0.9504	0.9907	0.9969	(86)
MIT	19.7578	19.8992	20.2098	20.5958	20.8663	20.9788	20.9959	20.9941	20.9199	20.5750	20.1152	19.7408	(87)
Th 2	19.8741	19.8791	19.8775	19.8807	19.8807	19.8823	19.8838	19.8852	19.8867	19.8823	19.8852	19.8823	(88)
util rest of house													
	0.9946	0.9895	0.9681	0.8885	0.7130	0.4540	0.2949	0.3223	0.6487	0.9256	0.9867	0.9958	(89)
MIT 2	18.2444	18.4535	18.8996	19.4351	19.7661	19.8713	19.8827	19.8837	19.8333	19.4222	18.7731	18.2256	(90)
Living area fraction									fLA = Living area / (4) =			0.1144	(91)
MIT	18.4175	18.6189	19.0495	19.5678	19.8919	19.9980	20.0101	20.0107	19.9576	19.5541	18.9267	18.3989	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4175	18.6189	19.0495	19.5678	19.8919	19.9980	20.0101	20.0107	19.9576	19.5541	18.9267	18.3989	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9850	0.9596	0.8787	0.7137	0.4647	0.3081	0.3366	0.6556	0.9160	0.9816	0.9936	(94)
Useful gains	1003.6565	1140.6767	1314.5309	1425.3558	1249.2194	859.8129	538.7274	537.3833	910.8674	1058.5604	990.8362	937.7664	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2533.8770	2484.0430	2251.0003	1874.6893	1376.4236	873.4295	540.1942	539.5151	973.1121	1515.9631	2043.8338	2491.0421	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1138.4841	902.7421	696.7332	323.5201	94.6399	0.0000	0.0000	0.0000	0.0000	340.3076	758.1583	1155.6371	(98)
Space heating												5410.2225	(98)
Space heating per m2											(98) / (4) =	36.3005	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5823.7056	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1138.4841	902.7421	696.7332	323.5201	94.6399	0.0000	0.0000	0.0000	0.0000	340.3076	758.1583	1155.6371	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1225.4942	971.7353	749.9820	348.2455	101.8729	0.0000	0.0000	0.0000	0.0000	366.3160	816.1015	1243.9581	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.2491	158.8532	164.7096	144.7091	139.6748	121.7363	114.0028	129.1181	130.1523	150.1991	162.5193	175.8957	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4466	89.4062	89.2700	88.8861	87.9647	86.7000	86.7000	86.7000	86.7000	88.8953	89.3181	89.4638	(217)
Fuel for water heating, kWh/month													
	202.6339	177.6758	184.5072	162.8029	158.7852	140.4110	131.4911	148.9251	150.1179	168.9618	181.9557	196.6110	(219)
Water heating fuel used												2004.8785	(219)
Annual totals kWh/year													
Space heating fuel - main system												5823.7056	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												504.8968	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1156 * 1.00) =										-1017.4830		-1017.4830	(233)
Total delivered energy for all uses												7390.9979	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5823.7056	7.3800	429.7895	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2004.8785	7.3800	147.9600	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	504.8968	28.6600	144.7034	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1017.4830	28.6600	-291.6106	(252)
Total energy cost			559.3373	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5823.7056	0.2160	1257.9204	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2004.8785	0.2160	433.0538	(264)
Space and water heating			1690.9742	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	504.8968	0.5190	262.0415	(268)
Energy saving/generation technologies				
PV Unit	-1017.4830	0.5190	-528.0737	(269)
Total kg/year			1463.8669	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5823.7056	1.2200	7104.9208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2004.8785	1.2200	2445.9518	(264)
Space and water heating			9550.8726	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	504.8968	3.0700	1550.0333	(268)
Energy saving/generation technologies				
PV Unit	-1017.4830	3.0700	-3123.6728	(269)
Primary energy kWh/year			8207.4831	(272)
Primary energy kWh/m2/year			55.0690	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 62	-199 kg (13.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£166	£166	£0
Mains gas	£685	£685	£0
Space heating	£558	£558	£0
Water heating	£148	£148	£0
Lighting	£145	£145	£0
Generated (PV)	-£292	-£292	£0
Total cost of fuels	£559	£559	£0
Total cost of uses	£559	£559	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1014.88 (P1)
Transmission heat loss coefficient	117.16 (37)
Summer heat loss coefficient	1132.04 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
North East	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.0400	87.1704	0.7200	0.7000	0.7650	61.7069
North East	14.4000	106.0502	0.7200	0.7000	0.7650	529.9178
East	2.0400	125.2818	0.7200	0.7000	0.7650	88.6855
South East	0.8200	127.3119	0.7200	0.7000	0.7650	36.2257
South West	8.7800	127.3119	0.7200	0.7000	0.7650	387.8804
North West	2.7900	106.0502	0.7200	0.7000	0.7650	102.6716
total:						1207.0880

	Jun	Jul	Aug	
Solar gains	1306	1207	1041	(P3)
Internal gains	572	547	557	
Total summer gains	1878	1754	1598	(P5)
Summer gain/loss ratio	1.66	1.55	1.41	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.31	19.10	18.96	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 438 - New BG	**Issued on Date**	07/08/2024
Assessment Reference	3	**Prop Type Ref**	
Property	39 Wren Walk, Boorley Green, Southhampton, SO32 2DX		

SAP Rating	88 B	**DER**	13.05	**TER**	16.82
Environmental	88 B	**% DER<TER**	22.42		
CO_2 Emissions (t/year)	1.40	**DFEE**	52.87	**TFEE**	60.83
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.08		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.05	$kgCO_2/m^2$	Pass
	-3.77 (-22.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.83	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.87	$kWh/m^2/yr$	
	-7.9 (-13.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.25 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	2.04 m², No overhang
Windows facing North East	14.40 m², No overhang
Windows facing East	2.04 m², No overhang
Windows facing South East	0.82 m², No overhang
Windows facing South West	8.78 m², No overhang
Windows facing North West	2.79 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.25 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Roof U-value	0.07	W/m²K
Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 439 -BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	89 B	**DER**	12.86	**TER**	16.73
Environmental	89 B	**% DER<TER**	23.11		
CO_2 Emissions (t/year)	1.19	**DFEE**	51.57	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 130 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.73 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.86 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.6 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.33 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.34 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North East:              9.36 m², No overhang
Windows facing South East:              7.62 m², No overhang
Windows facing South:                   1.02 m², No overhang
Windows facing South West:              6.90 m², No overhang
Windows facing West:                    1.02 m², No overhang
Windows facing North West:              0.48 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.022 W/m²K
Photovoltaic array                      1.10 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3658	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3964	0.3887	0.3809	0.3420	0.3343	0.2954	0.2954	0.2876	0.3109	0.3343	0.3498	0.3653	(22b)
Effective ac	0.5786	0.5755	0.5725	0.5585	0.5559	0.5436	0.5436	0.5414	0.5483	0.5559	0.5612	0.5667	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1555	63.8171	63.4855	61.9277	61.6362	60.2794	60.2794	60.0282	60.8021	61.6362	62.2258	62.8423	(38)
Heat transfer coeff	170.0682	169.7298	169.3982	167.8404	167.5489	166.1922	166.1922	165.9409	166.7148	167.5489	168.1385	168.7550	(39)
Average = Sum(39)m / 12 =												167.8390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3056	1.3030	1.3005	1.2885	1.2863	1.2758	1.2758	1.2739	1.2799	1.2863	1.2908	1.2955	(40)
HLP (average)												1.2885	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300	(61)
Total heat required for water heating calculated for each month													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Total per year (kWh/year) = Sum(64)m =												1758.9601	(64)
Heat gains from water heating, kWh/month													
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	473.2373	470.9610	453.7903	425.7873	396.7877	369.2547	351.6241	358.2139	372.8194	401.0579	433.5478	458.4586	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	11.2829	0.7200	0.7000	0.7700	36.8860	(75)
Southeast	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	6.9000	36.7938	0.7200	0.7000	0.7700	88.6723	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	0.4800	11.2829	0.7200	0.7000	0.7700	1.8916	(81)

Solar gains	249.0277	437.7427	634.3892	844.5483	998.7095	1014.5121	968.5290	850.1143	706.6941	493.4112	300.7601	211.5023	(83)
Total gains	722.2650	908.7037	1088.1795	1270.3356	1395.4972	1383.7667	1320.1531	1208.3282	1079.5135	894.4691	734.3079	669.9609	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1895	53.2955	53.3998	53.8955	53.9892	54.4300	54.4300	54.5124	54.2593	53.9892	53.7999	53.6034	
alpha	4.5460	4.5530	4.5600	4.5930	4.5993	4.6287	4.6287	4.6342	4.6173	4.5993	4.5867	4.5736	
util living area													
	0.9985	0.9956	0.9863	0.9532	0.8635	0.7006	0.5373	0.6018	0.8471	0.9768	0.9966	0.9990	(86)
MIT	19.5144	19.7178	20.0294	20.4233	20.7515	20.9336	20.9845	20.9745	20.8338	20.3888	19.8715	19.4788	(87)
Th 2	19.8364	19.8385	19.8405	19.8499	19.8516	19.8598	19.8598	19.8613	19.8566	19.8516	19.8481	19.8443	(88)
util rest of house													
	0.9980	0.9940	0.9812	0.9352	0.8125	0.6017	0.4064	0.4673	0.7705	0.9646	0.9952	0.9986	(89)
MIT 2	17.8633	18.1615	18.6151	19.1805	19.6125	19.8169	19.8544	19.8513	19.7246	19.1434	18.3936	17.8167	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.1708	18.4514	18.8785	19.4120	19.8247	20.0249	20.0649	20.0604	19.9312	19.3754	18.6688	18.1262	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1708	18.4514	18.8785	19.4120	19.8247	20.0249	20.0649	20.0604	19.9312	19.3754	18.6688	18.1262	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9911	0.9752	0.9263	0.8111	0.6172	0.4309	0.4922	0.7764	0.9575	0.9928	0.9977	(94)
Useful gains	719.9540	900.6442	1061.1818	1176.7633	1131.8324	854.0676	568.7960	594.6827	838.1439	856.4963	729.0431	668.4194	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2358.9879	2300.0732	2096.9007	1764.3314	1361.2796	901.5739	575.8381	607.4180	972.1509	1470.3057	1945.1651	2350.1207	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1219.4412	940.4162	770.5748	423.0490	170.7087	0.0000	0.0000	0.0000	0.0000	456.6741	875.6079	1251.1858	(98)
Space heating												6107.6578	(98)
Space heating per m2											(98) / (4) =	46.8882	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6574.4432	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1219.4412	940.4162	770.5748	423.0490	170.7087	0.0000	0.0000	0.0000	0.0000	456.6741	875.6079	1251.1858	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1312.6385	1012.2887	829.4670	455.3810	183.7554	0.0000	0.0000	0.0000	0.0000	491.5760	942.5273	1346.8092	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4756	89.4263	89.3232	89.0670	88.4374	86.7000	86.7000	86.7000	86.7000	89.0910	89.3870	89.4957	(217)
Fuel for water heating, kWh/month													
	200.9629	176.2312	182.9461	161.2033	156.7084	139.3302	130.4896	147.7758	148.9565	167.2736	180.3824	194.9866	(219)
Water heating fuel used												1987.2466	(219)
Annual totals kWh/year													
Space heating fuel - main system												6574.4432	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1004 * 1.00) =										-883.5167		-883.5167	(233)
Total delivered energy for all uses												8225.0848	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6574.4432	0.2160	1420.0797	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.2466	0.2160	429.2453	(264)
Space and water heating			1849.3250	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-883.5167	0.5190	-458.5451	(269)
Total CO2, kg/year			1674.6270	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.8600	ZC1
Total Floor Area	TFA	130.2600	
Assumed number of occupants	N	2.8957	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5582	ZC2
CO2 emissions from cooking, equation (L16)		1.4471	ZC3
Total CO2 emissions		27.8652	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.8652	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							4 * 10 =		40.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1190	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.3250	45.7026	47.2260	49.3250	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (64)
								Total per year (kWh/year) = Sum(64)m =				2209.5365 (64)
Heat gains from water heating, kWh/month												
	68.5914	60.3551	63.1467	56.2748	54.4985	47.8128	45.5245	51.0232	51.4828	58.3700	62.1378	66.8291 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	92.1927	89.8141	84.8746	78.1594	73.2507	66.4066	61.1889	68.5795	71.5039	78.4543	86.3024	89.8240	(72)
Total internal gains													
	486.3828	484.1091	466.9441	438.9486	409.4069	381.1777	363.5526	370.8383	385.9882	414.2189	446.7000	471.6068	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	11.2829	0.6300	0.7000	0.7700	32.2753	(75)
Southeast	7.6200	36.7938	0.6300	0.7000	0.7700	85.6844	(77)
South	1.0200	46.7521	0.6300	0.7000	0.7700	14.5738	(78)
Southwest	6.9000	36.7938	0.6300	0.7000	0.7700	77.5882	(79)
West	1.0200	19.6403	0.6300	0.7000	0.7700	6.1224	(80)
Northwest	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(81)

Solar gains	217.8992	383.0249	555.0905	738.9797	873.8708	887.6981	847.4629	743.8500	618.3573	431.7348	263.1651	185.0645 (83)
Total gains	704.2821	867.1340	1022.0346	1177.9284	1283.2778	1268.8757	1211.0155	1114.6882	1004.3455	845.9537	709.8650	656.6713 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area													
	0.9987	0.9963	0.9886	0.9603	0.8783	0.7180	0.5512	0.6144	0.8581	0.9797	0.9971	0.9991	(86)
MIT	19.5997	19.7854	20.0744	20.4449	20.7590	20.9369	20.9860	20.9769	20.8434	20.4226	19.9379	19.5680	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house													
	0.9983	0.9950	0.9844	0.9448	0.8318	0.6233	0.4242	0.4846	0.7865	0.9691	0.9958	0.9988	(89)
MIT 2	18.0294	18.3021	18.7234	19.2582	19.6761	19.8792	19.9159	19.9131	19.7905	19.2364	18.5325	17.9887	(90)
Living area fraction										fLA = Living area / (4) =		0.1862	(91)
MIT	18.3219	18.5783	18.9750	19.4792	19.8778	20.0762	20.1152	20.1113	19.9866	19.4573	18.7942	18.2829	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3219	18.5783	18.9750	19.4792	19.8778	20.0762	20.1152	20.1113	19.9866	19.4573	18.7942	18.2829	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9927	0.9794	0.9369	0.8300	0.6381	0.4479	0.5086	0.7919	0.9628	0.9938	0.9980	(94)
Useful gains	702.3547	860.7662	1001.0084	1103.6480	1065.1393	809.6817	542.4329	566.8826	795.3381	814.5171	705.4905	655.3727	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2244.8062	2185.0983	1988.6628	1669.6797	1288.2375	855.0992	548.8985	578.5579	922.3195	1395.2870	1849.2048	2235.7491	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1147.5839	889.9512	734.8149	407.5428	165.9851	0.0000	0.0000	0.0000	0.0000	432.0928	823.4743	1175.8000	(98)
Space heating												5777.2450	(98)
Space heating per m2											(98) / (4) =	44.3516	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6185.4871	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1147.5839	889.9512	734.8149	407.5428	165.9851	0.0000	0.0000	0.0000	0.0000	432.0928	823.4743	1175.8000	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1228.6765	952.8385	786.7397	436.3413	177.7142	0.0000	0.0000	0.0000	0.0000	462.6261	881.6642	1258.8866	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6143	88.4185	88.0080	87.0274	84.9020	80.3000	80.3000	80.3000	80.3000	87.0771	88.2389	88.6849	(217)
Fuel for water heating, kWh/month													
	247.0637	218.2113	230.1596	208.5361	207.4671	193.1975	185.0979	206.3408	208.0592	216.1220	225.6561	240.8906	(219)
Water heating fuel used												2586.8020	(219)
Annual totals kWh/year													
Space heating fuel - main system												6185.4871	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Total delivered energy for all uses												9319.2008	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6185.4871	0.2160	1336.0652	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.8020	0.2160	558.7492	(264)
Space and water heating			1894.8144	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Total CO2, kg/m2/year			2178.6616	(272)
Emissions per m2 for space and water heating			14.5464	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8803	(272b)
Emissions per m2 for pumps and fans			0.2988	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5464 * 1.00) + 1.8803 + 0.2988, rounded to 2 d.p.			16.7300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1190	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3360	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3642	0.3570	0.3499	0.3142	0.3071	0.2714	0.2714	0.2642	0.2856	0.3071	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5494	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.7953	62.5098	62.2299	60.9153	60.6693	59.5243	59.5243	59.3123	59.9654	60.6693	61.1669	61.6871	(38)
Heat transfer coeff	168.7080	168.4225	168.1426	166.8280	166.5820	165.4370	165.4370	165.2250	165.8781	166.5820	167.0796	167.5998	(39)
Average = Sum(39)m / 12 =												166.8268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2952	1.2930	1.2908	1.2807	1.2788	1.2701	1.2701	1.2684	1.2734	1.2788	1.2827	1.2867	(40)
HLP (average)												1.2807	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264 (71)

Water heating gains (Table 5)

	47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629 (72)

Total internal gains

	439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	11.2829	0.7200	0.7000	0.7700	36.8860	(75)
Southeast	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	6.9000	36.7938	0.7200	0.7000	0.7700	88.6723	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	0.4800	11.2829	0.7200	0.7000	0.7700	1.8916	(81)

Solar gains	249.0277	437.7427	634.3892	844.5483	998.7095	1014.5121	968.5290	850.1143	706.6941	493.4112	300.7601	211.5023	(83)
Total gains	688.1945	875.4943	1056.7584	1241.3455	1368.0875	1358.5816	1296.8566	1182.6095	1052.9329	865.3723	702.3699	636.7479	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6183	53.7092	53.7986	54.2225	54.3026	54.6784	54.6784	54.7486	54.5330	54.3026	54.1409	53.9728	
alpha	4.5746	4.5806	4.5866	4.6148	4.6202	4.6452	4.6452	4.6499	4.6355	4.6202	4.6094	4.5982	
util living area	0.9988	0.9962	0.9876	0.9563	0.8691	0.7078	0.5438	0.6106	0.8551	0.9793	0.9972	0.9992	(86)
MIT	19.5038	19.7074	20.0198	20.4144	20.7462	20.9314	20.9840	20.9733	20.8278	20.3766	19.8581	19.4668	(87)
Th 2	19.8446	19.8463	19.8480	19.8560	19.8574	19.8644	19.8644	19.8657	19.8617	19.8574	19.8544	19.8513	(88)
util rest of house	0.9984	0.9948	0.9830	0.9393	0.8193	0.6093	0.4122	0.4755	0.7805	0.9684	0.9960	0.9989	(89)
MIT 2	18.4851	18.6895	19.0006	19.3899	19.6898	19.8339	19.8605	19.8584	19.7673	19.3614	18.8467	18.4534	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.6749	18.8791	19.1904	19.5807	19.8865	20.0383	20.0698	20.0660	19.9648	19.5505	19.0351	18.6421	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6749	18.8791	19.1904	19.5807	19.8865	20.0383	20.0698	20.0660	19.9648	19.5505	19.0351	18.6421	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9932	0.9795	0.9341	0.8208	0.6257	0.4370	0.5008	0.7885	0.9643	0.9947	0.9984	(94)
Useful gains	686.6431	869.5499	1035.0819	1159.5788	1122.8645	850.0557	566.6965	592.2463	830.2831	834.5170	698.6516	635.7364	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2425.1557	2354.3884	2133.7976	1781.8427	1363.7273	899.7026	574.0289	605.7180	972.8423	1490.9889	1994.1095	2420.4995	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1293.4534	997.8115	817.4445	448.0300	179.2019	0.0000	0.0000	0.0000	0.0000	488.4151	932.7297	1327.8637	(98)
Space heating												6484.9498	(98)
Space heating per m2											(98) / (4) =	49.7847	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1555.1082	1224.2341	1255.7100	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8589	0.9181	0.8877	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1335.6221	1123.9763	1114.6709	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1706.7386	1631.8873	1500.6064	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	267.2038	377.8858	287.1360	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												932.2256 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	66.8010	94.4715	71.7840	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												233.0564 (107)
Space cooling per m2												1.7892 (108)
Energy for space heating												49.7847 (99)
Energy for space cooling												1.7892 (108)
Total												51.5738 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1190	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264 (71)

Water heating gains (Table 5)

	47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629 (72)

Total internal gains

	439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	11.2829	0.6300	0.7000	0.7700	32.2753	(75)
Southeast	7.6200	36.7938	0.6300	0.7000	0.7700	85.6844	(77)
South	1.0200	46.7521	0.6300	0.7000	0.7700	14.5738	(78)
Southwest	6.9000	36.7938	0.6300	0.7000	0.7700	77.5882	(79)
West	1.0200	19.6403	0.6300	0.7000	0.7700	6.1224	(80)
Northwest	0.4800	11.2829	0.6300	0.7000	0.7700	1.6551	(81)

Solar gains	217.8992	383.0249	555.0905	738.9797	873.8708	887.6981	847.4629	743.8500	618.3573	431.7348	263.1651	185.0645	(83)
Total gains	657.0661	820.7765	977.4597	1135.7770	1243.2489	1231.7676	1175.7905	1076.3452	964.5962	803.6959	664.7748	610.3101	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area	0.9991	0.9971	0.9905	0.9652	0.8887	0.7329	0.5657	0.6323	0.8726	0.9834	0.9978	0.9993	(86)
MIT	19.5663	19.7530	20.0444	20.4200	20.7431	20.9310	20.9844	20.9739	20.8291	20.3952	19.9062	19.5351	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house	0.9987	0.9960	0.9870	0.9513	0.8445	0.6386	0.4364	0.5006	0.8048	0.9745	0.9968	0.9991	(89)
MIT 2	18.5885	18.7765	19.0675	19.4421	19.7386	19.8894	19.9171	19.9152	19.8211	19.4248	18.9376	18.5638	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.7706	18.9583	19.2495	19.6242	19.9257	20.0834	20.1159	20.1124	20.0089	19.6055	19.1180	18.7447	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7706	18.9583	19.2495	19.6242	19.9257	20.0834	20.1159	20.1124	20.0089	19.6055	19.1180	18.7447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9948	0.9841	0.9467	0.8451	0.6541	0.4607	0.5252	0.8116	0.9711	0.9958	0.9988	(94)
Useful gains	655.9063	816.5049	961.9328	1075.2411	1050.6718	805.6801	541.6995	565.3306	782.8452	780.4320	662.0154	609.5526	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2316.6550	2245.8063	2032.4111	1692.5601	1295.7892	856.2182	548.9978	578.7285	925.8026	1418.6328	1900.4027	2309.0744	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1235.5970	960.4906	796.4358	444.4696	182.3674	0.0000	0.0000	0.0000	0.0000	474.8213	891.6389	1264.4442	(98)
Space heating												6250.2647	(98)
Space heating per m2											(98) / (4) =	47.9830	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1467.7953	1155.4984	1184.7846	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8533	0.9159	0.8853	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1252.4534	1058.3048	1048.9126	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1558.5144	1490.3814	1376.4014	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	220.3640	321.4650	243.6517	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												785.4807 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	55.0910	80.3663	60.9129	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												196.3702 (107)
Space cooling per m2												1.5075 (108)
Energy for space heating												47.9830 (99)
Energy for space cooling												1.5075 (108)
Total												49.4905 (109)
Target Fabric Energy Efficiency (TFEE)												56.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3658	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3265	0.3032	0.3109	0.2954	0.2954	0.2876	0.2798	0.2721	0.2643	0.2876	0.2721	0.2876	(22b)
Effective ac	0.5533	0.5460	0.5483	0.5436	0.5436	0.5414	0.5392	0.5370	0.5349	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.3515	60.5374	60.8021	60.2794	60.2794	60.0282	59.7836	59.5458	59.3146	60.0282	59.5458	60.0282	(38)
Heat transfer coeff	167.2642	166.4501	166.7148	166.1922	166.1922	165.9409	165.6963	165.4585	165.2273	165.9409	165.4585	165.9409	(39)
Average = Sum(39)m / 12 =												166.0397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2841	1.2778	1.2799	1.2758	1.2758	1.2739	1.2720	1.2702	1.2684	1.2739	1.2702	1.2739	(40)
HLP (average)												1.2747	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
RHI water heating demand												1759 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	14.6176	0.7200	0.7000	0.7700	47.7878	(75)
Southeast	7.6200	45.1778	0.7200	0.7000	0.7700	120.2386	(77)
South	1.0200	56.7559	0.7200	0.7000	0.7700	20.2197	(78)
Southwest	6.9000	45.1778	0.7200	0.7000	0.7700	108.8775	(79)
West	1.0200	25.1925	0.7200	0.7000	0.7700	8.9750	(80)
Northwest	0.4800	14.6176	0.7200	0.7000	0.7700	2.4507	(81)

Solar gains	308.5493	462.6840	679.4237	916.2390	1034.5564	1143.4632	1082.3488	970.1375	801.5350	563.6140	371.6427	257.4846	(83)
Total gains	1015.4097	1164.3097	1353.3919	1546.9988	1620.4668	1689.5935	1605.4858	1502.8225	1359.3123	1164.8352	1021.2036	944.2033	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0811	54.3456	54.2593	54.4300	54.4300	54.5124	54.5928	54.6713	54.7478	54.5124	54.6713	54.5124	
alpha	4.6054	4.6230	4.6173	4.6287	4.6287	4.6342	4.6395	4.6448	4.6499	4.6342	4.6448	4.6342	
util living area													
	0.9930	0.9867	0.9644	0.8971	0.7617	0.5424	0.3990	0.4245	0.6992	0.9240	0.9837	0.9946	(86)
MIT	19.8143	19.9681	20.2754	20.6311	20.8743	20.9793	20.9960	20.9948	20.9361	20.6356	20.1795	19.7901	(87)
Th 2	19.8533	19.8582	19.8566	19.8598	19.8598	19.8613	19.8628	19.8642	19.8656	19.8613	19.8642	19.8613	(88)
util rest of house													
	0.9906	0.9822	0.9523	0.8633	0.6915	0.4419	0.2845	0.3035	0.5990	0.8899	0.9771	0.9928	(89)
MIT 2	18.3119	18.5377	18.9751	19.4612	19.7538	19.8508	19.8618	19.8629	19.8250	19.4818	18.8497	18.2826	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.5918	18.8041	19.2172	19.6790	19.9625	20.0609	20.0730	20.0737	20.0319	19.6967	19.0974	18.5634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5918	18.8041	19.2172	19.6790	19.9625	20.0609	20.0730	20.0737	20.0319	19.6967	19.0974	18.5634	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9867	0.9764	0.9435	0.8570	0.6984	0.4601	0.3059	0.3262	0.6149	0.8837	0.9708	0.9896	(94)
Useful gains	1001.9187	1136.8119	1276.9124	1325.7926	1131.7361	777.4438	491.1965	490.1754	835.8217	1029.3766	991.3552	934.3437	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2290.1393	2247.7560	2036.7941	1691.6762	1240.2118	790.0337	492.6201	492.0298	880.9805	1376.7559	1852.6981	2250.7195	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	958.4362	746.5545	565.3520	263.4362	80.7059	0.0000	0.0000	0.0000	0.0000	258.4502	620.1669	979.3836	(98)
Space heating												4472.4854	(98)
RHI space heating demand												4472	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3658	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3964	0.3887	0.3809	0.3420	0.3343	0.2954	0.2954	0.2876	0.3109	0.3343	0.3498	0.3653	(22b)
Effective ac	0.5786	0.5755	0.5725	0.5585	0.5559	0.5436	0.5436	0.5414	0.5483	0.5559	0.5612	0.5667	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1555	63.8171	63.4855	61.9277	61.6362	60.2794	60.2794	60.0282	60.8021	61.6362	62.2258	62.8423	(38)
Heat transfer coeff	170.0682	169.7298	169.3982	167.8404	167.5489	166.1922	166.1922	165.9409	166.7148	167.5489	168.1385	168.7550	(39)
Average = Sum(39)m / 12 =												167.8390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3056	1.3030	1.3005	1.2885	1.2863	1.2758	1.2758	1.2739	1.2799	1.2863	1.2908	1.2955	(40)
HLP (average)												1.2885	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	11.2829	0.7200	0.7000	0.7700	36.8860	(75)
Southeast	7.6200	36.7938	0.7200	0.7000	0.7700	97.9250	(77)
South	1.0200	46.7521	0.7200	0.7000	0.7700	16.6558	(78)
Southwest	6.9000	36.7938	0.7200	0.7000	0.7700	88.6723	(79)
West	1.0200	19.6403	0.7200	0.7000	0.7700	6.9970	(80)
Northwest	0.4800	11.2829	0.7200	0.7000	0.7700	1.8916	(81)

Solar gains	249.0277	437.7427	634.3892	844.5483	998.7095	1014.5121	968.5290	850.1143	706.6941	493.4112	300.7601	211.5023 (83)
Total gains	955.8881	1139.3684	1308.3574	1475.3080	1584.6200	1560.6424	1491.6660	1382.7993	1264.4714	1094.6325	950.3210	898.2210 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1895	53.2955	53.3998	53.8955	53.9892	54.4300	54.4300	54.5124	54.2593	53.9892	53.7999	53.6034	
alpha	4.5460	4.5530	4.5600	4.5930	4.5993	4.6287	4.6287	4.6342	4.6173	4.5993	4.5867	4.5736	
util living area													
	0.9953	0.9891	0.9727	0.9243	0.8144	0.6399	0.4808	0.5357	0.7810	0.9527	0.9904	0.9964	(86)
MIT	19.6758	19.8737	20.1694	20.5308	20.8117	20.9542	20.9901	20.9841	20.8854	20.5078	20.0187	19.6374	(87)
Th 2	19.8364	19.8385	19.8405	19.8499	19.8516	19.8598	19.8598	19.8613	19.8566	19.8516	19.8481	19.8443	(88)
util rest of house													
	0.9937	0.9854	0.9634	0.8984	0.7555	0.5426	0.3611	0.4112	0.6940	0.9308	0.9865	0.9952	(89)
MIT 2	18.0986	18.3871	18.8133	19.3220	19.6779	19.8316	19.8565	19.8554	19.7718	19.3043	18.6064	18.0481	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.3923	18.6639	19.0659	19.5471	19.8891	20.0407	20.0676	20.0656	19.9792	19.5284	18.8695	18.3440	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3923	18.6639	19.0659	19.5471	19.8891	20.0407	20.0676	20.0656	19.9792	19.5284	18.8695	18.3440	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9801	0.9551	0.8900	0.7577	0.5589	0.3834	0.4343	0.7045	0.9228	0.9817	0.9928	(94)
Useful gains	947.0304	1116.7475	1249.6432	1313.0812	1200.6452	872.3120	571.9406	600.6168	890.7942	1010.1123	932.9485	891.7795	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2396.6510	2336.1481	2128.6350	1787.0161	1372.0705	904.1961	576.2944	608.2695	980.1538	1495.9439	1978.8989	2386.8783	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1078.5177	819.4372	653.9699	341.2331	127.5405	0.0000	0.0000	0.0000	0.0000	361.4587	753.0843	1112.3535	(98)
Space heating												5247.5949	(98)
Space heating per m2											(98) / (4) =	40.2855	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5648.6490	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1078.5177	819.4372	653.9699	341.2331	127.5405	0.0000	0.0000	0.0000	0.0000	361.4587	753.0843	1112.3535	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1160.9448	882.0637	703.9504	367.3123	137.2879	0.0000	0.0000	0.0000	0.0000	389.0836	810.6397	1197.3665	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4283	89.3680	89.2415	88.9280	88.2047	86.7000	86.7000	86.7000	86.7000	88.9417	89.3186	89.4523	(217)
Fuel for water heating, kWh/month													
	201.0691	176.3462	183.1135	161.4553	157.1219	139.3302	130.4896	147.7758	148.9565	167.5543	180.5204	195.0812	(219)
Water heating fuel used												1988.8142	(219)
Annual totals kWh/year													
Space heating fuel - main system												5648.6490	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1004 * 1.00) =										-883.5167		-883.5167	(233)
Total delivered energy for all uses												7300.8582	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5648.6490	3.4800	196.5730	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1988.8142	3.4800	69.2107	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	471.9117	13.1900	62.2452	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-883.5167	13.1900	-116.5358	(252)
Total energy cost			341.3855	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8181	(257)
SAP value		88.5874	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5648.6490	0.2160	1220.1082	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1988.8142	0.2160	429.5839	(264)
Space and water heating			1649.6921	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-883.5167	0.5190	-458.5451	(269)
Total kg/year			1474.9941	(272)
CO2 emissions per m2			11.3200	(273)
EI value			88.7225	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8831 = 3.941, stars = 4
Water heating environmental impact	0.216 / 0.8831 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3658	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3265	0.3032	0.3109	0.2954	0.2954	0.2876	0.2798	0.2721	0.2643	0.2876	0.2721	0.2876	(22b)
Effective ac	0.5533	0.5460	0.5483	0.5436	0.5436	0.5414	0.5392	0.5370	0.5349	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.3515	60.5374	60.8021	60.2794	60.2794	60.0282	59.7836	59.5458	59.3146	60.0282	59.5458	60.0282	(38)
Heat transfer coeff	167.2642	166.4501	166.7148	166.1922	166.1922	165.9409	165.6963	165.4585	165.2273	165.9409	165.4585	165.9409	(39)
Average = Sum(39)m / 12 =												166.0397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2841	1.2778	1.2799	1.2758	1.2758	1.2739	1.2720	1.2702	1.2684	1.2739	1.2702	1.2739	(40)
HLP (average)												1.2747	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.3600	14.6176	0.7200	0.7000	0.7700	47.7878	(75)
Southeast	7.6200	45.1778	0.7200	0.7000	0.7700	120.2386	(77)
South	1.0200	56.7559	0.7200	0.7000	0.7700	20.2197	(78)
Southwest	6.9000	45.1778	0.7200	0.7000	0.7700	108.8775	(79)
West	1.0200	25.1925	0.7200	0.7000	0.7700	8.9750	(80)
Northwest	0.4800	14.6176	0.7200	0.7000	0.7700	2.4507	(81)

Solar gains	308.5493	462.6840	679.4237	916.2390	1034.5564	1143.4632	1082.3488	970.1375	801.5350	563.6140	371.6427	257.4846 (83)
Total gains	1015.4097	1164.3097	1353.3919	1546.9988	1620.4668	1689.5935	1605.4858	1502.8225	1359.3123	1164.8352	1021.2036	944.2033 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0811	54.3456	54.2593	54.4300	54.4300	54.5124	54.5928	54.6713	54.7478	54.5124	54.6713	54.5124	
alpha	4.6054	4.6230	4.6173	4.6287	4.6287	4.6342	4.6395	4.6448	4.6499	4.6342	4.6448	4.6342	
util living area													
	0.9930	0.9867	0.9644	0.8971	0.7617	0.5424	0.3990	0.4245	0.6992	0.9240	0.9837	0.9946	(86)
MIT	19.8143	19.9681	20.2754	20.6311	20.8743	20.9793	20.9960	20.9948	20.9361	20.6356	20.1795	19.7901	(87)
Th 2	19.8533	19.8582	19.8566	19.8598	19.8598	19.8613	19.8628	19.8642	19.8656	19.8613	19.8642	19.8613	(88)
util rest of house													
	0.9906	0.9822	0.9523	0.8633	0.6915	0.4419	0.2845	0.3035	0.5990	0.8899	0.9771	0.9928	(89)
MIT 2	18.3119	18.5377	18.9751	19.4612	19.7538	19.8508	19.8618	19.8629	19.8250	19.4818	18.8497	18.2826	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.5918	18.8041	19.2172	19.6790	19.9625	20.0609	20.0730	20.0737	20.0319	19.6967	19.0974	18.5634	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5918	18.8041	19.2172	19.6790	19.9625	20.0609	20.0730	20.0737	20.0319	19.6967	19.0974	18.5634	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9867	0.9764	0.9435	0.8570	0.6984	0.4601	0.3059	0.3262	0.6149	0.8837	0.9708	0.9896	(94)
Useful gains	1001.9187	1136.8119	1276.9124	1325.7926	1131.7361	777.4438	491.1965	490.1754	835.8217	1029.3766	991.3552	934.3437	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2290.1393	2247.7560	2036.7941	1691.6762	1240.2118	790.0337	492.6201	492.0298	880.9805	1376.7559	1852.6981	2250.7195	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	958.4362	746.5545	565.3520	263.4362	80.7059	0.0000	0.0000	0.0000	0.0000	258.4502	620.1669	979.3836	(98)
Space heating												4472.4854	(98)
Space heating per m2											(98) / (4) =	34.3351	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4814.3007	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	958.4362	746.5545	565.3520	263.4362	80.7059	0.0000	0.0000	0.0000	0.0000	258.4502	620.1669	979.3836	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1031.6859	803.6108	608.5597	283.5696	86.8740	0.0000	0.0000	0.0000	0.0000	278.2025	667.5639	1054.2342	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3789	89.3253	89.1621	88.7445	87.8508	86.7000	86.7000	86.7000	86.7000	88.7026	89.2205	89.4010	(217)
Fuel for water heating, kWh/month													
	201.1804	176.4303	183.2766	161.7890	157.7547	139.3302	130.4896	147.7758	148.9565	168.0059	180.7190	195.1932	(219)
Water heating fuel used												1990.9013	(219)
Annual totals kWh/year													
Space heating fuel - main system												4814.3007	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1122 * 1.00) =										-987.2902		-987.2902	(233)
Total delivered energy for all uses												6364.8235	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4814.3007	7.3800	355.2954	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1990.9013	7.3800	146.9285	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	471.9117	28.6600	135.2499	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-987.2902	28.6600	-282.9574	(252)
Total energy cost			483.0114	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4814.3007	0.2160	1039.8890	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.9013	0.2160	430.0347	(264)
Space and water heating			1469.9236	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-987.2902	0.5190	-512.4036	(269)
Total kg/year			1241.3672	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4814.3007	1.2200	5873.4469	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.9013	1.2200	2428.8995	(264)
Space and water heating			8302.3464	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	471.9117	3.0700	1448.7689	(268)
Energy saving/generation technologies				
PV Unit	-987.2902	3.0700	-3030.9808	(269)
Primary energy kWh/year			6950.3846	(272)
Primary energy kWh/m2/year			53.3578	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 62	-198 kg (15.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£157	£0
Mains gas	£609	£609	£0
Space heating	£484	£484	£0
Water heating	£147	£147	£0
Lighting	£135	£135	£0
Generated (PV)	-£283	-£283	£0
Total cost of fuels	£483	£483	£0
Total cost of uses	£483	£483	£0
Delivered energy	49 kWh/m²	49 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	53 kWh/m²	53 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	887.07 (P1)
Transmission heat loss coefficient	105.91 (37)
Summer heat loss coefficient	992.98 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
South	0.000	1.000	None
South West	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.850	0.90	1.000	0.765 (P8)
South East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
South West	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	9.3600	106.0502	0.7200	0.7000	0.7650	344.4466
South East	7.6200	127.3119	0.7200	0.7000	0.7650	336.6343
South	1.0200	118.5567	0.7200	0.7000	0.7650	41.9624
South West	6.9000	127.3119	0.7200	0.7000	0.7650	304.8263
West	1.0200	125.2818	0.7200	0.7000	0.7650	44.3427
North West	0.4800	106.0502	0.7200	0.7000	0.7650	17.6639
total:						1089.8762

	Jun	Jul	Aug	
Solar gains	1170	1090	974	(P3)
Internal gains	543	520	530	
Total summer gains	1714	1610	1503	(P5)
Summer gain/loss ratio	1.73	1.62	1.51	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.38	19.17	19.06	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 439 -BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	2 Pheasant Road, BOTLEY, SO32 2DY		

SAP Rating	89 B	**DER**	12.86	**TER**	16.73
Environmental	89 B	**% DER<TER**	23.11		
CO_2 Emissions (t/year)	1.19	**DFEE**	51.57	**TFEE**	56.91
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.38		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.73	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.86	$kgCO_2/m^2$	Pass
	-3.87 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.91	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.57	$kWh/m^2/yr$	
	-5.3 (-9.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	9.36 m², No overhang
Windows facing South East	7.62 m², No overhang
Windows facing South	1.02 m², No overhang
Windows facing South West	6.90 m², No overhang
Windows facing West	1.02 m², No overhang
Windows facing North West	0.48 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 440 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 440	**Prop Type Ref**	
Property	4 Pheasant Road, Boorley Green, Southampton, SO32 2DY		

SAP Rating	88 B	**DER**	13.52	**TER**	16.85
Environmental	88 B	**% DER<TER**	19.74		
CO_2 Emissions (t/year)	1.33	**DFEE**	52.00	**TFEE**	57.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 130 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.52 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.34 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.90 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 7.62 m², No overhang
Windows facing South: 9.36 m², No overhang
Windows facing West: 0.48 m², No overhang
Windows facing North West: 1.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3658	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3964	0.3887	0.3809	0.3420	0.3343	0.2954	0.2954	0.2876	0.3109	0.3343	0.3498	0.3653	(22b)
Effective ac	0.5786	0.5755	0.5725	0.5585	0.5559	0.5436	0.5436	0.5414	0.5483	0.5559	0.5612	0.5667	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1555	63.8171	63.4855	61.9277	61.6362	60.2794	60.2794	60.0282	60.8021	61.6362	62.2258	62.8423	(38)
Heat transfer coeff	170.0682	169.7298	169.3982	167.8404	167.5489	166.1922	166.1922	165.9409	166.7148	167.5489	168.1385	168.7550	(39)
Average = Sum(39)m / 12 =												167.8390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3056	1.3030	1.3005	1.2885	1.2863	1.2758	1.2758	1.2739	1.2799	1.2863	1.2908	1.2955	(40)
HLP (average)												1.2885	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300	(61)
Total heat required for water heating calculated for each month													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601	(64)
Heat gains from water heating, kWh/month													
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	473.2373	470.9610	453.7903	425.7873	396.7877	369.2547	351.6241	358.2139	372.8194	401.0579	433.5478	458.4586	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908	(83)
Total gains	715.3084	895.3083	1064.3530	1229.3216	1337.4221	1320.3335	1261.4337	1163.5114	1050.0735	878.3163	725.7277	664.1494	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1895	53.2955	53.3998	53.8955	53.9892	54.4300	54.4300	54.5124	54.2593	53.9892	53.7999	53.6034	
alpha	4.5460	4.5530	4.5600	4.5930	4.5993	4.6287	4.6287	4.6342	4.6173	4.5993	4.5867	4.5736	
util living area													
	0.9986	0.9958	0.9874	0.9581	0.8780	0.7238	0.5592	0.6208	0.8573	0.9783	0.9968	0.9990	(86)
MIT	19.5095	19.7086	20.0138	20.4001	20.7298	20.9239	20.9818	20.9711	20.8238	20.3786	19.8656	19.4747	(87)
Th 2	19.8364	19.8385	19.8405	19.8499	19.8516	19.8598	19.8598	19.8613	19.8566	19.8516	19.8481	19.8443	(88)
util rest of house													
	0.9981	0.9943	0.9827	0.9416	0.8299	0.6253	0.4245	0.4840	0.7831	0.9668	0.9954	0.9986	(89)
MIT 2	17.8563	18.1482	18.5927	19.1492	19.5880	19.8097	19.8534	19.8497	19.7149	19.1294	18.3849	17.8107	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.1642	18.4388	18.8574	19.3821	19.8006	20.0172	20.0635	20.0585	19.9214	19.3620	18.6607	18.1206	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1642	18.4388	18.8574	19.3821	19.8006	20.0172	20.0635	20.0585	19.9214	19.3620	18.6607	18.1206	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9916	0.9770	0.9329	0.8274	0.6402	0.4497	0.5092	0.7881	0.9599	0.9931	0.9978	(94)
Useful gains	713.1046	887.7913	1039.8409	1146.8376	1106.5792	845.2470	567.2237	592.4821	827.6110	843.1053	720.7499	662.6735	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2357.8560	2297.9376	2093.3204	1759.3272	1357.2542	900.2932	575.6107	607.1025	970.5210	1468.0704	1943.7998	2349.1781	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1223.6950	947.6183	783.7887	440.9925	186.5021	0.0000	0.0000	0.0000	0.0000	464.9741	880.5959	1254.7594	(98)
Space heating												6182.9261	(98)
Space heating per m2											(98) / (4) =	47.4660	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6655.4640	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1223.6950	947.6183	783.7887	440.9925	186.5021	0.0000	0.0000	0.0000	0.0000	464.9741	880.5959	1254.7594	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1317.2174	1020.0413	843.6907	474.6959	200.7558	0.0000	0.0000	0.0000	0.0000	500.5103	947.8966	1350.6560	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4769	89.4293	89.3312	89.0923	88.5074	86.7000	86.7000	86.7000	86.7000	89.1018	89.3894	89.4967	(217)
Fuel for water heating, kWh/month													
	200.9600	176.2251	182.9297	161.1574	156.5845	139.3302	130.4896	147.7758	148.9565	167.2532	180.3775	194.9844	(219)
Water heating fuel used												1987.0241	(219)
Annual totals kWh/year													
Space heating fuel - main system												6655.4640	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												8438.7335	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6655.4640	0.2160	1437.5802	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.0241	0.2160	429.1972	(264)
Space and water heating			1866.7774	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1761.0288	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5200	ZC1
Total Floor Area	TFA	130.2600	
Assumed number of occupants	N	2.8957	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5582	ZC2
CO2 emissions from cooking, equation (L16)		1.4471	ZC3
Total CO2 emissions		28.5252	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.5252	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							4 * 10 =		40.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1190	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.3250	45.7026	47.2260	49.3250	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (64)
								Total per year (kWh/year) = Sum(64)m =				2209.5365 (64)
Heat gains from water heating, kWh/month												
	68.5914	60.3551	63.1467	56.2748	54.4985	47.8128	45.5245	51.0232	51.4828	58.3700	62.1378	66.8291 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	92.1927	89.8141	84.8746	78.1594	73.2507	66.4066	61.1889	68.5795	71.5039	78.4543	86.3024	89.8240	(72)
Total internal gains													
	486.3828	484.1091	466.9441	438.9486	409.4069	381.1777	363.5526	370.8383	385.9882	414.2189	446.7000	471.6068	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.6300	0.7000	0.7700	22.4229	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(76)
South	9.3600	46.7521	0.6300	0.7000	0.7700	133.7360	(78)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	211.8121	371.3039	534.2423	703.0925	823.0551	832.1940	796.0834	704.6353	592.5974	417.6012	255.6574	179.9795 (83)
Total gains	698.1950	855.4130	1001.1864	1142.0412	1232.4620	1213.3717	1159.6360	1075.4736	978.5856	831.8200	702.3574	651.5862 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area													
	0.9988	0.9965	0.9896	0.9645	0.8915	0.7404	0.5726	0.6327	0.8675	0.9810	0.9972	0.9991	(86)
MIT	19.5954	19.7773	20.0604	20.4238	20.7387	20.9278	20.9835	20.9738	20.8342	20.4135	19.9327	19.5644	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house													
	0.9983	0.9953	0.9857	0.9504	0.8479	0.6463	0.4422	0.5009	0.7983	0.9710	0.9960	0.9988	(89)
MIT 2	18.0231	18.2902	18.7033	19.2294	19.6527	19.8722	19.9150	19.9117	19.7815	19.2237	18.5248	17.9835	(90)
Living area fraction										fLA = Living area / (4) =		0.1862	(91)
MIT	18.3159	18.5671	18.9561	19.4519	19.8549	20.0688	20.1140	20.1095	19.9775	19.4453	18.7870	18.2779	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3159	18.5671	18.9561	19.4519	19.8549	20.0688	20.1140	20.1095	19.9775	19.4453	18.7870	18.2779	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9930	0.9809	0.9426	0.8451	0.6605	0.4665	0.5253	0.8029	0.9649	0.9941	0.9981	(94)
Useful gains	696.3512	849.4561	982.0539	1076.5234	1041.5915	801.4022	541.0035	564.8956	785.7069	802.6017	698.2081	650.3390	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2243.8600	2183.3084	1985.6376	1665.3598	1284.6416	853.9472	548.7009	578.2855	920.8938	1393.3951	1848.0631	2234.9619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1151.3465	896.3488	746.6663	423.9622	180.8292	0.0000	0.0000	0.0000	0.0000	439.5502	827.8956	1178.9594	(98)
Space heating												5845.5583	(98)
Space heating per m2											(98) / (4) =	44.8761	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6258.6277	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1151.3465	896.3488	746.6663	423.9622	180.8292	0.0000	0.0000	0.0000	0.0000	439.5502	827.8956	1178.9594	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1232.7051	959.6882	799.4286	453.9210	193.6073	0.0000	0.0000	0.0000	0.0000	470.6105	886.3979	1262.2692	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6191	88.4299	88.0371	87.1155	85.1173	80.3000	80.3000	80.3000	80.3000	87.1151	88.2480	88.6887	(217)
Fuel for water heating, kWh/month													
	247.0503	218.1833	230.0836	208.3251	206.9424	193.1975	185.0979	206.3408	208.0592	216.0277	225.6329	240.8802	(219)
Water heating fuel used												2585.8208	(219)
Annual totals kWh/year													
Space heating fuel - main system												6258.6277	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Total delivered energy for all uses												9391.3602	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6258.6277	0.2160	1351.8636	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.8208	0.2160	558.5373	(264)
Space and water heating			1910.4009	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Total CO2, kg/m2/year			2194.2480	(272)
Emissions per m2 for space and water heating			14.6661	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8803	(272b)
Emissions per m2 for pumps and fans			0.2988	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6661 * 1.00) + 1.8803 + 0.2988, rounded to 2 d.p.			16.8500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1190	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3360	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3642	0.3570	0.3499	0.3142	0.3071	0.2714	0.2714	0.2642	0.2856	0.3071	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5494	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	62.7953	62.5098	62.2299	60.9153	60.6693	59.5243	59.5243	59.3123	59.9654	60.6693	61.1669	61.6871	(38)
Heat transfer coeff	168.7080	168.4225	168.1426	166.8280	166.5820	165.4370	165.4370	165.2250	165.8781	166.5820	167.0796	167.5998	(39)
Average = Sum(39)m / 12 =												166.8268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2952	1.2930	1.2908	1.2807	1.2788	1.2701	1.2701	1.2684	1.2734	1.2788	1.2827	1.2867	(40)
HLP (average)												1.2807	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264 (71)

Water heating gains (Table 5)

	47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629 (72)

Total internal gains

	439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908	(83)
Total gains	681.2378	862.0989	1032.9318	1200.3316	1310.0124	1295.1484	1238.1372	1137.7927	1023.4930	849.2196	693.7896	630.9365	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6183	53.7092	53.7986	54.2225	54.3026	54.6784	54.6784	54.7486	54.5330	54.3026	54.1409	53.9728	
alpha	4.5746	4.5806	4.5866	4.6148	4.6202	4.6452	4.6452	4.6499	4.6355	4.6202	4.6094	4.5982	
util living area	0.9989	0.9964	0.9887	0.9611	0.8834	0.7314	0.5663	0.6301	0.8652	0.9807	0.9973	0.9992	(86)
MIT	19.4990	19.6982	20.0040	20.3908	20.7239	20.9213	20.9811	20.9696	20.8174	20.3663	19.8522	19.4627	(87)
Th 2	19.8446	19.8463	19.8480	19.8560	19.8574	19.8644	19.8644	19.8657	19.8617	19.8574	19.8544	19.8513	(88)
util rest of house	0.9984	0.9951	0.9844	0.9456	0.8368	0.6334	0.4309	0.4928	0.7933	0.9704	0.9962	0.9989	(89)
MIT 2	18.4803	18.6803	18.9851	19.3681	19.6724	19.8287	19.8598	19.8572	19.7603	19.3516	18.8408	18.4493	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.6700	18.8699	19.1749	19.5586	19.8682	20.0322	20.0686	20.0644	19.9572	19.5406	19.0292	18.6381	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6700	18.8699	19.1749	19.5586	19.8682	20.0322	20.0686	20.0644	19.9572	19.5406	19.0292	18.6381	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9936	0.9811	0.9405	0.8373	0.6493	0.4564	0.5185	0.8005	0.9665	0.9950	0.9985	(94)
Useful gains	679.7639	856.5824	1013.3836	1128.8529	1096.8764	840.9756	565.0739	589.9391	819.2979	820.7773	690.2896	629.9713	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2424.3378	2352.8415	2131.1903	1778.1483	1360.6810	898.6869	573.8371	605.4516	971.5733	1489.3433	1993.1195	2419.8181	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1297.9630	1005.4861	831.6482	467.4927	196.2706	0.0000	0.0000	0.0000	0.0000	497.4131	938.0376	1331.6460	(98)
Space heating												6565.9573	(98)
Space heating per m2										(98) / (4) =		50.4066	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1555.1082	1224.2341	1255.7100	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8423	0.9069	0.8762	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1309.8011	1110.2739	1100.2906	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1632.5958	1563.2542	1448.2232	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	232.4122	337.0173	258.8619	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												828.2914 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.1031	84.2543	64.7155	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												207.0729 (107)
Space cooling per m2												1.5897 (108)
Energy for space heating												50.4066 (99)
Energy for space cooling												1.5897 (108)
Total												51.9962 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1190	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264 (71)

Water heating gains (Table 5)

	47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629 (72)

Total internal gains

	439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.6300	0.7000	0.7700	22.4229	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(76)
South	9.3600	46.7521	0.6300	0.7000	0.7700	133.7360	(78)
West	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	211.8121	371.3039	534.2423	703.0925	823.0551	832.1940	796.0834	704.6353	592.5974	417.6012	255.6574	179.9795	(83)
Total gains	650.9790	809.0555	956.6115	1099.8898	1192.4331	1176.2635	1124.4110	1037.1305	938.8362	789.5623	657.2672	605.2251	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area	0.9991	0.9973	0.9913	0.9691	0.9015	0.7556	0.5881	0.6515	0.8818	0.9845	0.9979	0.9994	(86)
MIT	19.5620	19.7448	20.0302	20.3984	20.7218	20.9210	20.9816	20.9704	20.8192	20.3859	19.9010	19.5315	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house	0.9988	0.9963	0.9880	0.9565	0.8604	0.6624	0.4554	0.5179	0.8166	0.9762	0.9970	0.9992	(89)
MIT 2	18.5842	18.7683	19.0536	19.4218	19.7215	19.8840	19.9163	19.9140	19.8143	19.4159	18.9324	18.5602	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.7663	18.9502	19.2355	19.6037	19.9078	20.0771	20.1147	20.1107	20.0014	19.5966	19.1128	18.7411	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	18.9502	19.2355	19.6037	19.9078	20.0771	20.1147	20.1107	20.0014	19.5966	19.1128	18.7411	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9951	0.9853	0.9520	0.8601	0.6773	0.4803	0.5429	0.8227	0.9728	0.9960	0.9988	(94)
Useful gains	649.8744	805.0832	942.5971	1047.0583	1025.6579	796.6378	540.0947	563.0643	772.3344	768.1007	654.6638	604.5005	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2315.9668	2244.5005	2030.1876	1689.3185	1292.9693	855.2477	548.8169	578.4788	924.6367	1417.2216	1899.5698	2308.5021	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1239.5727	967.2884	809.1673	462.4273	198.8797	0.0000	0.0000	0.0000	0.0000	482.9460	896.3323	1267.7772	(98)
Space heating												6324.3909	(98)
Space heating per m2											(98) / (4) =	48.5521	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1467.7953	1155.4984	1184.7846	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8366	0.9046	0.8739	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1227.9104	1045.2640	1035.3927	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1493.6395	1430.3275	1330.5661	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	191.3250	286.4873	219.6090	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												697.4212 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	47.8312	71.6218	54.9023	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												174.3553 (107)
Space cooling per m2												1.3385 (108)
Energy for space heating												48.5521 (99)
Energy for space cooling												1.3385 (108)
Total												49.8906 (109)
Target Fabric Energy Efficiency (TFEE)												57.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.3400	
Infiltration rate			0.3658	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3265	0.3032	0.3109	0.2954	0.2954	0.2876	0.2798	0.2721	0.2643	0.2876	0.2721	0.2876	(22b)
Effective ac	0.5533	0.5460	0.5483	0.5436	0.5436	0.5414	0.5392	0.5370	0.5349	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.3515	60.5374	60.8021	60.2794	60.2794	60.0282	59.7836	59.5458	59.3146	60.0282	59.5458	60.0282	(38)
Heat transfer coeff	167.2642	166.4501	166.7148	166.1922	166.1922	165.9409	165.6963	165.4585	165.2273	165.9409	165.4585	165.9409	(39)
Average = Sum(39)m / 12 =												166.0397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2841	1.2778	1.2799	1.2758	1.2758	1.2739	1.2720	1.2702	1.2684	1.2739	1.2702	1.2739	(40)
HLP (average)												1.2747	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
RHI water heating demand												1759 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	13.4839	0.7200	0.7000	0.7700	32.4959	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(76)
South	9.3600	56.7559	0.7200	0.7000	0.7700	185.5455	(78)
West	0.4800	25.1925	0.7200	0.7000	0.7700	4.2235	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	299.7289	447.9527	652.4742	869.3110	971.7289	1069.2339	1014.0402	916.3943	766.2179	544.2777	360.7392	250.2798 (83)
Total gains	1006.5893	1149.5784	1326.4424	1500.0707	1557.6394	1615.3643	1537.1771	1449.0793	1323.9952	1145.4990	1010.3001	936.9985 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0811	54.3456	54.2593	54.4300	54.4300	54.5124	54.5928	54.6713	54.7478	54.5124	54.6713	54.5124	
alpha	4.6054	4.6230	4.6173	4.6287	4.6287	4.6342	4.6395	4.6448	4.6499	4.6342	4.6448	4.6342	
util living area													
	0.9932	0.9873	0.9668	0.9058	0.7799	0.5642	0.4160	0.4395	0.7123	0.9278	0.9844	0.9948	(86)
MIT	19.8083	19.9584	20.2594	20.6106	20.8606	20.9757	20.9952	20.9940	20.9309	20.6261	20.1724	19.7852	(87)
Th 2	19.8533	19.8582	19.8566	19.8598	19.8598	19.8613	19.8628	19.8642	19.8656	19.8613	19.8642	19.8613	(88)
util rest of house													
	0.9909	0.9830	0.9554	0.8739	0.7112	0.4610	0.2971	0.3146	0.6122	0.8949	0.9780	0.9930	(89)
MIT 2	18.3033	18.5237	18.9529	19.4358	19.7407	19.8488	19.8616	19.8627	19.8212	19.4700	18.8396	18.2754	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.5836	18.7909	19.1962	19.6546	19.9493	20.0586	20.0727	20.0734	20.0279	19.6853	19.0878	18.5566	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5836	18.7909	19.1962	19.6546	19.9493	20.0586	20.0727	20.0734	20.0279	19.6853	19.0878	18.5566	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9774	0.9468	0.8671	0.7171	0.4796	0.3193	0.3380	0.6278	0.8885	0.9718	0.9898	(94)
Useful gains	993.6298	1123.5842	1255.8782	1300.7153	1117.0598	774.7488	490.8622	489.8199	831.1956	1017.8169	981.8102	927.4876	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2288.7719	2245.5676	2033.2874	1687.6107	1238.0095	789.6530	492.5694	491.9762	880.3134	1374.8706	1851.1233	2249.5982	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	963.5857	753.9728	578.3924	278.5647	89.9866	0.0000	0.0000	0.0000	0.0000	265.6480	625.9054	983.6503	(98)
Space heating												4539.7059	(98)
RHI space heating demand												4540	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3658	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3964	0.3887	0.3809	0.3420	0.3343	0.2954	0.2954	0.2876	0.3109	0.3343	0.3498	0.3653	(22b)
Effective ac	0.5786	0.5755	0.5725	0.5585	0.5559	0.5436	0.5436	0.5414	0.5483	0.5559	0.5612	0.5667	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1555	63.8171	63.4855	61.9277	61.6362	60.2794	60.2794	60.0282	60.8021	61.6362	62.2258	62.8423	(38)
Heat transfer coeff	170.0682	169.7298	169.3982	167.8404	167.5489	166.1922	166.1922	165.9409	166.7148	167.5489	168.1385	168.7550	(39)
Average = Sum(39)m / 12 =												167.8390	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3056	1.3030	1.3005	1.2885	1.2863	1.2758	1.2758	1.2739	1.2799	1.2863	1.2908	1.2955	(40)
HLP (average)												1.2885	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908 (83)
Total gains	948.9314	1125.9730	1284.5308	1434.2941	1526.5448	1497.2092	1432.9465	1337.9826	1235.0315	1078.4797	941.7408	892.4096 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1895	53.2955	53.3998	53.8955	53.9892	54.4300	54.4300	54.5124	54.2593	53.9892	53.7999	53.6034	
alpha	4.5460	4.5530	4.5600	4.5930	4.5993	4.6287	4.6287	4.6342	4.6173	4.5993	4.5867	4.5736	
util living area													
	0.9954	0.9895	0.9745	0.9306	0.8297	0.6609	0.4989	0.5515	0.7916	0.9550	0.9907	0.9965	(86)
MIT	19.6710	19.8648	20.1547	20.5105	20.7949	20.9478	20.9885	20.9821	20.8784	20.4987	20.0129	19.6333	(87)
Th 2	19.8364	19.8385	19.8405	19.8499	19.8516	19.8598	19.8598	19.8613	19.8566	19.8516	19.8481	19.8443	(88)
util rest of house													
	0.9939	0.9860	0.9657	0.9063	0.7729	0.5627	0.3755	0.4244	0.7057	0.9340	0.9870	0.9953	(89)
MIT 2	18.0916	18.3742	18.7927	19.2957	19.6600	19.8271	19.8559	19.8545	19.7657	19.2923	18.5982	18.0422	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.3858	18.6518	19.0464	19.5220	19.8714	20.0358	20.0669	20.0645	19.9729	19.5170	18.8617	18.3386	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3858	18.6518	19.0464	19.5220	19.8714	20.0358	20.0669	20.0645	19.9729	19.5170	18.8617	18.3386	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9809	0.9576	0.8977	0.7740	0.5789	0.3985	0.4480	0.7156	0.9259	0.9823	0.9930	(94)
Useful gains	940.3709	1104.5085	1230.0706	1287.5860	1181.5597	866.6854	571.0576	599.4103	883.8065	998.6033	925.0611	886.1639	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2395.5422	2334.0963	2125.3317	1782.7927	1369.1059	903.3913	576.1660	608.0962	979.1063	1494.0269	1977.5879	2385.9509	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1082.6475	826.2830	666.0742	356.5489	139.5344	0.0000	0.0000	0.0000	0.0000	368.5952	757.8193	1115.8415	(98)
Space heating												5313.3440	(98)
Space heating per m2											(98) / (4) =	40.7903	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5719.4231	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1082.6475	826.2830	666.0742	356.5489	139.5344	0.0000	0.0000	0.0000	0.0000	368.5952	757.8193	1115.8415	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1165.3902	889.4328	716.9798	383.7986	150.1985	0.0000	0.0000	0.0000	0.0000	396.7655	815.7366	1201.1211	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4299	89.3716	89.2510	88.9574	88.2764	86.7000	86.7000	86.7000	86.7000	88.9547	89.3216	89.4535	(217)
Fuel for water heating, kWh/month													
	201.0657	176.3389	183.0940	161.4019	156.9942	139.3302	130.4896	147.7758	148.9565	167.5297	180.5144	195.0786	(219)
Water heating fuel used												1988.5694	(219)
Annual totals kWh/year													
Space heating fuel - main system												5719.4231	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												7504.2379	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5719.4231	3.4800	199.0359	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1988.5694	3.4800	69.2022	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	471.9117	13.1900	62.2452	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			361.3629	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8660	(257)
SAP value		87.9195	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5719.4231	0.2160	1235.3954	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1988.5694	0.2160	429.5310	(264)
Space and water heating			1664.9264	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1559.1777	(272)
CO2 emissions per m2			11.9700	(273)
EI value			88.0789	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.3400	
Infiltration rate		0.3658	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3109	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3265	0.3032	0.3109	0.2954	0.2954	0.2876	0.2798	0.2721	0.2643	0.2876	0.2721	0.2876	(22b)
Effective ac	0.5533	0.5460	0.5483	0.5436	0.5436	0.5414	0.5392	0.5370	0.5349	0.5414	0.5370	0.5414	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.3515	60.5374	60.8021	60.2794	60.2794	60.0282	59.7836	59.5458	59.3146	60.0282	59.5458	60.0282	(38)
Heat transfer coeff	167.2642	166.4501	166.7148	166.1922	166.1922	165.9409	165.6963	165.4585	165.2273	165.9409	165.4585	165.9409	(39)
Average = Sum(39)m / 12 =												166.0397	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2841	1.2778	1.2799	1.2758	1.2758	1.2739	1.2720	1.2702	1.2684	1.2739	1.2702	1.2739	(40)
HLP (average)												1.2747	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300	(61)
Total heat required for water heating calculated for each month													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601	(64)
Heat gains from water heating, kWh/month													
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	13.4839	0.7200	0.7000	0.7700	32.4959	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(76)
South	9.3600	56.7559	0.7200	0.7000	0.7700	185.5455	(78)
West	0.4800	25.1925	0.7200	0.7000	0.7700	4.2235	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	299.7289	447.9527	652.4742	869.3110	971.7289	1069.2339	1014.0402	916.3943	766.2179	544.2777	360.7392	250.2798	(83)
Total gains	1006.5893	1149.5784	1326.4424	1500.0707	1557.6394	1615.3643	1537.1771	1449.0793	1323.9952	1145.4990	1010.3001	936.9985	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0811	54.3456	54.2593	54.4300	54.4300	54.5124	54.5928	54.6713	54.7478	54.5124	54.6713	54.5124	
alpha	4.6054	4.6230	4.6173	4.6287	4.6287	4.6342	4.6395	4.6448	4.6499	4.6342	4.6448	4.6342	
util living area													
	0.9932	0.9873	0.9668	0.9058	0.7799	0.5642	0.4160	0.4395	0.7123	0.9278	0.9844	0.9948	(86)
MIT	19.8083	19.9584	20.2594	20.6106	20.8606	20.9757	20.9952	20.9940	20.9309	20.6261	20.1724	19.7852	(87)
Th 2	19.8533	19.8582	19.8566	19.8598	19.8598	19.8613	19.8628	19.8642	19.8656	19.8613	19.8642	19.8613	(88)
util rest of house													
	0.9909	0.9830	0.9554	0.8739	0.7112	0.4610	0.2971	0.3146	0.6122	0.8949	0.9780	0.9930	(89)
MIT 2	18.3033	18.5237	18.9529	19.4358	19.7407	19.8488	19.8616	19.8627	19.8212	19.4700	18.8396	18.2754	(90)
Living area fraction										fLA = Living area / (4) =		0.1862	(91)
MIT	18.5836	18.7909	19.1962	19.6546	19.9493	20.0586	20.0727	20.0734	20.0279	19.6853	19.0878	18.5566	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5836	18.7909	19.1962	19.6546	19.9493	20.0586	20.0727	20.0734	20.0279	19.6853	19.0878	18.5566	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9774	0.9468	0.8671	0.7171	0.4796	0.3193	0.3380	0.6278	0.8885	0.9718	0.9898	(94)
Useful gains	993.6298	1123.5842	1255.8782	1300.7153	1117.0598	774.7488	490.8622	489.8199	831.1956	1017.8169	981.8102	927.4876	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2288.7719	2245.5676	2033.2874	1687.6107	1238.0095	789.6530	492.5694	491.9762	880.3134	1374.8706	1851.1233	2249.5982	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	963.5857	753.9728	578.3924	278.5647	89.9866	0.0000	0.0000	0.0000	0.0000	265.6480	625.9054	983.6503	(98)
Space heating												4539.7059	(98)
Space heating per m2											(98) / (4) =	34.8511	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4886.6587	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	963.5857	753.9728	578.3924	278.5647	89.9866	0.0000	0.0000	0.0000	0.0000	265.6480	625.9054	983.6503	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1037.2290	811.5961	622.5968	299.8544	96.8639	0.0000	0.0000	0.0000	0.0000	285.9505	673.7411	1058.8270	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3812	89.3300	89.1749	88.7854	87.9322	86.7000	86.7000	86.7000	86.7000	88.7231	89.2254	89.4028	(217)
Fuel for water heating, kWh/month													
	201.1751	176.4211	183.2502	161.7145	157.6087	139.3302	130.4896	147.7758	148.9565	167.9670	180.7090	195.1892	(219)
Water heating fuel used												1990.5871	(219)
Annual totals kWh/year													
Space heating fuel - main system												4886.6587	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												6573.3823	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4886.6587	7.3800	360.6354	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1990.5871	7.3800	146.9053	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	471.9117	28.6600	135.2499	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			527.4535	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4886.6587	0.2160	1055.5183	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5871	0.2160	429.9668	(264)
Space and water heating			1485.4851	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1327.7800	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4886.6587	1.2200	5961.7236	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5871	1.2200	2428.5162	(264)
Space and water heating			8390.2398	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	471.9117	3.0700	1448.7689	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			7457.3791	(272)
Primary energy kWh/m2/year			57.2500	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 62	-198 kg (14.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£157	£0
Mains gas	£615	£615	£0
Space heating	£489	£489	£0
Water heating	£147	£147	£0
Lighting	£135	£135	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£528	£528	£0
Total cost of uses	£527	£527	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	887.07 (P1)
Transmission heat loss coefficient	105.91 (37)
Summer heat loss coefficient	992.98 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
North East	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.9000	87.1704	0.7200	0.7000	0.7650	208.7146
North East	1.0200	106.0502	0.7200	0.7000	0.7650	37.5358
East	7.6200	125.2818	0.7200	0.7000	0.7650	331.2664
South	9.3600	118.5567	0.7200	0.7000	0.7650	385.0670
West	0.4800	125.2818	0.7200	0.7000	0.7650	20.8672
North West	1.0200	106.0502	0.7200	0.7000	0.7650	37.5358
total:						1020.9869

	Jun	Jul	Aug	
Solar gains	1094	1021	920	(P3)
Internal gains	543	520	530	
Total summer gains	1637	1541	1449	(P5)
Summer gain/loss ratio	1.65	1.55	1.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.30	19.10	19.01	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 440 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 440	**Prop Type Ref**	
Property	4 Pheasant Road, Boorley Green, Southampton, SO32 2DY		

SAP Rating	88 B	**DER**	13.52	**TER**	16.85
Environmental	88 B	**% DER<TER**	19.74		
CO_2 Emissions (t/year)	1.33	**DFEE**	52.00	**TFEE**	57.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.37		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.52	$kgCO_2/m^2$	Pass
	-3.33 (-19.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.00	$kWh/m^2/yr$	
	-5.4 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.90 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	7.62 m², No overhang
Windows facing South	9.36 m², No overhang
Windows facing West	0.48 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.34 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 441 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 441	**Prop Type Ref**	
Property	4 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	13.20	**TER**	17.17
Environmental	89 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	1.25	**DFEE**	53.36	**TFEE**	57.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.17 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.20 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.18 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.11 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 0.82 m², No overhang
Windows facing South: 8.08 m², No overhang
Windows facing West: 1.42 m², No overhang
Windows facing North West: 1.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

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10 Key features
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.1800	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3900	0.3823	0.3747	0.3364	0.3288	0.2906	0.2906	0.2829	0.3059	0.3288	0.3441	0.3594	(22b)
Effective ac	0.5760	0.5731	0.5702	0.5566	0.5541	0.5422	0.5422	0.5400	0.5468	0.5541	0.5592	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.0149	62.6919	62.3753	60.8882	60.6100	59.3148	59.3148	59.0749	59.8137	60.6100	61.1728	61.7613	(38)
Heat transfer coeff	164.2471	163.9241	163.6075	162.1204	161.8422	160.5470	160.5470	160.3071	161.0459	161.8422	162.4050	162.9934	(39)
Average = Sum(39)m / 12 =												162.1191	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2806	1.2781	1.2756	1.2640	1.2618	1.2517	1.2517	1.2499	1.2556	1.2618	1.2662	1.2708	(40)
HLP (average)												1.2640	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297	(61)
Total heat required for water heating calculated for each month													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657	(64)
Heat gains from water heating, kWh/month													
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	471.4291	469.0425	451.8108	423.8129	394.8802	367.4647	349.9693	356.6640	371.3337	399.5668	431.9855	456.7820	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	10.6334	0.7200	0.7000	0.7700	30.1201	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.0800	46.7521	0.7200	0.7000	0.7700	131.9398	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.4651	320.0677	452.0482	588.8196	689.3848	698.5084	667.4933	589.6649	498.6324	357.2511	222.8257	158.3192	(83)
Total gains	656.8942	789.1102	903.8591	1012.6325	1084.2650	1065.9730	1017.4626	946.3289	869.9660	756.8179	654.8112	615.1012	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2289	54.3358	54.4409	54.9403	55.0348	55.4787	55.4787	55.5617	55.3069	55.0348	54.8440	54.6460	
alpha	4.6153	4.6224	4.6294	4.6627	4.6690	4.6986	4.6986	4.7041	4.6871	4.6690	4.6563	4.6431	
util living area													
	0.9990	0.9974	0.9929	0.9773	0.9284	0.8090	0.6506	0.7091	0.9083	0.9867	0.9978	0.9992	(86)
MIT	19.5075	19.6747	19.9442	20.3027	20.6422	20.8813	20.9680	20.9523	20.7693	20.3280	19.8498	19.4785	(87)
Th 2	19.8561	19.8581	19.8600	19.8691	19.8709	19.8788	19.8788	19.8803	19.8758	19.8709	19.8674	19.8638	(88)
util rest of house													
	0.9986	0.9964	0.9901	0.9675	0.8945	0.7190	0.5058	0.5684	0.8506	0.9793	0.9968	0.9990	(89)
MIT 2	17.8667	18.1124	18.5065	19.0301	19.5004	19.7935	19.8665	19.8592	19.6756	19.0728	18.3753	17.8294	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.0917	18.3266	18.7037	19.2046	19.6570	19.9427	20.0175	20.0091	19.8256	19.2450	18.5775	18.0556	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0917	18.3266	18.7037	19.2046	19.6570	19.9427	20.0175	20.0091	19.8256	19.2450	18.5775	18.0556	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9944	0.9859	0.9595	0.8864	0.7249	0.5252	0.5864	0.8473	0.9731	0.9950	0.9983	(94)
Useful gains	655.3528	784.6789	891.0958	971.5826	961.0398	772.7728	534.3636	554.9214	737.0829	736.4738	651.5464	614.0334	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2265.2532	2200.9476	1996.6163	1670.5895	1287.7707	857.7493	548.6740	578.5652	922.0873	1399.1179	1864.0000	2258.3713	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1197.7659	951.7326	822.5072	503.2849	243.0878	0.0000	0.0000	0.0000	0.0000	493.0073	872.9666	1223.3874	(98)
Space heating												6307.7396	(98)
Space heating per m2											(98) / (4) =	49.1793	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6789.8166	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1197.7659	951.7326	822.5072	503.2849	243.0878	0.0000	0.0000	0.0000	0.0000	493.0073	872.9666	1223.3874	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1289.3067	1024.4699	885.3684	541.7491	261.6661	0.0000	0.0000	0.0000	0.0000	530.6860	939.6842	1316.8863	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4694	89.4315	89.3539	89.1701	88.7120	86.7000	86.7000	86.7000	86.7000	89.1370	89.3861	89.4881	(217)
Fuel for water heating, kWh/month													
	200.7458	176.0187	182.6744	160.8344	156.0473	139.1747	130.3455	147.6104	148.7894	166.9977	180.1778	194.7795	(219)
Water heating fuel used												1984.1957	(219)
Annual totals kWh/year													
Space heating fuel - main system												6789.8166	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												8384.8342	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6789.8166	0.2160	1466.6004	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1984.1957	0.2160	428.5863	(264)
Space and water heating			1895.1867	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total CO2, kg/year			1693.2032	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.2000	ZC1
Total Floor Area	TFA	128.2600	
Assumed number of occupants	N	2.8903	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6576	ZC2
CO2 emissions from cooking, equation (L16)		1.4686	ZC3
Total CO2 emissions		28.3263	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3263	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650 (1b) - (3b)	
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2644	45.6465	47.1680	49.2644	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.3104 (64)
Heat gains from water heating, kWh/month												
	68.5227	60.2950	63.0848	56.2208	54.4315	47.7540	45.4686	50.9605	51.4347	58.3139	62.0766	66.7626 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	92.1005	89.7248	84.7913	78.0844	73.1607	66.3251	61.1137	68.4953	71.4371	78.3789	86.2174	89.7347	(72)
Total internal gains													
	484.5747	482.1908	464.9647	436.9743	407.4792	379.3683	361.8784	369.2681	384.5026	412.7279	445.1377	469.9303	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	10.6334	0.6300	0.7000	0.7700	26.3551	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	8.0800	46.7521	0.6300	0.7000	0.7700	115.4474	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	162.2820	280.0592	395.5422	515.2171	603.2117	611.1948	584.0566	515.9568	436.3033	312.5947	194.9725	138.5293 (83)
Total gains	646.8567	762.2500	860.5069	952.1915	1010.6909	990.5631	945.9350	885.2249	820.8059	725.3226	640.1102	608.4596 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area													
	0.9991	0.9977	0.9939	0.9803	0.9351	0.8169	0.6549	0.7115	0.9121	0.9879	0.9980	0.9993	(86)
MIT	19.6129	19.7661	20.0156	20.3508	20.6688	20.8941	20.9733	20.9599	20.7928	20.3815	19.9356	19.5876	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house													
	0.9988	0.9969	0.9916	0.9718	0.9044	0.7319	0.5175	0.5779	0.8578	0.9813	0.9972	0.9991	(89)
MIT 2	18.0687	18.2941	18.6595	19.1508	19.5934	19.8724	19.9395	19.9335	19.7643	19.2006	18.5495	18.0375	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.2805	18.4960	18.8455	19.3154	19.7409	20.0125	20.0813	20.0743	19.9054	19.3625	18.7396	18.2501	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2805	18.4960	18.8455	19.3154	19.7409	20.0125	20.0813	20.0743	19.9054	19.3625	18.7396	18.2501	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9953	0.9881	0.9649	0.8971	0.7377	0.5359	0.5952	0.8551	0.9759	0.9956	0.9985	(94)
Useful gains	645.5397	758.6416	850.2667	918.7906	906.6461	730.7517	506.9242	526.8529	701.8785	707.8456	637.3117	607.5413	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2139.2804	2075.7761	1880.7139	1570.2435	1209.8859	806.9647	519.0290	546.8760	868.6111	1318.4660	1758.3278	2131.2429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1111.3431	885.1144	766.6527	469.0461	225.6104	0.0000	0.0000	0.0000	0.0000	454.3015	807.1316	1133.6340	(98)
Space heating												5852.8339	(98)
Space heating per m2											(98) / (4) =	45.6326	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6266.4174	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1111.3431	885.1144	766.6527	469.0461	225.6104	0.0000	0.0000	0.0000	0.0000	454.3015	807.1316	1133.6340	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1189.8748	947.6599	820.8273	502.1907	241.5529	0.0000	0.0000	0.0000	0.0000	486.4042	864.1666	1213.7409	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7274	192.7588	202.3725	181.3211	175.9273	154.9470	148.4510	165.4881	166.9269	188.0241	198.9325	213.4337	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5681	88.4113	88.0862	87.3374	85.6785	80.3000	80.3000	80.3000	80.3000	87.1898	88.2063	88.6336	(217)
Fuel for water heating, kWh/month													
	246.9597	218.0249	229.7438	207.6101	205.3344	192.9601	184.8705	206.0873	207.8790	215.6492	225.5310	240.8044	(219)
Water heating fuel used												2581.4544	(219)
Annual totals kWh/year													
Space heating fuel - main system												6266.4174	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Total delivered energy for all uses												9408.6754	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6266.4174	0.2160	1353.5462	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2581.4544	0.2160	557.5942	(264)
Space and water heating			1911.1403	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Total CO2, kg/m2/year			2202.1974	(272)
Emissions per m2 for space and water heating			14.9005	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9658	(272b)
Emissions per m2 for pumps and fans			0.3035	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9005 * 1.00) + 1.9658 + 0.3035, rounded to 2 d.p.			17.1700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		4.1800	
Infiltration rate		0.3297	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2802	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3573	0.3503	0.3433	0.3082	0.3012	0.2662	0.2662	0.2592	0.2802	0.3012	0.3152	0.3293	(22b)
Effective ac	0.5638	0.5613	0.5589	0.5475	0.5454	0.5354	0.5354	0.5336	0.5393	0.5454	0.5497	0.5542	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.6787	61.4076	61.1418	59.8936	59.6601	58.5730	58.5730	58.3717	58.9917	59.6601	60.1325	60.6264	(38)
Heat transfer coeff	162.9109	162.6397	162.3740	161.1258	160.8923	159.8052	159.8052	159.6038	160.2239	160.8923	161.3647	161.8586	(39)
Average = Sum(39)m / 12 =												161.1247	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2702	1.2680	1.2660	1.2562	1.2544	1.2459	1.2459	1.2444	1.2492	1.2544	1.2581	1.2620	(40)
HLP (average)												1.2562	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8903	(42)
Average daily hot water use (litres/day)												102.8454	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133 (71)

Water heating gains (Table 5)

	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058 (72)

Total internal gains

	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	10.6334	0.7200	0.7000	0.7700	30.1201	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.0800	46.7521	0.7200	0.7000	0.7700	131.9398	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.4651	320.0677	452.0482	588.8196	689.3848	698.5084	667.4933	589.6649	498.6324	357.2511	222.8257	158.3192	(83)
Total gains	622.8571	755.9332	872.4681	983.6696	1056.8806	1040.8105	994.1862	920.6333	843.4097	727.7484	622.9039	581.9206	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6737	54.7649	54.8545	55.2794	55.3597	55.7363	55.7363	55.8066	55.5906	55.3597	55.1976	55.0292	
alpha	4.6449	4.6510	4.6570	4.6853	4.6906	4.7158	4.7158	4.7204	4.7060	4.6906	4.6798	4.6686	
util living area	0.9992	0.9978	0.9938	0.9795	0.9333	0.8177	0.6603	0.7210	0.9156	0.9885	0.9982	0.9994	(86)
MIT	19.4965	19.6637	19.9334	20.2916	20.6336	20.8765	20.9664	20.9493	20.7603	20.3146	19.8358	19.4660	(87)
Th 2	19.8643	19.8659	19.8676	19.8753	19.8767	19.8834	19.8834	19.8847	19.8808	19.8767	19.8738	19.8708	(88)
util rest of house	0.9989	0.9970	0.9914	0.9705	0.9012	0.7294	0.5152	0.5806	0.8610	0.9821	0.9974	0.9992	(89)
MIT 2	18.4932	18.6614	18.9314	19.2907	19.6158	19.8221	19.8744	19.8691	19.7370	19.3178	18.8398	18.4679	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.6308	18.7989	19.0688	19.4280	19.7553	19.9667	20.0242	20.0173	19.8773	19.4545	18.9764	18.6047	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6308	18.7989	19.0688	19.4280	19.7553	19.9667	20.0242	20.0173	19.8773	19.4545	18.9764	18.6047	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9959	0.9890	0.9658	0.8968	0.7370	0.5351	0.5993	0.8608	0.9786	0.9965	0.9988	(94)
Useful gains	621.8697	752.8429	862.8434	949.9837	947.8070	767.1094	531.9755	551.7692	726.0077	712.1636	620.7144	581.2504	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2334.6446	2260.5080	2040.8432	1696.3347	1296.0428	857.6280	547.2033	577.3279	925.6623	1424.6165	1916.4296	2331.5328	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1274.3045	1013.1509	876.4318	537.3727	259.0875	0.0000	0.0000	0.0000	0.0000	530.0650	932.9150	1302.2101	(98)
Space heating												6725.5375	(98)
Space heating per m2											(98) / (4) =	52.4367	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1502.1685	1182.5582	1212.9892	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7731	0.8554	0.8187	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1161.3670	1011.5841	993.0933	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1335.0141	1277.8761	1194.2860	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	125.0259	198.1213	149.6874	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												472.8346 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	31.2565	49.5303	37.4218	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												118.2086 (107)
Space cooling per m2												0.9216 (108)
Energy for space heating												52.4367 (99)
Energy for space cooling												0.9216 (108)
Total												53.3584 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1207	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3707	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3151	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4017	0.3938	0.3860	0.3466	0.3387	0.2993	0.2993	0.2914	0.3151	0.3387	0.3544	0.3702	(22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5496	0.5574	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.4700	1.3258	27.1383			(27)
Ground floor			64.7500	0.1300	8.4175			(28a)
External Wall	174.6400	24.7100	149.9300	0.1800	26.9874			(29a)
Main Roof	63.5100		63.5100	0.1300	8.2563			(30)
Bay Roof	1.2400		1.2400	0.1300	0.1612			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.0487			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.4467	(36)
Total fabric heat loss (33) + (36) =	89.4954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.5233	63.1806	62.8446	61.2666	60.9714	59.5971	59.5971	59.3425	60.1264	60.9714	61.5687	62.1931	(38)
Heat transfer coeff	153.0187	152.6759	152.3400	150.7620	150.4668	149.0924	149.0924	148.8379	149.6218	150.4668	151.0640	151.6884	(39)
Average = Sum(39)m / 12 =												150.7606	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1930	1.1904	1.1877	1.1754	1.1731	1.1624	1.1624	1.1604	1.1666	1.1731	1.1778	1.1827	(40)
HLP (average)												1.1754	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6508	31.1804	32.1754	28.0513	26.9159	23.2264	21.5226	24.6975	24.9925	29.1264	31.7937	34.5259 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	144.5167	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	27.5082	24.4325	19.8699	15.0428	11.2447	9.4932	10.2577	13.3334	17.8961	22.7232	26.5213	28.2727 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	295.6110	298.6785	290.9485	274.4921	253.7189	234.1951	221.1519	218.0844	225.8144	242.2708	263.0440	282.5678 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517	37.4517 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133 (71)

Water heating gains (Table 5)

	47.9177	46.3994	43.2465	38.9601	36.1773	32.2588	28.9283	33.1956	34.7118	39.1483	44.1579	46.4058 (72)

Total internal gains

	437.3919	435.8655	420.4198	394.8500	367.4958	342.3021	326.6929	330.9684	344.7773	370.4973	400.0782	423.6014 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	10.6334	0.6300	0.7000	0.7700	26.3551	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.8200	19.6403	0.6300	0.7000	0.7700	4.9219	(76)
South	8.0800	46.7521	0.6300	0.7000	0.7700	115.4474	(78)
West	1.4200	19.6403	0.6300	0.7000	0.7700	8.5233	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	162.2820	280.0592	395.5422	515.2171	603.2117	611.1948	584.0566	515.9568	436.3033	312.5947	194.9725	138.5293 (83)
Total gains	599.6739	715.9247	815.9621	910.0672	970.7075	953.4969	910.7495	846.9252	781.0807	683.0920	595.0507	562.1307 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.2082	58.3389	58.4675	59.0795	59.1954	59.7411	59.7411	59.8432	59.5297	59.1954	58.9614	58.7187	
alpha	4.8805	4.8893	4.8978	4.9386	4.9464	4.9827	4.9827	4.9895	4.9686	4.9464	4.9308	4.9146	
util living area	0.9994	0.9983	0.9952	0.9836	0.9434	0.8332	0.6746	0.7340	0.9249	0.9906	0.9986	0.9995	(86)
MIT	19.5788	19.7328	19.9841	20.3228	20.6474	20.8833	20.9696	20.9539	20.7737	20.3524	19.9031	19.5540	(87)
Th 2	19.9256	19.9277	19.9298	19.9397	19.9415	19.9502	19.9502	19.9518	19.9469	19.9415	19.9378	19.9339	(88)
util rest of house	0.9991	0.9977	0.9933	0.9764	0.9157	0.7509	0.5357	0.6004	0.8759	0.9853	0.9980	0.9994	(89)
MIT 2	18.6237	18.7792	19.0314	19.3742	19.6854	19.8905	19.9417	19.9371	19.8077	19.4074	18.9576	18.6056	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.7547	18.9099	19.1621	19.5043	19.8174	20.0267	20.0827	20.0765	19.9401	19.5370	19.0872	18.7356	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7547	18.9099	19.1621	19.5043	19.8174	20.0267	20.0827	20.0765	19.9401	19.5370	19.0872	18.7356	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9968	0.9914	0.9724	0.9115	0.7579	0.5547	0.6182	0.8755	0.9824	0.9972	0.9991	(94)
Useful gains	598.9253	713.6626	808.9557	884.9260	884.8470	722.6716	505.1742	523.5762	683.8234	671.0893	593.3951	561.6236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2211.8404	2138.9805	1928.9377	1598.7304	1221.3931	809.0754	519.2375	547.2081	873.8125	1344.7234	1810.8391	2204.8890	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1200.0088	957.8136	833.2667	513.9392	250.3903	0.0000	0.0000	0.0000	0.0000	501.1838	876.5597	1222.5895	(98)
Space heating												6355.7515	(98)
Space heating per m2											(98) / (4) =	49.5537	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1401.4689	1103.2840	1131.1682	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7754	0.8597	0.8244	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1086.6872	948.4513	932.4870	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1232.9593	1180.3527	1108.1336	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	105.3159	172.5346	130.6811	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												408.5316 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3290	43.1337	32.6703	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												102.1329 (107)
Space cooling per m2												0.7963 (108)
Energy for space heating												49.5537 (99)
Energy for space cooling												0.7963 (108)
Total												50.3499 (109)
Target Fabric Energy Efficiency (TFEE)												57.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.1800	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3211	0.2982	0.3059	0.2906	0.2906	0.2829	0.2753	0.2676	0.2600	0.2829	0.2676	0.2829	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5422	0.5422	0.5400	0.5379	0.5358	0.5338	0.5400	0.5358	0.5400	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3382	59.5610	59.8137	59.3148	59.3148	59.0749	58.8415	58.6144	58.3938	59.0749	58.6144	59.0749	(38)
Heat transfer coeff	161.5703	160.7932	161.0459	160.5470	160.5470	160.3071	160.0737	159.8466	159.6260	160.3071	159.8466	160.3071	(39)
Average = Sum(39)m / 12 =												160.4015	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2597	1.2537	1.2556	1.2517	1.2517	1.2499	1.2480	1.2463	1.2445	1.2499	1.2463	1.2499	(40)
HLP (average)												1.2506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
RHI water heating demand												1757 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	13.4839	0.7200	0.7000	0.7700	38.1944	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(76)
South	8.0800	56.7559	0.7200	0.7000	0.7700	160.1717	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	228.4913	336.2863	481.5391	636.6125	712.9575	786.5676	745.0243	671.1445	562.8865	405.6736	273.7431	191.6774	(83)
Total gains	933.4661	1035.7720	1153.1417	1264.8712	1296.3547	1330.3059	1265.9898	1201.9073	1118.9704	1005.3366	921.7535	876.7278	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1273	55.3938	55.3069	55.4787	55.4787	55.5617	55.6428	55.7218	55.7988	55.5617	55.7218	55.5617	
alpha	4.6752	4.6929	4.6871	4.6986	4.6986	4.7041	4.7095	4.7148	4.7199	4.7041	4.7148	4.7041	
util living area													
	0.9947	0.9909	0.9784	0.9398	0.8450	0.6452	0.4840	0.5071	0.7784	0.9487	0.9882	0.9958	(86)
MIT	19.7991	19.9234	20.1908	20.5272	20.8064	20.9602	20.9917	20.9900	20.9031	20.5792	20.1486	19.7833	(87)
Th 2	19.8725	19.8773	19.8758	19.8788	19.8788	19.8803	19.8818	19.8832	19.8845	19.8803	19.8832	19.8803	(88)
util rest of house													
	0.9928	0.9878	0.9706	0.9167	0.7854	0.5363	0.3501	0.3680	0.6832	0.9233	0.9833	0.9943	(89)
MIT 2	18.3034	18.4871	18.8716	19.3452	19.7036	19.8584	19.8795	19.8804	19.8180	19.4261	18.8195	18.2859	(90)
Living area fraction									fLA = Living area / (4) =			0.1371	(91)
MIT	18.5085	18.6840	19.0525	19.5073	19.8548	20.0095	20.0321	20.0326	19.9668	19.5842	19.0018	18.4913	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5085	18.6840	19.0525	19.5073	19.8548	20.0095	20.0321	20.0326	19.9668	19.5842	19.0018	18.4913	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9830	0.9627	0.9071	0.7840	0.5497	0.3685	0.3872	0.6911	0.9145	0.9776	0.9914	(94)
Useful gains	923.6039	1018.1291	1110.1466	1147.3346	1016.2853	731.3049	466.5770	465.3748	773.3643	919.3349	901.0754	869.2296	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2198.7324	2152.0635	1941.0036	1606.6465	1180.7957	754.9688	469.3460	468.7658	840.7144	1311.9899	1774.5869	2162.7476	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.6957	762.0039	618.1576	330.7045	122.3957	0.0000	0.0000	0.0000	0.0000	292.1353	628.9283	962.3774	(98)
Space heating												4665.3984	(98)
RHI space heating demand												4665	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500	(1b)	x 2.5400	(2b) =	164.4650	(1b) - (3b)
First floor	63.5100	(1c)	x 2.6300	(2c) =	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							5 * 10 =		50.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1508	(8)
Pressure test			Yes	
Measured/design AP50			4.1800	
Infiltration rate			0.3598	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3900	0.3823	0.3747	0.3364	0.3288	0.2906	0.2906	0.2829	0.3059	0.3288	0.3441	0.3594	(22b)
Effective ac	0.5760	0.5731	0.5702	0.5566	0.5541	0.5422	0.5422	0.5400	0.5468	0.5541	0.5592	0.5646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4330	(36)
Total fabric heat loss (33) + (36) =	101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.0149	62.6919	62.3753	60.8882	60.6100	59.3148	59.3148	59.0749	59.8137	60.6100	61.1728	61.7613	(38)
Heat transfer coeff	164.2471	163.9241	163.6075	162.1204	161.8422	160.5470	160.5470	160.3071	161.0459	161.8422	162.4050	162.9934	(39)
Average = Sum(39)m / 12 =												162.1191	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2806	1.2781	1.2756	1.2640	1.2618	1.2517	1.2517	1.2499	1.2556	1.2618	1.2662	1.2708	(40)
HLP (average)												1.2640	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903 (42)
Average daily hot water use (litres/day)	102.8454 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	10.6334	0.7200	0.7000	0.7700	30.1201	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.8200	19.6403	0.7200	0.7000	0.7700	5.6250	(76)
South	8.0800	46.7521	0.7200	0.7000	0.7700	131.9398	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	185.4651	320.0677	452.0482	588.8196	689.3848	698.5084	667.4933	589.6649	498.6324	357.2511	222.8257	158.3192 (83)
Total gains	890.4399	1019.5533	1123.6509	1217.0783	1272.7820	1242.2467	1188.4588	1120.4277	1054.7162	956.9141	870.8361	843.3696 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2289	54.3358	54.4409	54.9403	55.0348	55.4787	55.4787	55.5617	55.3069	55.0348	54.8440	54.6460	
alpha	4.6153	4.6224	4.6294	4.6627	4.6690	4.6986	4.6986	4.7041	4.6871	4.6690	4.6563	4.6431	
util living area													
	0.9962	0.9924	0.9832	0.9561	0.8850	0.7384	0.5723	0.6235	0.8450	0.9678	0.9927	0.9971	(86)
MIT	19.6727	19.8355	20.0926	20.4275	20.7282	20.9208	20.9812	20.9721	20.8419	20.4567	20.0012	19.6406	(87)
Th 2	19.8561	19.8581	19.8600	19.8691	19.8709	19.8788	19.8788	19.8803	19.8758	19.8709	19.8674	19.8638	(88)
util rest of house													
	0.9950	0.9898	0.9771	0.9390	0.8390	0.6417	0.4375	0.4884	0.7687	0.9519	0.9897	0.9961	(89)
MIT 2	18.1076	18.3460	18.7194	19.2015	19.6033	19.8258	19.8720	19.8690	19.7502	19.2512	18.5949	18.0662	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.3223	18.5502	18.9078	19.3696	19.7576	19.9760	20.0242	20.0203	19.8999	19.4165	18.7878	18.2821	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3223	18.5502	18.9078	19.3696	19.7576	19.9760	20.0242	20.0203	19.8999	19.4165	18.7878	18.2821	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9854	0.9700	0.9292	0.8334	0.6510	0.4558	0.5064	0.7707	0.9431	0.9854	0.9939	(94)
Useful gains	883.6062	1004.7079	1089.9889	1130.9521	1060.7960	808.6657	541.7450	567.3810	812.8564	902.4613	858.1603	838.2438	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2303.1163	2237.6044	2030.0015	1697.3427	1304.0547	863.0971	549.7371	580.3577	934.0500	1426.8884	1898.1540	2295.2889	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1056.1155	828.5064	699.3693	407.8012	180.9845	0.0000	0.0000	0.0000	0.0000	390.1738	748.7955	1084.0415	(98)
Space heating												5395.7878	(98)
Space heating per m2											(98) / (4) =	42.0691	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5808.1677	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1056.1155	828.5064	699.3693	407.8012	180.9845	0.0000	0.0000	0.0000	0.0000	390.1738	748.7955	1084.0415	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1136.8305	891.8261	752.8195	438.9680	194.8164	0.0000	0.0000	0.0000	0.0000	419.9933	806.0232	1166.8908	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4203	89.3733	89.2765	89.0449	88.4846	86.7000	86.7000	86.7000	86.7000	88.9929	89.3165	89.4427	(217)
Fuel for water heating, kWh/month													
	200.8560	176.1333	182.8328	161.0606	156.4482	139.1747	130.3455	147.6104	148.7894	167.2681	180.3184	194.8783	(219)
Water heating fuel used												1985.7158	(219)
Annual totals kWh/year													
Space heating fuel - main system												5808.1677	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1080 * 1.00) =										-949.9817		-949.9817	(233)
Total delivered energy for all uses												7404.7054	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5808.1677	3.4800	202.1242	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1985.7158	3.4800	69.1029	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	485.8036	13.1900	64.0775	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-949.9817	13.1900	-125.3026	(252)
Total energy cost			339.8946	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8239	(257)
SAP value		88.5060	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5808.1677	0.2160	1254.5642	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1985.7158	0.2160	428.9146	(264)
Space and water heating			1683.4788	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-949.9817	0.5190	-493.0405	(269)
Total kg/year			1481.4954	(272)
CO2 emissions per m2			11.5500	(273)
EI value			88.5421	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	3.48 / 0.8835 = 3.939, stars = 4
Water heating environmental impact	0.216 / 0.8835 = 0.2445, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7500 (1b)	x	2.5400 (2b)	=	164.4650	(1b) - (3b)
First floor	63.5100 (1c)	x	2.6300 (2c)	=	167.0313	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	331.4963	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1508	(8)
Pressure test		Yes	
Measured/design AP50		4.1800	
Infiltration rate		0.3598	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3059	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3211	0.2982	0.3059	0.2906	0.2906	0.2829	0.2753	0.2676	0.2600	0.2829	0.2676	0.2829	(22b)
Effective ac	0.5516	0.5445	0.5468	0.5422	0.5422	0.5400	0.5379	0.5358	0.5338	0.5400	0.5358	0.5400	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.4700	1.2357	25.2956			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			64.7500	0.1900	12.3025			(28a)
External Wall	174.6400	24.7100	149.9300	0.2700	40.4811			(29a)
Main Roof	63.5100		63.5100	0.1600	10.1616			(30)
Bay Roof	1.2400		1.2400	0.1600	0.1984			(30)
Total net area of external elements Aum(A, m2)			304.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	94.7992			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4330	(36)
Total fabric heat loss					(33) + (36) =		101.2322	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.3382	59.5610	59.8137	59.3148	59.3148	59.0749	58.8415	58.6144	58.3938	59.0749	58.6144	59.0749	(38)
Heat transfer coeff	161.5703	160.7932	161.0459	160.5470	160.5470	160.3071	160.0737	159.8466	159.6260	160.3071	159.8466	160.3071	(39)
Average = Sum(39)m / 12 =												160.4015	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2597	1.2537	1.2556	1.2517	1.2517	1.2499	1.2480	1.2463	1.2445	1.2499	1.2463	1.2499	(40)
HLP (average)												1.2506	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8903	(42)
Average daily hot water use (litres/day)	102.8454	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1300	109.0162	104.9023	100.7885	96.6747	92.5609	92.5609	96.6747	100.7885	104.9023	109.0162	113.1300	(44)
Energy conte	167.7685	146.7314	151.4136	132.0061	126.6630	109.3005	101.2830	116.2237	117.6118	137.0652	149.6174	162.4748	(45)
Energy content (annual)										Total = Sum(45)m =		1618.1590	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1653	22.0097	22.7120	19.8009	18.9994	16.3951	15.1924	17.4336	17.6418	20.5598	22.4426	24.3712	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8376	10.6848	11.8131	11.4102	11.7696	11.3640	11.7266	11.7545	11.3886	11.7915	11.4366	11.8297 (61)
Total heat required for water heating calculated for each month												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.9657 (64)
Heat gains from water heating, kWh/month												
	58.7424	51.4594	53.2983	46.7446	45.0578	39.1834	36.6082	41.5830	41.9531	48.5221	52.6069	56.9803 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	173.4200	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	68.7705	61.0814	49.6747	37.6069	28.1116	23.7330	25.6444	33.3335	44.7402	56.8079	66.3033	70.6819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	441.2104	445.7888	434.2514	409.6897	378.6850	349.5449	330.0775	325.4991	337.0365	361.5982	392.6029	421.7430	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	55.2323	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	-115.6133	(71)
Water heating gains (Table 5)													
	78.9549	76.5765	71.6375	64.9230	60.5616	54.4214	49.2046	55.8911	58.2682	65.2178	73.0652	76.5864	(72)
Total internal gains													
	704.9748	699.4856	671.6026	628.2587	583.3972	543.7383	520.9655	530.7628	556.0838	599.6630	648.0104	685.0503	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.1100	13.4839	0.7200	0.7000	0.7700	38.1944	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.8200	25.1925	0.7200	0.7000	0.7700	7.2152	(76)
South	8.0800	56.7559	0.7200	0.7000	0.7700	160.1717	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	228.4913	336.2863	481.5391	636.6125	712.9575	786.5676	745.0243	671.1445	562.8865	405.6736	273.7431	191.6774 (83)
Total gains	933.4661	1035.7720	1153.1417	1264.8712	1296.3547	1330.3059	1265.9898	1201.9073	1118.9704	1005.3366	921.7535	876.7278 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1273	55.3938	55.3069	55.4787	55.4787	55.5617	55.6428	55.7218	55.7988	55.5617	55.7218	55.5617	
alpha	4.6752	4.6929	4.6871	4.6986	4.6986	4.7041	4.7095	4.7148	4.7199	4.7041	4.7148	4.7041	
util living area													
	0.9947	0.9909	0.9784	0.9398	0.8450	0.6452	0.4840	0.5071	0.7784	0.9487	0.9882	0.9958	(86)
MIT	19.7991	19.9234	20.1908	20.5272	20.8064	20.9602	20.9917	20.9900	20.9031	20.5792	20.1486	19.7833	(87)
Th 2	19.8725	19.8773	19.8758	19.8788	19.8788	19.8803	19.8818	19.8832	19.8845	19.8803	19.8832	19.8803	(88)
util rest of house													
	0.9928	0.9878	0.9706	0.9167	0.7854	0.5363	0.3501	0.3680	0.6832	0.9233	0.9833	0.9943	(89)
MIT 2	18.3034	18.4871	18.8716	19.3452	19.7036	19.8584	19.8795	19.8804	19.8180	19.4261	18.8195	18.2859	(90)
Living area fraction										fLA = Living area / (4) =		0.1371	(91)
MIT	18.5085	18.6840	19.0525	19.5073	19.8548	20.0095	20.0321	20.0326	19.9668	19.5842	19.0018	18.4913	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5085	18.6840	19.0525	19.5073	19.8548	20.0095	20.0321	20.0326	19.9668	19.5842	19.0018	18.4913	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9894	0.9830	0.9627	0.9071	0.7840	0.5497	0.3685	0.3872	0.6911	0.9145	0.9776	0.9914	(94)
Useful gains	923.6039	1018.1291	1110.1466	1147.3346	1016.2853	731.3049	466.5770	465.3748	773.3643	919.3349	901.0754	869.2296	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2198.7324	2152.0635	1941.0036	1606.6465	1180.7957	754.9688	469.3460	468.7658	840.7144	1311.9899	1774.5869	2162.7476	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	948.6957	762.0039	618.1576	330.7045	122.3957	0.0000	0.0000	0.0000	0.0000	292.1353	628.9283	962.3774	(98)
Space heating												4665.3984	(98)
Space heating per m2											(98) / (4) =	36.3745	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5021.9573	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	948.6957	762.0039	618.1576	330.7045	122.3957	0.0000	0.0000	0.0000	0.0000	292.1353	628.9283	962.3774	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1021.2009	820.2410	665.4010	355.9791	131.7500	0.0000	0.0000	0.0000	0.0000	314.4621	676.9949	1035.9283	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.6061	157.4162	163.2267	143.4163	138.4326	120.6645	113.0096	127.9782	129.0004	148.8568	161.0540	174.3045	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3749	89.3355	89.2122	88.9074	88.1728	86.7000	86.7000	86.7000	86.7000	88.7938	89.2286	89.3940	(217)
Fuel for water heating, kWh/month													
	200.9581	176.2080	182.9646	161.3097	157.0015	139.1747	130.3455	147.6104	148.7894	167.6433	180.4960	194.9844	(219)
Water heating fuel used												1987.4856	(219)
Annual totals kWh/year													
Space heating fuel - main system												5021.9573	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												485.8036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1208 * 1.00) =										-1063.1729		-1063.1729	(233)
Total delivered energy for all uses												6507.0736	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5021.9573	7.3800	370.6205	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1987.4856	7.3800	146.6764	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	485.8036	28.6600	139.2313	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-1063.1729	28.6600	-304.7054	(252)
Total energy cost			480.3178	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5021.9573	0.2160	1084.7428	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.4856	0.2160	429.2969	(264)
Space and water heating			1514.0397	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	485.8036	0.5190	252.1321	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	0.5190	-551.7867	(269)
Total kg/year			1253.3100	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5021.9573	1.2200	6126.7880	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.4856	1.2200	2424.7324	(264)
Space and water heating			8551.5204	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	485.8036	3.0700	1491.4170	(268)
Energy saving/generation technologies				
PV Unit	-1063.1729	3.0700	-3263.9408	(269)
Primary energy kWh/year			7009.2465	(272)
Primary energy kWh/m2/year			54.6487	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 1.0	-£ 62	-198 kg (15.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£161	£161	£0
Mains gas	£624	£624	£0
Space heating	£499	£499	£0
Water heating	£147	£147	£0
Lighting	£139	£139	£0
Generated (PV)	-£305	-£305	£0
Total cost of fuels	£480	£480	£0
Total cost of uses	£480	£480	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	875.15 (P1)
Transmission heat loss coefficient	101.23 (37)
Summer heat loss coefficient	976.38 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)
North West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.1100	87.1704	0.7200	0.7000	0.8865	284.2771
North East	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
East	0.8200	125.2818	0.7200	0.7000	0.8865	41.3098
South	8.0800	118.5567	0.7200	0.7000	0.8865	385.2025
West	1.4200	125.2818	0.7200	0.7000	0.8865	71.5366
North West	1.0200	106.0502	0.7200	0.7000	0.8865	43.4974
total:						869.3209

	Jun	Jul	Aug	
Solar gains	933	869	780	(P3)
Internal gains	541	518	528	
Total summer gains	1474	1387	1308	(P5)
Summer gain/loss ratio	1.51	1.42	1.34	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.16	18.97	18.89	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 441 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 441	**Prop Type Ref**	
Property	4 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	89 B	**DER**	13.20	**TER**	17.17
Environmental	89 B	**% DER<TER**	23.12		
CO_2 Emissions (t/year)	1.25	**DFEE**	53.36	**TFEE**	57.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.85		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.17	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.20	$kgCO_2/m^2$	Pass
	-3.97 (-23.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.90	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	53.36	$kWh/m^2/yr$	
	-4.5 (-7.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.18 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	8.11 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	0.82 m², No overhang
Windows facing South	8.08 m², No overhang
Windows facing West	1.42 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.18 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.021	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 442 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.94	**TER**	17.92
Environmental	89 B	**% DER<TER**	22.19		
CO_2 Emissions (t/year)	1.05	**DFEE**	51.20	**TFEE**	55.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.25		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Detached House, total floor area 101 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
-------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.94 kgCO□/m²OK
-------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.2 kWh/m²/yrOK
-------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.27 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           0.19 (max. 0.25)        0.19 (max. 0.70)          OK
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.32 (max. 2.00)        1.50 (max. 3.30)          OK
-------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
-------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.30 (measured in this dwelling)
Maximum                                 10.0                                    OK
-------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
-------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
-------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
-------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
-------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
-------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing North:                   7.62 m², No overhang
Windows facing South:                   11.04 m², No overhang
Air change rate:                        8.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 100% of daylight hours
-------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.022 W/m²K
Photovoltaic array                      0.81 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4410	0.4324	0.4237	0.3805	0.3718	0.3286	0.3286	0.3199	0.3459	0.3718	0.3891	0.4064	(22b)
Effective ac	0.5972	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4241	(36)
Total fabric heat loss (33) + (36) =	83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.3452	51.0206	50.7024	49.2078	48.9282	47.6265	47.6265	47.3854	48.1279	48.9282	49.4939	50.0853	(38)
Heat transfer coeff	135.1966	134.8720	134.5538	133.0592	132.7796	131.4778	131.4778	131.2368	131.9793	132.7796	133.3453	133.9367	(39)
Average = Sum(39)m / 12 =												133.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3415	1.3383	1.3351	1.3203	1.3175	1.3046	1.3046	1.3022	1.3096	1.3175	1.3231	1.3290	(40)
HLP (average)												1.3203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	424.5986	422.3610	406.9769	382.0463	356.5042	332.0689	316.3092	322.7117	335.6192	360.7770	389.6891	411.5926	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	633.1731	771.6870	874.9645	954.7222	998.2951	971.2144	931.5474	884.8624	838.9807	743.6030	638.2876	590.9586	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7662	51.8908	52.0135	52.5977	52.7085	53.2303	53.2303	53.3281	53.0281	52.7085	52.4849	52.2531	
alpha	4.4511	4.4594	4.4676	4.5065	4.5139	4.5487	4.5487	4.5552	4.5352	4.5139	4.4990	4.4835	
util living area													
	0.9975	0.9936	0.9845	0.9591	0.8938	0.7565	0.5920	0.6391	0.8512	0.9708	0.9946	0.9982	(86)
MIT	19.5356	19.7344	20.0177	20.3724	20.6902	20.9033	20.9755	20.9654	20.8221	20.4041	19.8990	19.5017	(87)
Th 2	19.8085	19.8110	19.8134	19.8250	19.8271	19.8372	19.8372	19.8391	19.8333	19.8271	19.8228	19.8182	(88)
util rest of house													
	0.9966	0.9913	0.9788	0.9427	0.8490	0.6583	0.4498	0.4981	0.7747	0.9559	0.9923	0.9975	(89)
MIT 2	17.8754	18.1666	18.5789	19.0921	19.5204	19.7719	19.8284	19.8251	19.6917	19.1459	18.4160	17.8324	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.1644	18.4395	18.8293	19.3149	19.7240	19.9688	20.0281	20.0236	19.8885	19.3649	18.6741	18.1229	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1644	18.4395	18.8293	19.3149	19.7240	19.9688	20.0281	20.0236	19.8885	19.3649	18.6741	18.1229	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9875	0.9720	0.9334	0.8442	0.6708	0.4745	0.5222	0.7790	0.9478	0.9889	0.9960	(94)
Useful gains	629.8181	762.0330	850.5005	891.1587	842.7845	651.4436	441.9984	462.1181	653.5527	704.7713	631.1838	588.6186	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1874.4159	1826.0964	1658.9530	1385.7987	1065.4237	705.8775	450.7135	475.5432	763.9571	1163.7956	1543.3565	1864.7876	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	925.9808	715.0506	601.4886	356.1408	165.6436	0.0000	0.0000	0.0000	0.0000	341.5141	656.7644	949.4698	(98)
Space heating												4712.0525	(98)
Space heating per m2											(98) / (4) =	46.7558	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5072.1771	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	925.9808	715.0506	601.4886	356.1408	165.6436	0.0000	0.0000	0.0000	0.0000	341.5141	656.7644	949.4698	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	996.7501	769.6992	647.4582	383.3593	178.3031	0.0000	0.0000	0.0000	0.0000	367.6147	706.9584	1022.0342	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3781	89.3204	89.2143	88.9780	88.4390	86.7000	86.7000	86.7000	86.7000	88.9251	89.2673	89.4017	(217)
Fuel for water heating, kWh/month													
	194.7124	170.7780	177.3196	156.2456	151.7626	134.9797	126.4582	143.1491	144.2759	162.2729	174.8472	188.9278	(219)
Water heating fuel used												1925.7291	(219)
Annual totals kWh/year													
Space heating fuel - main system												5072.1771	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6793.2115	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5072.1771	0.2160	1095.5903	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1925.7291	0.2160	415.9575	(264)
Space and water heating			1511.5477	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1405.3112	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9400	ZC1
Total Floor Area	TFA	100.7800	
Assumed number of occupants	N	2.7466	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1457	ZC2
CO2 emissions from cooking, equation (L16)		1.8349	ZC3
Total CO2 emissions		30.9205	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.9205	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4035 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4373	0.4288	0.4202	0.3773	0.3687	0.3259	0.3259	0.3173	0.3430	0.3687	0.3859	0.4030	(22b)
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.6600	1.3258	24.7386			(27)
Ground floor			50.3900	0.1300	6.5507			(28a)
External Wall	148.7500	20.7800	127.9700	0.1800	23.0346			(29a)
Main Roof	50.3900		50.3900	0.1300	6.5507			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.4186			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2653	(36)
Total fabric heat loss (33) + (36) =	74.6839	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2067	50.8875	50.5745	49.1047	48.8297	47.5495	47.5495	47.3125	48.0427	48.8297	49.3860	49.9676	(38)
Heat transfer coeff	125.8906	125.5714	125.2584	123.7886	123.5136	122.2334	122.2334	121.9964	122.7265	123.5136	124.0699	124.6515	(39)
Average = Sum(39)m / 12 =												123.7873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2492	1.2460	1.2429	1.2283	1.2256	1.2129	1.2129	1.2105	1.2178	1.2256	1.2311	1.2369	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466 (42)
Average daily hot water use (litres/day)	99.4325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
								Total per year (kWh/year) = Sum(64)m =				2144.7403	(64)
Heat gains from water heating, kWh/month													
	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250	(72)
Total internal gains													
	437.7470	435.5120	420.1333	394.7740	368.5579	343.4500	327.6954	334.7702	348.3539	373.9403	402.8439	424.7436	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.6300	0.7000	0.7700	24.7627	(74)
South	11.0400	46.7521	0.6300	0.7000	0.7700	157.7399	(78)

Solar gains	182.5027	305.6602	409.4891	501.0914	561.5671	559.2523	538.3334	491.8819	440.4413	334.9728	217.5237	156.9453	(83)
Total gains	620.2497	741.1723	829.6224	895.8654	930.1250	902.7023	866.0288	826.6521	788.7953	708.9131	620.3676	581.6888	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5928	55.7341	55.8734	56.5368	56.6627	57.2561	57.2561	57.3674	57.0261	56.6627	56.4086	56.1454	
alpha	4.7062	4.7156	4.7249	4.7691	4.7775	4.8171	4.8171	4.8245	4.8017	4.7775	4.7606	4.7430	
util living area													
	0.9977	0.9944	0.9864	0.9635	0.9015	0.7640	0.5957	0.6413	0.8556	0.9729	0.9951	0.9983	(86)
MIT	19.6420	19.8234	20.0856	20.4169	20.7149	20.9146	20.9798	20.9714	20.8418	20.4532	19.9832	19.6116	(87)
Th 2	19.8809	19.8834	19.8858	19.8974	19.8996	19.9097	19.9097	19.9116	19.9058	19.8996	19.8952	19.8906	(88)
util rest of house													
	0.9970	0.9925	0.9815	0.9490	0.8601	0.6707	0.4607	0.5075	0.7830	0.9593	0.9930	0.9978	(89)
MIT 2	18.0802	18.3462	18.7283	19.2095	19.6132	19.8508	19.9022	19.8996	19.7779	19.2688	18.5886	18.0425	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.3520	18.6033	18.9645	19.4196	19.8049	20.0360	20.0897	20.0862	19.9631	19.4749	18.8313	18.3156	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3520	18.6033	18.9645	19.4196	19.8049	20.0360	20.0897	20.0862	19.9631	19.4749	18.8313	18.3156	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9892	0.9757	0.9407	0.8558	0.6827	0.4842	0.5305	0.7875	0.9521	0.9900	0.9965	(94)
Useful gains	617.3385	733.1588	809.4835	842.7633	796.0384	616.2764	419.3017	438.5049	621.2134	674.9583	614.1809	579.6418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1769.0166	1720.7454	1561.2874	1302.2080	1001.0679	664.4604	426.5628	449.6992	719.5535	1096.1724	1455.4992	1759.5297	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	856.8485	663.6582	559.3421	330.8001	152.5419	0.0000	0.0000	0.0000	0.0000	313.3833	605.7491	877.8366	(98)
Space heating												4360.1599	(98)
Space heating per m2											(98) / (4) =	43.2641	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4668.2654	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	856.8485	663.6582	559.3421	330.8001	152.5419	0.0000	0.0000	0.0000	0.0000	313.3833	605.7491	877.8366	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	917.3967	710.5548	598.8673	354.1757	163.3211	0.0000	0.0000	0.0000	0.0000	335.5282	648.5537	939.8679	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1902	87.9589	87.5288	86.6209	84.7784	80.3000	80.3000	80.3000	80.3000	86.3876	87.7238	88.2728	(217)
Fuel for water heating, kWh/month													
	241.7047	213.6104	225.4663	202.8147	200.6280	186.5567	178.7355	199.2482	201.4487	212.3864	221.1114	235.6806	(219)
Water heating fuel used												2519.3915	(219)
Annual totals kWh/year													
Space heating fuel - main system												4668.2654	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Total delivered energy for all uses												7675.0719	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4668.2654	0.2160	1008.3453	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2519.3915	0.2160	544.1886	(264)
Space and water heating			1552.5339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Total CO2, kg/m2/year			1805.5023	(272)
Emissions per m2 for space and water heating			15.4052	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1239	(272b)
Emissions per m2 for pumps and fans			0.3862	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4052 * 1.00) + 2.1239 + 0.3862, rounded to 2 d.p.			17.9200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.3685	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3133	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3994	0.3916	0.3837	0.3446	0.3368	0.2976	0.2976	0.2898	0.3133	0.3368	0.3524	0.3681	(22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5677	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	49.8424	49.5762	49.3152	48.0892	47.8599	46.7921	46.7921	46.5944	47.2034	47.8599	48.3239	48.8090	(38)
Heat transfer coeff	133.6938	133.4276	133.1666	131.9406	131.7113	130.6435	130.6435	130.4458	131.0548	131.7113	132.1753	132.6604	(39)
Average = Sum(39)m / 12 =												131.9395	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3266	1.3239	1.3214	1.3092	1.3069	1.2963	1.2963	1.2944	1.3004	1.3069	1.3115	1.3163	(40)
HLP (average)												1.3092	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains													
	391.4623	390.0562	376.3989	353.8175	329.8018	307.5143	293.5781	297.6419	309.7169	332.4434	358.6119	379.2843	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	600.0368	739.3822	844.3865	926.4934	971.5928	946.6598	908.8162	859.7927	813.0784	715.2694	607.2104	558.6503	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3480	52.4525	52.5553	53.0436	53.1360	53.5703	53.5703	53.6515	53.4022	53.1360	52.9495	52.7559	
alpha	4.4899	4.4968	4.5037	4.5362	4.5424	4.5714	4.5714	4.5768	4.5601	4.5424	4.5300	4.5171	
util living area													
	0.9980	0.9946	0.9863	0.9626	0.9002	0.7661	0.6014	0.6509	0.8608	0.9743	0.9955	0.9986	(86)
MIT	19.5249	19.7238	20.0077	20.3619	20.6826	20.8994	20.9744	20.9633	20.8146	20.3904	19.8841	19.4887	(87)
Th 2	19.8201	19.8221	19.8241	19.8336	19.8354	19.8437	19.8437	19.8453	19.8405	19.8354	19.8318	19.8281	(88)
util rest of house													
	0.9973	0.9927	0.9812	0.9475	0.8572	0.6691	0.4586	0.5095	0.7869	0.9610	0.9937	0.9980	(89)
MIT 2	18.4870	18.6866	18.9694	19.3222	19.6192	19.7968	19.8373	19.8350	19.7385	19.3561	18.8546	18.4572	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6676	18.8672	19.1501	19.5031	19.8043	19.9887	20.0352	20.0314	19.9258	19.5361	19.0338	18.6367	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6676	18.8672	19.1501	19.5031	19.8043	19.9887	20.0352	20.0314	19.9258	19.5361	19.0338	18.6367	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9905	0.9773	0.9420	0.8559	0.6827	0.4837	0.5342	0.7934	0.9564	0.9918	0.9973	(94)
Useful gains	597.8112	732.3570	825.1835	872.7456	831.5529	646.3202	439.5841	459.2801	645.1165	684.0859	602.2400	557.1336	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1920.8616	1863.6043	1684.5715	1398.9822	1067.4265	703.9986	448.7918	473.6953	763.4954	1176.9885	1577.3515	1915.1771	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	984.3495	760.1982	639.3847	378.8903	175.4900	0.0000	0.0000	0.0000	0.0000	366.7196	702.0803	1010.3844	(98)
Space heating												5017.4969	(98)
Space heating per m2											(98) / (4) =	49.7866	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1228.0492	966.7621	991.3881	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8151	0.8879	0.8638	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1001.0014	858.4122	856.3740	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1212.1265	1165.6224	1110.2361	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	152.0101	228.5644	188.8734	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												569.4479	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   38.0025   57.1411   47.2184    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          142.3620 (107)
Space cooling per m2                                                                                                     1.4126 (108)
Energy for space heating                                                                                                49.7866 (99)
Energy for space cooling                                                                                                 1.4126 (108)
Total                                                                                                                   51.1992 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                   51.2 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4373	0.4288	0.4202	0.3773	0.3687	0.3259	0.3259	0.3173	0.3430	0.3687	0.3859	0.4030	(22b)
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.6600	1.3258	24.7386			(27)
Ground floor			50.3900	0.1300	6.5507			(28a)
External Wall	148.7500	20.7800	127.9700	0.1800	23.0346			(29a)
Main Roof	50.3900		50.3900	0.1300	6.5507			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.4186			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2653	(36)
Total fabric heat loss (33) + (36) =	74.6839	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2067	50.8875	50.5745	49.1047	48.8297	47.5495	47.5495	47.3125	48.0427	48.8297	49.3860	49.9676	(38)
Heat transfer coeff	125.8906	125.5714	125.2584	123.7886	123.5136	122.2334	122.2334	121.9964	122.7265	123.5136	124.0699	124.6515	(39)
Average = Sum(39)m / 12 =												123.7873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2492	1.2460	1.2429	1.2283	1.2256	1.2129	1.2129	1.2105	1.2178	1.2256	1.2311	1.2369	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains													
	391.4623	390.0562	376.3989	353.8175	329.8018	307.5143	293.5781	297.6419	309.7169	332.4434	358.6119	379.2843	(73)

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6. Solar gains

[Jan]													
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North					7.6200	10.6334	0.6300	0.7000	0.7700			24.7627	(74)
South					11.0400	46.7521	0.6300	0.7000	0.7700			157.7399	(78)
Solar gains	182.5027	305.6602	409.4891	501.0914	561.5671	559.2523	538.3334	491.8819	440.4413	334.9728	217.5237	156.9453	(83)
Total gains	573.9650	695.7165	785.8880	854.9089	891.3689	866.7666	831.9114	789.5239	750.1582	667.4162	576.1356	536.2296	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5928	55.7341	55.8734	56.5368	56.6627	57.2561	57.2561	57.3674	57.0261	56.6627	56.4086	56.1454	
alpha	4.7062	4.7156	4.7249	4.7691	4.7775	4.8171	4.8171	4.8245	4.8017	4.7775	4.7606	4.7430	
util living area													
	0.9984	0.9957	0.9891	0.9692	0.9133	0.7831	0.6161	0.6649	0.8737	0.9785	0.9964	0.9988	(86)
MIT	19.6001	19.7828	20.0479	20.3851	20.6924	20.9046	20.9767	20.9666	20.8238	20.4195	19.9435	19.5702	(87)
Th 2	19.8809	19.8834	19.8858	19.8974	19.8996	19.9097	19.9097	19.9116	19.9058	19.8996	19.8952	19.8906	(88)
util rest of house													
	0.9978	0.9942	0.9850	0.9566	0.8752	0.6914	0.4784	0.5292	0.8057	0.9673	0.9949	0.9984	(89)
MIT 2	18.6096	18.7937	19.0587	19.3980	19.6857	19.8639	19.9037	19.9019	19.8063	19.4372	18.9637	18.5875	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.7820	18.9658	19.2309	19.5698	19.8609	20.0450	20.0904	20.0872	19.9834	19.6081	19.1342	18.7585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7820	18.9658	19.2309	19.5698	19.8609	20.0450	20.0904	20.0872	19.9834	19.6081	19.1342	18.7585	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9925	0.9818	0.9518	0.8736	0.7042	0.5026	0.5529	0.8115	0.9633	0.9934	0.9978	(94)
Useful gains	572.2547	690.4798	771.5608	813.6776	778.6636	610.4152	418.1415	436.4941	608.7217	642.8966	572.3179	535.0645	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1823.1517	1766.2645	1594.6505	1320.7992	1007.9863	665.5663	426.6483	449.8214	722.0440	1112.6271	1493.0875	1814.7453	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	930.6674	722.9273	612.3787	365.1276	170.6161	0.0000	0.0000	0.0000	0.0000	349.4795	662.9541	952.0826	(98)
Space heating												4766.2334	(98)
Space heating per m2											(98) / (4) =	47.2934	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1148.9944	904.5275	927.1725	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8169	0.8913	0.8681	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.5692	806.1960	804.9059	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1118.7449	1075.7337	1028.1037	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	129.7265	200.5361	166.0592	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												496.3218	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   32.4316   50.1340   41.5148    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          124.0804 (107)
Space cooling per m2                                                                                                     1.2312 (108)
Energy for space heating                                                                                                47.2934 (99)
Energy for space cooling                                                                                                 1.2312 (108)
Total                                                                                                                   48.5246 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     55.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3632	0.3372	0.3459	0.3286	0.3286	0.3199	0.3113	0.3027	0.2940	0.3199	0.3027	0.3199	(22b)
Effective ac	0.5660	0.5569	0.5598	0.5540	0.5540	0.5512	0.5485	0.5458	0.5432	0.5512	0.5458	0.5512	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.6550	47.8739	48.1279	47.6265	47.6265	47.3854	47.1508	46.9225	46.7008	47.3854	46.9225	47.3854	(38)
Heat transfer coeff	132.5064	131.7253	131.9793	131.4778	131.4778	131.2368	131.0022	130.7739	130.5522	131.2368	130.7739	131.2368	(39)
Average = Sum(39)m / 12 =												131.3316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3148	1.3071	1.3096	1.3046	1.3046	1.3022	1.2999	1.2976	1.2954	1.3022	1.2976	1.3022	(40)
HLP (average)												1.3032	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
RHI water heating demand												1703	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8172	53.1303	53.0281	53.2303	53.2303	53.3281	53.4236	53.5169	53.6078	53.3281	53.5169	53.3281	
alpha	4.5211	4.5420	4.5352	4.5487	4.5487	4.5552	4.5616	4.5678	4.5739	4.5552	4.5678	4.5552	
util living area													
	0.9889	0.9813	0.9599	0.9060	0.7962	0.5927	0.4383	0.4521	0.7035	0.9092	0.9758	0.9912	(86)
MIT	19.8628	20.0062	20.2778	20.5946	20.8398	20.9683	20.9936	20.9927	20.9309	20.6558	20.2281	19.8413	(87)
Th 2	19.8293	19.8353	19.8333	19.8372	19.8372	19.8391	19.8409	19.8427	19.8444	19.8391	19.8427	19.8391	(88)
util rest of house													
	0.9852	0.9752	0.9465	0.8739	0.7282	0.4848	0.3113	0.3218	0.6020	0.8704	0.9664	0.9881	(89)
MIT 2	18.3648	18.5754	18.9602	19.3963	19.6989	19.8225	19.8393	19.8408	19.8005	19.4874	18.9021	18.3410	(90)
Living area fraction										fLA = Living area / (4) =		0.1740	(91)
MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9680	0.9369	0.8662	0.7322	0.5026	0.3336	0.3446	0.6166	0.8643	0.9584	0.9835	(94)
Useful gains	868.2428	957.9661	1024.9572	1017.8893	865.1257	604.6793	383.4195	382.6606	654.1010	836.8143	847.1180	815.5399	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1818.7176	1781.5053	1608.7671	1328.5584	972.5993	619.6909	385.1709	384.6488	691.5648	1088.0525	1468.9688	1785.0982	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	707.1533	553.4184	434.3546	223.6818	79.9604	0.0000	0.0000	0.0000	0.0000	186.9213	447.7325	721.3513	(98)
Space heating												3354.5734	(98)
RHI space heating demand												3355	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4410	0.4324	0.4237	0.3805	0.3718	0.3286	0.3286	0.3199	0.3459	0.3718	0.3891	0.4064	(22b)
Effective ac	0.5972	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4241	(36)
Total fabric heat loss (33) + (36) =	83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.3452	51.0206	50.7024	49.2078	48.9282	47.6265	47.6265	47.3854	48.1279	48.9282	49.4939	50.0853	(38)
Heat transfer coeff	135.1966	134.8720	134.5538	133.0592	132.7796	131.4778	131.4778	131.2368	131.9793	132.7796	133.3453	133.9367	(39)
Average = Sum(39)m / 12 =												133.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3415	1.3383	1.3351	1.3203	1.3175	1.3046	1.3046	1.3022	1.3096	1.3175	1.3231	1.3290	(40)
HLP (average)												1.3203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	840.0307	975.9445	1070.0944	1136.6426	1166.4636	1128.7734	1084.4822	1040.3973	1003.6432	921.4750	829.9115	793.1919	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7662	51.8908	52.0135	52.5977	52.7085	53.2303	53.2303	53.3281	53.0281	52.7085	52.4849	52.2531	
alpha	4.4511	4.4594	4.4676	4.5065	4.5139	4.5487	4.5487	4.5552	4.5352	4.5139	4.4990	4.4835	
util living area													
	0.9923	0.9842	0.9679	0.9282	0.8412	0.6834	0.5187	0.5588	0.7774	0.9400	0.9850	0.9939	(86)
MIT	19.7175	19.9090	20.1749	20.4984	20.7706	20.9365	20.9855	20.9798	20.8819	20.5345	20.0640	19.6808	(87)
Th 2	19.8085	19.8110	19.8134	19.8250	19.8271	19.8372	19.8372	19.8391	19.8333	19.8271	19.8228	19.8182	(88)
util rest of house													
	0.9897	0.9791	0.9571	0.9030	0.7854	0.5832	0.3891	0.4283	0.6888	0.9135	0.9791	0.9919	(89)
MIT 2	18.1397	18.4181	18.8005	19.2593	19.6113	19.7970	19.8323	19.8315	19.7466	19.3193	18.6532	18.0932	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.4143	18.6776	19.0397	19.4750	19.8131	19.9953	20.0330	20.0313	19.9442	19.5308	18.8987	18.3695	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4143	18.6776	19.0397	19.4750	19.8131	19.9953	20.0330	20.0313	19.9442	19.5308	18.8987	18.3695	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9723	0.9478	0.8937	0.7846	0.5979	0.4117	0.4509	0.6983	0.9049	0.9726	0.9883	(94)
Useful gains	827.6925	948.9122	1014.2820	1015.8679	915.2524	674.8853	446.4416	469.0947	700.7959	833.8758	807.1714	783.8748	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1908.2025	1858.2082	1687.2672	1407.0983	1077.2486	709.3661	451.3678	476.5628	771.3082	1185.8294	1573.3018	1897.8139	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	803.8994	611.0469	500.7010	281.6859	120.5251	0.0000	0.0000	0.0000	0.0000	261.8535	551.6139	828.7707	(98)
Space heating												3960.0964	(98)
Space heating per m2											(98) / (4) =	39.2945	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4262.7518	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	803.8994	611.0469	500.7010	281.6859	120.5251	0.0000	0.0000	0.0000	0.0000	261.8535	551.6139	828.7707	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	865.3384	657.7469	538.9677	303.2141	129.7364	0.0000	0.0000	0.0000	0.0000	281.8660	593.7716	892.1106	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3134	89.2420	89.1104	88.8167	88.1851	86.7000	86.7000	86.7000	86.7000	88.7364	89.1741	89.3417	(217)
Fuel for water heating, kWh/month													
	194.8535	170.9280	177.5265	156.5292	152.1994	134.9797	126.4582	143.1491	144.2759	162.6181	175.0300	189.0545	(219)
Water heating fuel used												1927.6022	(219)
Annual totals kWh/year													
Space heating fuel - main system												4262.7518	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												5985.6592	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4262.7518	3.4800	148.3438	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1927.6022	3.4800	67.0806	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	412.4150	13.1900	54.3975	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			308.4251	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8886	(257)
SAP value		87.6042	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4262.7518	0.2160	920.7544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1927.6022	0.2160	416.3621	(264)
Space and water heating			1337.1165	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total kg/year			1230.8799	(272)
CO2 emissions per m2			12.2100	(273)
EI value			88.6858	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3632	0.3372	0.3459	0.3286	0.3286	0.3199	0.3113	0.3027	0.2940	0.3199	0.3027	0.3199	(22b)
Effective ac	0.5660	0.5569	0.5598	0.5540	0.5540	0.5512	0.5485	0.5458	0.5432	0.5512	0.5458	0.5512	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.6550	47.8739	48.1279	47.6265	47.6265	47.3854	47.1508	46.9225	46.7008	47.3854	46.9225	47.3854	(38)
Heat transfer coeff	132.5064	131.7253	131.9793	131.4778	131.4778	131.2368	131.0022	130.7739	130.5522	131.2368	130.7739	131.2368	(39)
Average = Sum(39)m / 12 =												131.3316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3148	1.3071	1.3096	1.3046	1.3046	1.3022	1.2999	1.2976	1.2954	1.3022	1.2976	1.3022	(40)
HLP (average)												1.3032	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8172	53.1303	53.0281	53.2303	53.2303	53.3281	53.4236	53.5169	53.6078	53.3281	53.5169	53.3281	
alpha	4.5211	4.5420	4.5352	4.5487	4.5487	4.5552	4.5616	4.5678	4.5739	4.5552	4.5678	4.5552	
util living area													
	0.9889	0.9813	0.9599	0.9060	0.7962	0.5927	0.4383	0.4521	0.7035	0.9092	0.9758	0.9912	(86)
MIT	19.8628	20.0062	20.2778	20.5946	20.8398	20.9683	20.9936	20.9927	20.9309	20.6558	20.2281	19.8413	(87)
Th 2	19.8293	19.8353	19.8333	19.8372	19.8372	19.8391	19.8409	19.8427	19.8444	19.8391	19.8427	19.8391	(88)
util rest of house													
	0.9852	0.9752	0.9465	0.8739	0.7282	0.4848	0.3113	0.3218	0.6020	0.8704	0.9664	0.9881	(89)
MIT 2	18.3648	18.5754	18.9602	19.3963	19.6989	19.8225	19.8393	19.8408	19.8005	19.4874	18.9021	18.3410	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9680	0.9369	0.8662	0.7322	0.5026	0.3336	0.3446	0.6166	0.8643	0.9584	0.9835	(94)
Useful gains	868.2428	957.9661	1024.9572	1017.8893	865.1257	604.6793	383.4195	382.6606	654.1010	836.8143	847.1180	815.5399	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1818.7176	1781.5053	1608.7671	1328.5584	972.5993	619.6909	385.1709	384.6488	691.5648	1088.0525	1468.9688	1785.0982	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	707.1533	553.4184	434.3546	223.6818	79.9604	0.0000	0.0000	0.0000	0.0000	186.9213	447.7325	721.3513	(98)
Space heating												3354.5734	(98)
Space heating per m2											(98) / (4) =	33.2861	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3610.9509	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	707.1533	553.4184	434.3546	223.6818	79.9604	0.0000	0.0000	0.0000	0.0000	186.9213	447.7325	721.3513	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	761.1983	595.7141	467.5507	240.7769	86.0714	0.0000	0.0000	0.0000	0.0000	201.2069	481.9511	776.4815	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2494	89.1887	89.0228	88.6459	87.8677	86.7000	86.7000	86.7000	86.7000	88.4773	89.0504	89.2748	(217)
Fuel for water heating, kWh/month													
	194.9931	171.0301	177.7011	156.8309	152.7493	134.9797	126.4582	143.1491	144.2759	163.0942	175.2732	189.1962	(219)
Water heating fuel used												1929.7310	(219)
Annual totals kWh/year													
Space heating fuel - main system												3610.9509	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												5259.2202	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.9509	7.3800	266.4882	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1929.7310	7.3800	142.4141	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	412.4150	28.6600	118.1981	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			435.2354	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.9509	0.2160	779.9654	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.7310	0.2160	416.8219	(264)
Space and water heating			1196.7873	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			1050.7087	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3610.9509	1.2200	4405.3602	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.7310	1.2200	2354.2718	(264)
Space and water heating			6759.6319	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	412.4150	3.0700	1266.1139	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			5895.5445	(272)
Primary energy kWh/m2/year			58.4992	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 61	-194 kg (18.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£61	1.92 kg/m²	B 89	B 90
Total Savings	£61	1.92 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£140	£154	-£14
Mains gas	£516	£441	£75
Space heating	£395	£395	£0
Water heating	£142	£82	£61
Lighting	£118	£118	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£436	£375	£61
Total cost of uses	£435	£375	£61
Delivered energy	52 kWh/m²	43 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	48 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900	(1b)	x 2.5400	(2b) =	127.9906	(1b) - (3b)
First floor	50.3900	(1c)	x 2.6300	(2c) =	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4410	0.4324	0.4237	0.3805	0.3718	0.3286	0.3286	0.3199	0.3459	0.3718	0.3891	0.4064	(22b)
Effective ac	0.5972	0.5935	0.5898	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.3452	51.0206	50.7024	49.2078	48.9282	47.6265	47.6265	47.3854	48.1279	48.9282	49.4939	50.0853	(38)
Heat transfer coeff	135.1966	134.8720	134.5538	133.0592	132.7796	131.4778	131.4778	131.2368	131.9793	132.7796	133.3453	133.9367	(39)
Average = Sum(39)m / 12 =												133.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3415	1.3383	1.3351	1.3203	1.3175	1.3046	1.3046	1.3022	1.3096	1.3175	1.3231	1.3290	(40)
HLP (average)												1.3203	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1593	(H8)
Utilisation factor												0.5779	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												99.4325	(H14)
Volume ratio Veff/V												0.7543	(H15)
Solar storage volume factor												0.9436	(H16)
Solar input												-869.6671	(H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037	(63)
								Solar input (sum of months) = Sum(63)m =				-869.6671	(63)
Output from w/h													
	148.8116	110.4569	86.5229	42.9702	15.5507	0.3593	0.0000	23.5238	46.3079	90.5043	126.1686	147.8009	(64)
									Total per year (kWh/year) = Sum(64)m =			838.9772	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	840.0307	975.9445	1070.0944	1136.6426	1166.4636	1128.7734	1084.4822	1040.3973	1003.6432	921.4750	829.9115	793.1919	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7662	51.8908	52.0135	52.5977	52.7085	53.2303	53.2303	53.3281	53.0281	52.7085	52.4849	52.2531	
alpha	4.4511	4.4594	4.4676	4.5065	4.5139	4.5487	4.5487	4.5552	4.5352	4.5139	4.4990	4.4835	
util living area													
	0.9923	0.9842	0.9679	0.9282	0.8412	0.6834	0.5187	0.5588	0.7774	0.9400	0.9850	0.9939	(86)
MIT	19.7175	19.9090	20.1749	20.4984	20.7706	20.9365	20.9855	20.9798	20.8819	20.5345	20.0640	19.6808	(87)
Th 2	19.8085	19.8110	19.8134	19.8250	19.8271	19.8372	19.8372	19.8391	19.8333	19.8271	19.8228	19.8182	(88)
util rest of house													
	0.9897	0.9791	0.9571	0.9030	0.7854	0.5832	0.3891	0.4283	0.6888	0.9135	0.9791	0.9919	(89)
MIT 2	18.1397	18.4181	18.8005	19.2593	19.6113	19.7970	19.8323	19.8315	19.7466	19.3193	18.6532	18.0932	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.4143	18.6776	19.0397	19.4750	19.8131	19.9953	20.0330	20.0313	19.9442	19.5308	18.8987	18.3695	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4143	18.6776	19.0397	19.4750	19.8131	19.9953	20.0330	20.0313	19.9442	19.5308	18.8987	18.3695	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9723	0.9478	0.8937	0.7846	0.5979	0.4117	0.4509	0.6983	0.9049	0.9726	0.9883	(94)
Useful gains	827.6925	948.9122	1014.2820	1015.8679	915.2524	674.8853	446.4416	469.0947	700.7959	833.8758	807.1714	783.8748	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1908.2025	1858.2082	1687.2672	1407.0983	1077.2486	709.3661	451.3678	476.5628	771.3082	1185.8294	1573.3018	1897.8139 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	803.8994	611.0469	500.7010	281.6859	120.5251	0.0000	0.0000	0.0000	0.0000	261.8535	551.6139	828.7707 (98)

Space heating 3960.0964 (98)
Space heating per m2 (98) / (4) = 39.2945 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4262.7518 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	803.8994	611.0469	500.7010	281.6859	120.5251	0.0000	0.0000	0.0000	0.0000	261.8535	551.6139	828.7707	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	865.3384	657.7469	538.9677	303.2141	129.7364	0.0000	0.0000	0.0000	0.0000	281.8660	593.7716	892.1106	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	148.8116	110.4569	86.5229	42.9702	15.5507	0.3593	0.0000	23.5238	46.3079	90.5043	126.1686	147.8009 (64)

Efficiency of water heater 86.7000 (216)

(217)m	89.3847	89.3949	89.4137	89.4630	89.5224	86.7000	86.7000	86.7000	86.7000	89.0557	89.2866	89.4006 (217)

Fuel for water heating, kWh/month

	166.4845	123.5607	96.7669	48.0313	17.3707	0.4144	0.0000	27.1325	53.4116	101.6266	141.3075	165.3243 (219)

Water heating fuel used 941.4310 (219)
Annual totals kWh/year
Space heating fuel - main system 4262.7518 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 412.4150 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) = -692.1097 -692.1097 (233)
Total delivered energy for all uses 5049.4880 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4262.7518	3.4800	148.3438	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	941.4310	3.4800	32.7618	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	412.4150	13.1900	54.3975	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			280.7013	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8087 (257)
SAP value 88.7184
SAP rating (Section 12) 89 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4262.7518	0.2160	920.7544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	941.4310	0.2160	203.3491	(264)
Space and water heating			1124.1035	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1043.8169 (272)
CO2 emissions per m2			10.3600 (273)
EI value			90.4053
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.3000	
Infiltration rate		0.4069	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3459	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3632	0.3372	0.3459	0.3286	0.3286	0.3199	0.3113	0.3027	0.2940	0.3199	0.3027	0.3199	(22b)
Effective ac	0.5660	0.5569	0.5598	0.5540	0.5540	0.5512	0.5485	0.5458	0.5432	0.5512	0.5458	0.5512	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.6550	47.8739	48.1279	47.6265	47.6265	47.3854	47.1508	46.9225	46.7008	47.3854	46.9225	47.3854	(38)
Heat transfer coeff	132.5064	131.7253	131.9793	131.4778	131.4778	131.2368	131.0022	130.7739	130.5522	131.2368	130.7739	131.2368	(39)
Average = Sum(39)m / 12 =												131.3316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3148	1.3071	1.3096	1.3046	1.3046	1.3022	1.2999	1.2976	1.2954	1.3022	1.2976	1.3022	(40)
HLP (average)												1.3032	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2974	(H8)
Utilisation factor												0.5374	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												99.4325	(H14)
Volume ratio Veff/V												0.7543	(H15)
Solar storage volume factor												0.9436	(H16)
Solar input												-904.9218	(H17)
Solar input	-29.5207	-41.9766	-72.1477	-97.3440	-114.3363	-122.1293	-119.5609	-107.0106	-83.7819	-57.9239	-34.9153	-24.2746	(63)
										Solar input (sum of months) = Sum(63)m =		-904.9218	(63)
Output from w/h													
	144.5095	110.5630	86.0467	41.6802	19.8809	0.0000	0.0000	17.0997	41.3053	86.3774	121.1662	144.6300	(64)
										Total per year (kWh/year) = Sum(64)m =		813.2589	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.8172	53.1303	53.0281	53.2303	53.2303	53.3281	53.4236	53.5169	53.6078	53.3281	53.5169	53.3281	
alpha	4.5211	4.5420	4.5352	4.5487	4.5487	4.5552	4.5616	4.5678	4.5739	4.5552	4.5678	4.5552	
util living area													
	0.9889	0.9813	0.9599	0.9060	0.7962	0.5927	0.4383	0.4521	0.7035	0.9092	0.9758	0.9912	(86)
MIT	19.8628	20.0062	20.2778	20.5946	20.8398	20.9683	20.9936	20.9927	20.9309	20.6558	20.2281	19.8413	(87)
Th 2	19.8293	19.8353	19.8333	19.8372	19.8372	19.8391	19.8409	19.8427	19.8444	19.8391	19.8427	19.8391	(88)
util rest of house													
	0.9852	0.9752	0.9465	0.8739	0.7282	0.4848	0.3113	0.3218	0.6020	0.8704	0.9664	0.9881	(89)
MIT 2	18.3648	18.5754	18.9602	19.3963	19.6989	19.8225	19.8393	19.8408	19.8005	19.4874	18.9021	18.3410	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6255	18.8244	19.1895	19.6048	19.8974	20.0219	20.0402	20.0413	19.9972	19.6908	19.1329	18.6021	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9680	0.9369	0.8662	0.7322	0.5026	0.3336	0.3446	0.6166	0.8643	0.9584	0.9835	(94)
Useful gains	868.2428	957.9661	1024.9572	1017.8893	865.1257	604.6793	383.4195	382.6606	654.1010	836.8143	847.1180	815.5399	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1818.7176	1781.5053	1608.7671	1328.5584	972.5993	619.6909	385.1709	384.6488	691.5648	1088.0525	1468.9688	1785.0982 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	707.1533	553.4184	434.3546	223.6818	79.9604	0.0000	0.0000	0.0000	0.0000	186.9213	447.7325	721.3513 (98)

Space heating 3354.5734 (98)
Space heating per m2 (98) / (4) = 33.2861 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3610.9509 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	707.1533	553.4184	434.3546	223.6818	79.9604	0.0000	0.0000	0.0000	0.0000	186.9213	447.7325	721.3513	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	761.1983	595.7141	467.5507	240.7769	86.0714	0.0000	0.0000	0.0000	0.0000	201.2069	481.9511	776.4815	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.5095	110.5630	86.0467	41.6802	19.8809	0.0000	0.0000	17.0997	41.3053	86.3774	121.1662	144.6300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3405	89.3509	89.3547	89.3818	89.2441	86.7000	86.7000	86.7000	86.7000	88.8634	89.1988	89.3492	(217)
Fuel for water heating, kWh/month													
	161.7514	123.7402	96.2980	46.6316	22.2770	0.0000	0.0000	19.7228	47.6416	97.2025	135.8384	161.8704	(219)
Water heating fuel used												912.9740	(219)
Annual totals kWh/year													
Space heating fuel - main system												3610.9509	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												4292.4632	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3610.9509	7.3800	266.4882	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	912.9740	7.3800	67.3775	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	412.4150	28.6600	118.1981	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			374.5287	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3610.9509	0.2160	779.9654	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	912.9740	0.2160	197.2024	(264)
Space and water heating			977.1678	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			857.0392	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	3610.9509	1.2200	4405.3602	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	912.9740	1.2200	1113.8283	(264)
Space and water heating			5519.1884	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	412.4150	3.0700	1266.1139	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			4808.6010	(272)
Primary energy kWh/m2/year			47.7138	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	687.76	(P1)
Transmission heat loss coefficient	83.85	(37)
Summer heat loss coefficient	771.61	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.6200	87.1704	0.7200	0.7000	0.7650	230.4935
South	11.0400	118.5567	0.7200	0.7000	0.7650	454.1816
total:						684.6751

	Jun	Jul	Aug	
Solar gains	730	685	634	(P3)
Internal gains	487	466	475	
Total summer gains	1217	1151	1109	(P5)
Summer gain/loss ratio	1.58	1.49	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 442 - BG	**Issued on Date**	07/08/2024
Assessment Reference	2	**Prop Type Ref**	
Property	3 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.94	**TER**	17.92
Environmental	89 B	**% DER<TER**	22.19		
CO_2 Emissions (t/year)	1.05	**DFEE**	51.20	**TFEE**	55.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.25		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.94	$kgCO_2/m^2$	Pass
	-3.98 (-22.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.20	$kWh/m^2/yr$	
	-4.6 (-8.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass
Based on:			
Overshading	Average		
Windows facing North	7.62 m², No overhang		
Windows facing South	11.04 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.30 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K	
Photovoltaic array	0.81	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 443 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 443	**Prop Type Ref**	
Property	2 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.97	**TER**	17.92
Environmental	89 B	**% DER<TER**	22.02		
CO_2 Emissions (t/year)	1.05	**DFEE**	51.32	**TFEE**	55.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 101 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.97 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.44 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.62 m², No overhang
Windows facing South: 11.04 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 0.81 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4486	0.4398	0.4310	0.3870	0.3782	0.3342	0.3342	0.3254	0.3518	0.3782	0.3958	0.4134	(22b)
Effective ac	0.6006	0.5967	0.5929	0.5749	0.5715	0.5559	0.5559	0.5530	0.5619	0.5715	0.5783	0.5855	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.6353	51.2994	50.9702	49.4237	49.1344	47.7875	47.7875	47.5381	48.3063	49.1344	49.7197	50.3317	(38)
Heat transfer coeff	135.4867	135.1508	134.8216	133.2751	132.9858	131.6389	131.6389	131.3895	132.1577	132.9858	133.5711	134.1831	(39)
Average = Sum(39)m / 12 =												133.2738	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3444	1.3410	1.3378	1.3224	1.3196	1.3062	1.3062	1.3037	1.3113	1.3196	1.3254	1.3314	(40)
HLP (average)												1.3224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	424.5986	422.3610	406.9769	382.0463	356.5042	332.0689	316.3092	322.7117	335.6192	360.7770	389.6891	411.5926	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	633.1731	771.6870	874.9645	954.7222	998.2951	971.2144	931.5474	884.8624	838.9807	743.6030	638.2876	590.9586	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6553	51.7837	51.9102	52.5125	52.6268	53.1652	53.1652	53.2661	52.9565	52.6268	52.3961	52.1572	
alpha	4.4437	4.4522	4.4607	4.5008	4.5085	4.5443	4.5443	4.5511	4.5304	4.5085	4.4931	4.4771	
util living area													
	0.9975	0.9936	0.9845	0.9592	0.8940	0.7570	0.5925	0.6396	0.8516	0.9709	0.9946	0.9982	(86)
MIT	19.5320	19.7309	20.0147	20.3704	20.6888	20.9028	20.9753	20.9652	20.8213	20.4024	19.8966	19.4986	(87)
Th 2	19.8062	19.8088	19.8114	19.8233	19.8255	19.8360	19.8360	19.8379	19.8320	19.8255	19.8210	19.8163	(88)
util rest of house													
	0.9966	0.9914	0.9788	0.9428	0.8493	0.6587	0.4501	0.4985	0.7750	0.9560	0.9923	0.9975	(89)
MIT 2	17.8686	18.1602	18.5731	19.0880	19.5174	19.7703	19.8271	19.8238	19.6897	19.1424	18.4113	17.8266	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.1581	18.4336	18.8240	19.3112	19.7213	19.9674	20.0269	20.0225	19.8866	19.3617	18.6699	18.1176	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1581	18.4336	18.8240	19.3112	19.7213	19.9674	20.0269	20.0225	19.8866	19.3617	18.6699	18.1176	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9875	0.9721	0.9335	0.8445	0.6711	0.4748	0.5226	0.7793	0.9478	0.9889	0.9960	(94)
Useful gains	629.8135	762.0324	850.5234	891.2534	843.0566	651.8196	442.3385	462.4391	653.8208	704.8176	631.1824	588.6150	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1877.5928	1829.0717	1661.5395	1387.5518	1066.7166	706.5554	451.1186	475.9530	764.7474	1165.1781	1545.3985	1867.5034	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	928.3478	717.0504	603.3960	357.3349	166.4030	0.0000	0.0000	0.0000	0.0000	342.5082	658.2356	951.4929	(98)
Space heating												4724.7688	(98)
Space heating per m2											(98) / (4) =	46.8820	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5085.8652	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	928.3478	717.0504	603.3960	357.3349	166.4030	0.0000	0.0000	0.0000	0.0000	342.5082	658.2356	951.4929	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	999.2979	771.8519	649.5113	384.6447	179.1205	0.0000	0.0000	0.0000	0.0000	368.6848	708.5421	1024.2120	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3792	89.3217	89.2160	88.9801	88.4426	86.7000	86.7000	86.7000	86.7000	88.9271	89.2685	89.4025	(217)
Fuel for water heating, kWh/month													
	194.7100	170.7755	177.3162	156.2418	151.7564	134.9797	126.4582	143.1491	144.2759	162.2693	174.8450	188.9259	(219)
Water heating fuel used												1925.7030	(219)
Annual totals kWh/year													
Space heating fuel - main system												5085.8652	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												6806.8735	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5085.8652	0.2160	1098.5469	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1925.7030	0.2160	415.9518	(264)
Space and water heating			1514.4987	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total CO2, kg/year			1408.2622	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.9700	ZC1
Total Floor Area	TFA	100.7800	
Assumed number of occupants	N	2.7466	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.1457	ZC2
CO2 emissions from cooking, equation (L16)		1.8349	ZC3
Total CO2 emissions		30.9505	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.9505	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4035 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4373	0.4288	0.4202	0.3773	0.3687	0.3259	0.3259	0.3173	0.3430	0.3687	0.3859	0.4030	(22b)
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.6600	1.3258	24.7386			(27)
Ground floor			50.3900	0.1300	6.5507			(28a)
External Wall	148.7500	20.7800	127.9700	0.1800	23.0346			(29a)
Main Roof	50.3900		50.3900	0.1300	6.5507			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.4186			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2653	(36)
Total fabric heat loss (33) + (36) =	74.6839	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2067	50.8875	50.5745	49.1047	48.8297	47.5495	47.5495	47.3125	48.0427	48.8297	49.3860	49.9676	(38)
Heat transfer coeff	125.8906	125.5714	125.2584	123.7886	123.5136	122.2334	122.2334	121.9964	122.7265	123.5136	124.0699	124.6515	(39)
Average = Sum(39)m / 12 =												123.7873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2492	1.2460	1.2429	1.2283	1.2256	1.2129	1.2129	1.2105	1.2178	1.2256	1.2311	1.2369	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466 (42)
Average daily hot water use (litres/day)	99.4325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.0545	47.6295	44.1317	45.6027	47.6295	48.0545	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
								Total per year (kWh/year) = Sum(64)m =				2144.7403	(64)
Heat gains from water heating, kWh/month													
	66.6716	58.6760	61.4140	54.4491	52.6252	46.1693	43.9597	49.2693	49.8218	56.8015	60.4257	64.9698	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	89.6123	87.3154	82.5458	75.6237	70.7328	64.1240	59.0856	66.2222	69.1969	76.3461	83.9245	87.3250	(72)
Total internal gains													
	437.7470	435.5120	420.1333	394.7740	368.5579	343.4500	327.6954	334.7702	348.3539	373.9403	402.8439	424.7436	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.6300	0.7000	0.7700	24.7627	(74)
South	11.0400	46.7521	0.6300	0.7000	0.7700	157.7399	(78)

Solar gains	182.5027	305.6602	409.4891	501.0914	561.5671	559.2523	538.3334	491.8819	440.4413	334.9728	217.5237	156.9453	(83)
Total gains	620.2497	741.1723	829.6224	895.8654	930.1250	902.7023	866.0288	826.6521	788.7953	708.9131	620.3676	581.6888	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5928	55.7341	55.8734	56.5368	56.6627	57.2561	57.2561	57.3674	57.0261	56.6627	56.4086	56.1454	
alpha	4.7062	4.7156	4.7249	4.7691	4.7775	4.8171	4.8171	4.8245	4.8017	4.7775	4.7606	4.7430	
util living area													
	0.9977	0.9944	0.9864	0.9635	0.9015	0.7640	0.5957	0.6413	0.8556	0.9729	0.9951	0.9983	(86)
MIT	19.6420	19.8234	20.0856	20.4169	20.7149	20.9146	20.9798	20.9714	20.8418	20.4532	19.9832	19.6116	(87)
Th 2	19.8809	19.8834	19.8858	19.8974	19.8996	19.9097	19.9097	19.9116	19.9058	19.8996	19.8952	19.8906	(88)
util rest of house													
	0.9970	0.9925	0.9815	0.9490	0.8601	0.6707	0.4607	0.5075	0.7830	0.9593	0.9930	0.9978	(89)
MIT 2	18.0802	18.3462	18.7283	19.2095	19.6132	19.8508	19.9022	19.8996	19.7779	19.2688	18.5886	18.0425	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.3520	18.6033	18.9645	19.4196	19.8049	20.0360	20.0897	20.0862	19.9631	19.4749	18.8313	18.3156	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3520	18.6033	18.9645	19.4196	19.8049	20.0360	20.0897	20.0862	19.9631	19.4749	18.8313	18.3156	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9953	0.9892	0.9757	0.9407	0.8558	0.6827	0.4842	0.5305	0.7875	0.9521	0.9900	0.9965	(94)
Useful gains	617.3385	733.1588	809.4835	842.7633	796.0384	616.2764	419.3017	438.5049	621.2134	674.9583	614.1809	579.6418	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1769.0166	1720.7454	1561.2874	1302.2080	1001.0679	664.4604	426.5628	449.6992	719.5535	1096.1724	1455.4992	1759.5297	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	856.8485	663.6582	559.3421	330.8001	152.5419	0.0000	0.0000	0.0000	0.0000	313.3833	605.7491	877.8366	(98)
Space heating												4360.1599	(98)
Space heating per m2											(98) / (4) =	43.2641	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4668.2654	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	856.8485	663.6582	559.3421	330.8001	152.5419	0.0000	0.0000	0.0000	0.0000	313.3833	605.7491	877.8366	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	917.3967	710.5548	598.8673	354.1757	163.3211	0.0000	0.0000	0.0000	0.0000	335.5282	648.5537	939.8679	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	213.1599	187.8894	197.3478	175.6799	170.0891	149.8050	143.5246	159.9963	161.7633	183.4756	193.9674	208.0419	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1902	87.9589	87.5288	86.6209	84.7784	80.3000	80.3000	80.3000	80.3000	86.3876	87.7238	88.2728	(217)
Fuel for water heating, kWh/month													
	241.7047	213.6104	225.4663	202.8147	200.6280	186.5567	178.7355	199.2482	201.4487	212.3864	221.1114	235.6806	(219)
Water heating fuel used												2519.3915	(219)
Annual totals kWh/year													
Space heating fuel - main system												4668.2654	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Total delivered energy for all uses												7675.0719	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4668.2654	0.2160	1008.3453	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2519.3915	0.2160	544.1886	(264)
Space and water heating			1552.5339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Total CO2, kg/m2/year			1805.5023	(272)
Emissions per m2 for space and water heating			15.4052	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1239	(272b)
Emissions per m2 for pumps and fans			0.3862	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4052 * 1.00) + 2.1239 + 0.3862, rounded to 2 d.p.			17.9200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.3755	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3192	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4070	0.3990	0.3910	0.3511	0.3432	0.3032	0.3032	0.2953	0.3192	0.3432	0.3591	0.3751	(22b)
Effective ac	0.5828	0.5796	0.5765	0.5616	0.5589	0.5460	0.5460	0.5436	0.5509	0.5589	0.5645	0.5703	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1054	49.8289	49.5579	48.2850	48.0468	46.9381	46.9381	46.7328	47.3652	48.0468	48.5286	49.0323	(38)
Heat transfer coeff	133.9568	133.6803	133.4093	132.1364	131.8982	130.7895	130.7895	130.5842	131.2166	131.8982	132.3800	132.8837	(39)
Average = Sum(39)m / 12 =												132.1352	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3292	1.3265	1.3238	1.3111	1.3088	1.2978	1.2978	1.2957	1.3020	1.3088	1.3136	1.3186	(40)
HLP (average)												1.3111	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7466 (42)
Average daily hot water use (litres/day)		99.4325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains													
	391.4623	390.0562	376.3989	353.8175	329.8018	307.5143	293.5781	297.6419	309.7169	332.4434	358.6119	379.2843	(73)

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6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North		7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South		11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	600.0368	739.3822	844.3865	926.4934	971.5928	946.6598	908.8162	859.7927	813.0784	715.2694	607.2104	558.6503	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.2453	52.3533	52.4597	52.9651	53.0607	53.5105	53.5105	53.5946	53.3363	53.0607	52.8676	52.6672	
alpha	4.4830	4.4902	4.4973	4.5310	4.5374	4.5674	4.5674	4.5730	4.5558	4.5374	4.5245	4.5111	
util living area													
	0.9980	0.9946	0.9863	0.9627	0.9004	0.7665	0.6019	0.6514	0.8611	0.9744	0.9955	0.9986	(86)
MIT	19.5216	19.7207	20.0049	20.3600	20.6813	20.8989	20.9742	20.9631	20.8139	20.3888	19.8819	19.4859	(87)
Th 2	19.8180	19.8202	19.8223	19.8321	19.8340	19.8426	19.8426	19.8442	19.8393	19.8340	19.8302	19.8263	(88)
util rest of house													
	0.9973	0.9927	0.9812	0.9476	0.8575	0.6694	0.4589	0.5099	0.7872	0.9611	0.9937	0.9980	(89)
MIT 2	18.4821	18.6820	18.9652	19.3192	19.6169	19.7954	19.8362	19.8338	19.7368	19.3535	18.8512	18.4530	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6630	18.8628	19.1462	19.5003	19.8021	19.9875	20.0342	20.0304	19.9242	19.5337	19.0306	18.6328	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6630	18.8628	19.1462	19.5003	19.8021	19.9875	20.0342	20.0304	19.9242	19.5337	19.0306	18.6328	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9905	0.9773	0.9421	0.8561	0.6831	0.4840	0.5345	0.7937	0.9565	0.9918	0.9973	(94)
Useful gains	597.8082	732.3567	825.2019	872.8257	831.7936	646.6580	439.8923	459.5694	645.3522	684.1226	602.2390	557.1313	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1924.0258	1866.5522	1687.1169	1400.6856	1068.6576	704.6267	449.1624	474.0706	764.2379	1178.3356	1579.3724	1917.8819	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	986.7059	762.1794	641.2647	380.0591	176.2268	0.0000	0.0000	0.0000	0.0000	367.6945	703.5361	1012.3984	(98)
Space heating												5030.0648	(98)
Space heating per m2											(98) / (4) =	49.9113	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1229.4215	967.8424	992.4400	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8145	0.8875	0.8633	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1001.3908	858.9134	856.7899	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1212.1265	1165.6224	1110.2361	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	151.7297	228.1915	188.5640	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												568.4852	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
              0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
              0.0000    0.0000    0.0000    0.0000    0.0000   37.9324   57.0479   47.1410    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                                142.1213 (107)
Space cooling per m2                                                                                                           1.4102 (108)
Energy for space heating                                                                                                      49.9113 (99)
Energy for space cooling                                                                                                       1.4102 (108)
Total                                                                                                                         51.3216 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                        51.3 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1535	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4035	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3430	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4373	0.4288	0.4202	0.3773	0.3687	0.3259	0.3259	0.3173	0.3430	0.3687	0.3859	0.4030	(22b)
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.6600	1.3258	24.7386			(27)
Ground floor			50.3900	0.1300	6.5507			(28a)
External Wall	148.7500	20.7800	127.9700	0.1800	23.0346			(29a)
Main Roof	50.3900		50.3900	0.1300	6.5507			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.4186			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.2653	(36)
Total fabric heat loss (33) + (36) =	74.6839	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2067	50.8875	50.5745	49.1047	48.8297	47.5495	47.5495	47.3125	48.0427	48.8297	49.3860	49.9676	(38)
Heat transfer coeff	125.8906	125.5714	125.2584	123.7886	123.5136	122.2334	122.2334	121.9964	122.7265	123.5136	124.0699	124.6515	(39)
Average = Sum(39)m / 12 =												123.7873	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2492	1.2460	1.2429	1.2283	1.2256	1.2129	1.2129	1.2105	1.2178	1.2256	1.2311	1.2369	(40)
HLP (average)												1.2283	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.4677	30.1457	31.1076	27.1204	26.0227	22.4556	20.8084	23.8779	24.1631	28.1598	30.7386	33.3801	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	137.3315	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.3526	20.7416	16.8682	12.7703	9.5460	8.0591	8.7081	11.3192	15.1926	19.2905	22.5148	24.0017	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	257.5826	260.2555	253.5199	239.1805	221.0797	204.0674	192.7022	190.0293	196.7649	211.1043	229.2051	246.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	36.7332	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	46.3276	44.8597	41.8114	37.6672	34.9767	31.1883	27.9683	32.0940	33.5599	37.8492	42.6925	44.8658	(72)
Total internal gains													
	391.4623	390.0562	376.3989	353.8175	329.8018	307.5143	293.5781	297.6419	309.7169	332.4434	358.6119	379.2843	(73)

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6. Solar gains

[Jan]													
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
North					7.6200	10.6334	0.6300	0.7000	0.7700			24.7627	(74)
South					11.0400	46.7521	0.6300	0.7000	0.7700			157.7399	(78)
Solar gains	182.5027	305.6602	409.4891	501.0914	561.5671	559.2523	538.3334	491.8819	440.4413	334.9728	217.5237	156.9453	(83)
Total gains	573.9650	695.7165	785.8880	854.9089	891.3689	866.7666	831.9114	789.5239	750.1582	667.4162	576.1356	536.2296	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.5928	55.7341	55.8734	56.5368	56.6627	57.2561	57.2561	57.3674	57.0261	56.6627	56.4086	56.1454	
alpha	4.7062	4.7156	4.7249	4.7691	4.7775	4.8171	4.8171	4.8245	4.8017	4.7775	4.7606	4.7430	
util living area													
	0.9984	0.9957	0.9891	0.9692	0.9133	0.7831	0.6161	0.6649	0.8737	0.9785	0.9964	0.9988	(86)
MIT	19.6001	19.7828	20.0479	20.3851	20.6924	20.9046	20.9767	20.9666	20.8238	20.4195	19.9435	19.5702	(87)
Th 2	19.8809	19.8834	19.8858	19.8974	19.8996	19.9097	19.9097	19.9116	19.9058	19.8996	19.8952	19.8906	(88)
util rest of house													
	0.9978	0.9942	0.9850	0.9566	0.8752	0.6914	0.4784	0.5292	0.8057	0.9673	0.9949	0.9984	(89)
MIT 2	18.6096	18.7937	19.0587	19.3980	19.6857	19.8639	19.9037	19.9019	19.8063	19.4372	18.9637	18.5875	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.7820	18.9658	19.2309	19.5698	19.8609	20.0450	20.0904	20.0872	19.9834	19.6081	19.1342	18.7585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7820	18.9658	19.2309	19.5698	19.8609	20.0450	20.0904	20.0872	19.9834	19.6081	19.1342	18.7585	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9925	0.9818	0.9518	0.8736	0.7042	0.5026	0.5529	0.8115	0.9633	0.9934	0.9978	(94)
Useful gains	572.2547	690.4798	771.5608	813.6776	778.6636	610.4152	418.1415	436.4941	608.7217	642.8966	572.3179	535.0645	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1823.1517	1766.2645	1594.6505	1320.7992	1007.9863	665.5663	426.6483	449.8214	722.0440	1112.6271	1493.0875	1814.7453	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	930.6674	722.9273	612.3787	365.1276	170.6161	0.0000	0.0000	0.0000	0.0000	349.4795	662.9541	952.0826	(98)
Space heating												4766.2334	(98)
Space heating per m2											(98) / (4) =	47.2934	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1148.9944	904.5275	927.1725	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8169	0.8913	0.8681	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.5692	806.1960	804.9059	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1118.7449	1075.7337	1028.1037	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	129.7265	200.5361	166.0592	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												496.3218	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   32.4316   50.1340   41.5148    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          124.0804 (107)
Space cooling per m2                                                                                                     1.2312 (108)
Energy for space heating                                                                                                47.2934 (99)
Energy for space cooling                                                                                                 1.2312 (108)
Total                                                                                                                   48.5246 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     55.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3694	0.3430	0.3518	0.3342	0.3342	0.3254	0.3167	0.3079	0.2991	0.3254	0.3079	0.3254	(22b)
Effective ac	0.5682	0.5588	0.5619	0.5559	0.5559	0.5530	0.5501	0.5474	0.5447	0.5530	0.5474	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8517	48.0436	48.3063	47.7875	47.7875	47.5381	47.2953	47.0592	46.8297	47.5381	47.0592	47.5381	(38)
Heat transfer coeff	132.7031	131.8950	132.1577	131.6389	131.6389	131.3895	131.1467	130.9106	130.6811	131.3895	130.9106	131.3895	(39)
Average = Sum(39)m / 12 =												131.4876	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3168	1.3087	1.3113	1.3062	1.3062	1.3037	1.3013	1.2990	1.2967	1.3037	1.2990	1.3037	(40)
HLP (average)												1.3047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
RHI water heating demand												1703	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7389	53.0620	52.9565	53.1652	53.1652	53.2661	53.3648	53.4610	53.5549	53.2661	53.4610	53.2661	
alpha	4.5159	4.5375	4.5304	4.5443	4.5443	4.5511	4.5577	4.5641	4.5703	4.5511	4.5641	4.5511	
util living area													
	0.9889	0.9814	0.9600	0.9062	0.7966	0.5932	0.4387	0.4525	0.7040	0.9094	0.9759	0.9912	(86)
MIT	19.8603	20.0041	20.2758	20.5932	20.8390	20.9681	20.9935	20.9927	20.9306	20.6547	20.2267	19.8394	(87)
Th 2	19.8277	19.8340	19.8320	19.8360	19.8360	19.8379	19.8398	19.8416	19.8434	19.8379	19.8416	19.8379	(88)
util rest of house													
	0.9852	0.9753	0.9465	0.8741	0.7286	0.4851	0.3115	0.3220	0.6023	0.8706	0.9664	0.9882	(89)
MIT 2	18.3602	18.5714	18.9565	19.3935	19.6969	19.8212	19.8382	19.8398	19.7993	19.4851	18.8993	18.3374	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9680	0.9369	0.8664	0.7326	0.5030	0.3338	0.3449	0.6169	0.8645	0.9584	0.9835	(94)
Useful gains	868.2515	957.9912	1025.0453	1018.1140	865.5514	605.1470	383.7057	382.9295	654.4564	836.9873	847.1465	815.5434	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1820.8542	1783.3222	1610.4860	1329.8535	973.5619	620.2657	385.4716	384.9330	692.1085	1089.0411	1470.1713	1786.7434	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	708.7364	554.6224	435.5679	224.4524	80.3598	0.0000	0.0000	0.0000	0.0000	187.5280	448.5778	722.5728	(98)
Space heating												3362.4176	(98)
RHI space heating demand												3362	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4486	0.4398	0.4310	0.3870	0.3782	0.3342	0.3342	0.3254	0.3518	0.3782	0.3958	0.4134	(22b)
Effective ac	0.6006	0.5967	0.5929	0.5749	0.5715	0.5559	0.5559	0.5530	0.5619	0.5715	0.5783	0.5855	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4241	(36)
Total fabric heat loss (33) + (36) =	83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.6353	51.2994	50.9702	49.4237	49.1344	47.7875	47.7875	47.5381	48.3063	49.1344	49.7197	50.3317	(38)
Heat transfer coeff	135.4867	135.1508	134.8216	133.2751	132.9858	131.6389	131.6389	131.3895	132.1577	132.9858	133.5711	134.1831	(39)
Average = Sum(39)m / 12 =												133.2738	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3444	1.3410	1.3378	1.3224	1.3196	1.3062	1.3062	1.3037	1.3113	1.3196	1.3254	1.3314	(40)
HLP (average)												1.3224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466 (42)
Average daily hot water use (litres/day)	99.4325 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	840.0307	975.9445	1070.0944	1136.6426	1166.4636	1128.7734	1084.4822	1040.3973	1003.6432	921.4750	829.9115	793.1919	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6553	51.7837	51.9102	52.5125	52.6268	53.1652	53.1652	53.2661	52.9565	52.6268	52.3961	52.1572	
alpha	4.4437	4.4522	4.4607	4.5008	4.5085	4.5443	4.5443	4.5511	4.5304	4.5085	4.4931	4.4771	
util living area													
	0.9923	0.9843	0.9680	0.9284	0.8416	0.6839	0.5192	0.5593	0.7778	0.9401	0.9850	0.9939	(86)
MIT	19.7138	19.9055	20.1719	20.4964	20.7694	20.9361	20.9854	20.9796	20.8812	20.5329	20.0616	19.6777	(87)
Th 2	19.8062	19.8088	19.8114	19.8233	19.8255	19.8360	19.8360	19.8379	19.8320	19.8255	19.8210	19.8163	(88)
util rest of house													
	0.9897	0.9792	0.9572	0.9032	0.7858	0.5836	0.3894	0.4286	0.6892	0.9137	0.9791	0.9919	(89)
MIT 2	18.1328	18.4116	18.7947	19.2554	19.6085	19.7955	19.8310	19.8302	19.7447	19.3159	18.6484	18.0873	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.4079	18.6716	19.0344	19.4714	19.8105	19.9940	20.0319	20.0303	19.9425	19.5277	18.8944	18.3641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4079	18.6716	19.0344	19.4714	19.8105	19.9940	20.0319	20.0303	19.9425	19.5277	18.8944	18.3641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9723	0.9479	0.8939	0.7850	0.5983	0.4120	0.4512	0.6987	0.9051	0.9726	0.9883	(94)
Useful gains	827.6946	948.9390	1014.3726	1016.0826	915.6971	675.3599	446.8108	469.4553	701.2090	834.0158	807.1895	783.8740	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1911.4362	1861.2393	1689.9095	1408.9008	1078.5868	710.0624	451.7778	476.9792	772.1303	1187.2559	1575.3862	1900.5770	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	806.3037	613.0658	502.5994	282.8291	121.1899	0.0000	0.0000	0.0000	0.0000	262.8107	553.1016	830.8270	(98)
Space heating												3972.7273	(98)
Space heating per m2											(98) / (4) =	39.4198	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4276.3480	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	806.3037	613.0658	502.5994	282.8291	121.1899	0.0000	0.0000	0.0000	0.0000	262.8107	553.1016	830.8270	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	867.9265	659.9201	541.0112	304.4447	130.4520	0.0000	0.0000	0.0000	0.0000	282.8963	595.3731	894.3240	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3148	89.2437	89.1126	88.8196	88.1895	86.7000	86.7000	86.7000	86.7000	88.7391	89.1756	89.3429	(217)
Fuel for water heating, kWh/month	194.8504	170.9247	177.5220	156.5241	152.1919	134.9797	126.4582	143.1491	144.2759	162.6131	175.0271	189.0521	(219)
Water heating fuel used												1927.5683	(219)
Annual totals kWh/year													
Space heating fuel - main system												4276.3480	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												5999.2216	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4276.3480	3.4800	148.8169	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1927.5683	3.4800	67.0794	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	412.4150	13.1900	54.3975	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			308.8971	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8899	(257)
SAP value		87.5852	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4276.3480	0.2160	923.6912	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1927.5683	0.2160	416.3547	(264)
Space and water heating			1340.0459	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total kg/year			1233.8094	(272)
CO2 emissions per m2			12.2400	(273)
EI value			88.6589	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8823 = 3.944, stars = 4
Water heating environmental impact	0.216 / 0.8823 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3694	0.3430	0.3518	0.3342	0.3342	0.3254	0.3167	0.3079	0.2991	0.3254	0.3079	0.3254	(22b)
Effective ac	0.5682	0.5588	0.5619	0.5559	0.5559	0.5530	0.5501	0.5474	0.5447	0.5530	0.5474	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4241	(36)
Total fabric heat loss					(33) + (36) =		83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8517	48.0436	48.3063	47.7875	47.7875	47.5381	47.2953	47.0592	46.8297	47.5381	47.0592	47.5381	(38)
Heat transfer coeff	132.7031	131.8950	132.1577	131.6389	131.6389	131.3895	131.1467	130.9106	130.6811	131.3895	130.9106	131.3895	(39)
Average = Sum(39)m / 12 =												131.4876	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3168	1.3087	1.3113	1.3062	1.3062	1.3037	1.3013	1.2990	1.2967	1.3037	1.2990	1.3037	(40)
HLP (average)												1.3047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7466	(42)
Average daily hot water use (litres/day)												99.4325	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
								Total per year (kWh/year) = Sum(64)m =				1703.1573	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7389	53.0620	52.9565	53.1652	53.1652	53.2661	53.3648	53.4610	53.5549	53.2661	53.4610	53.2661	
alpha	4.5159	4.5375	4.5304	4.5443	4.5443	4.5511	4.5577	4.5641	4.5703	4.5511	4.5641	4.5511	
util living area													
	0.9889	0.9814	0.9600	0.9062	0.7966	0.5932	0.4387	0.4525	0.7040	0.9094	0.9759	0.9912	(86)
MIT	19.8603	20.0041	20.2758	20.5932	20.8390	20.9681	20.9935	20.9927	20.9306	20.6547	20.2267	19.8394	(87)
Th 2	19.8277	19.8340	19.8320	19.8360	19.8360	19.8379	19.8398	19.8416	19.8434	19.8379	19.8416	19.8379	(88)
util rest of house													
	0.9852	0.9753	0.9465	0.8741	0.7286	0.4851	0.3115	0.3220	0.6023	0.8706	0.9664	0.9882	(89)
MIT 2	18.3602	18.5714	18.9565	19.3935	19.6969	19.8212	19.8382	19.8398	19.7993	19.4851	18.8993	18.3374	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9680	0.9369	0.8664	0.7326	0.5030	0.3338	0.3449	0.6169	0.8645	0.9584	0.9835	(94)
Useful gains	868.2515	957.9912	1025.0453	1018.1140	865.5514	605.1470	383.7057	382.9295	654.4564	836.9873	847.1465	815.5434	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1820.8542	1783.3222	1610.4860	1329.8535	973.5619	620.2657	385.4716	384.9330	692.1085	1089.0411	1470.1713	1786.7434	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	708.7364	554.6224	435.5679	224.4524	80.3598	0.0000	0.0000	0.0000	0.0000	187.5280	448.5778	722.5728	(98)
Space heating												3362.4176	(98)
Space heating per m2											(98) / (4) =	33.3639	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3619.3946	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	708.7364	554.6224	435.5679	224.4524	80.3598	0.0000	0.0000	0.0000	0.0000	187.5280	448.5778	722.5728	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	762.9025	597.0101	468.8567	241.6065	86.5014	0.0000	0.0000	0.0000	0.0000	201.8601	482.8610	777.7963	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2506	89.1899	89.0246	88.6485	87.8714	86.7000	86.7000	86.7000	86.7000	88.4799	89.0516	89.2757	(217)
Fuel for water heating, kWh/month													
	194.9906	171.0278	177.6975	156.8262	152.7429	134.9797	126.4582	143.1491	144.2759	163.0895	175.2709	189.1944	(219)
Water heating fuel used												1929.7027	(219)
Annual totals kWh/year													
Space heating fuel - main system												3619.3946	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												5267.6356	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3619.3946	7.3800	267.1113	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1929.7027	7.3800	142.4121	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	412.4150	28.6600	118.1981	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			435.8565	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3619.3946	0.2160	781.7892	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.7027	0.2160	416.8158	(264)
Space and water heating			1198.6050	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			1052.5264	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3619.3946	1.2200	4415.6615	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1929.7027	1.2200	2354.2373	(264)
Space and water heating			6769.8987	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	412.4150	3.0700	1266.1139	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			5905.8113	(272)
Primary energy kWh/m2/year			58.6010	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 61	-194 kg (18.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£61	1.92 kg/m²	B 89	B 90
Total Savings	£61	1.92 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£140	£154	-£14
Mains gas	£517	£441	£75
Space heating	£396	£396	£0
Water heating	£142	£82	£61
Lighting	£118	£118	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£437	£375	£61
Total cost of uses	£436	£376	£61
Delivered energy	52 kWh/m²	43 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	48 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900	(1b)	x 2.5400	(2b) =	127.9906	(1b) - (3b)
First floor	50.3900	(1c)	x 2.6300	(2c) =	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4486	0.4398	0.4310	0.3870	0.3782	0.3342	0.3342	0.3254	0.3518	0.3782	0.3958	0.4134	(22b)
Effective ac	0.6006	0.5967	0.5929	0.5749	0.5715	0.5559	0.5559	0.5530	0.5619	0.5715	0.5783	0.5855	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4241	(36)
Total fabric heat loss (33) + (36) =	83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.6353	51.2994	50.9702	49.4237	49.1344	47.7875	47.7875	47.5381	48.3063	49.1344	49.7197	50.3317	(38)
Heat transfer coeff	135.4867	135.1508	134.8216	133.2751	132.9858	131.6389	131.6389	131.3895	132.1577	132.9858	133.5711	134.1831	(39)
Average = Sum(39)m / 12 =												133.2738	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3444	1.3410	1.3378	1.3224	1.3196	1.3062	1.3062	1.3037	1.3113	1.3196	1.3254	1.3314	(40)
HLP (average)												1.3224	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1593	(H8)
Utilisation factor												0.5779	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												99.4325	(H14)
Volume ratio Veff/V												0.7543	(H15)
Solar storage volume factor												0.9436	(H16)
Solar input												-869.6671	(H17)
Solar input	-25.2186	-42.0826	-71.6715	-96.0539	-118.6666	-116.6681	-115.1263	-100.5864	-78.7794	-53.7970	-29.9129	-21.1037	(63)
								Solar input (sum of months) = Sum(63)m =				-869.6671	(63)
Output from w/h													
	148.8116	110.4569	86.5229	42.9702	15.5507	0.3593	0.0000	23.5238	46.3079	90.5043	126.1686	147.8009	(64)
									Total per year (kWh/year) = Sum(64)m =			838.9772	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	10.6334	0.7200	0.7000	0.7700	28.3003	(74)
South	11.0400	46.7521	0.7200	0.7000	0.7700	180.2742	(78)

Solar gains	208.5745	349.3260	467.9875	572.6759	641.7910	639.1455	615.2381	562.1507	503.3615	382.8260	248.5985	179.3660	(83)
Total gains	840.0307	975.9445	1070.0944	1136.6426	1166.4636	1128.7734	1084.4822	1040.3973	1003.6432	921.4750	829.9115	793.1919	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6553	51.7837	51.9102	52.5125	52.6268	53.1652	53.1652	53.2661	52.9565	52.6268	52.3961	52.1572	
alpha	4.4437	4.4522	4.4607	4.5008	4.5085	4.5443	4.5443	4.5511	4.5304	4.5085	4.4931	4.4771	
util living area													
	0.9923	0.9843	0.9680	0.9284	0.8416	0.6839	0.5192	0.5593	0.7778	0.9401	0.9850	0.9939	(86)
MIT	19.7138	19.9055	20.1719	20.4964	20.7694	20.9361	20.9854	20.9796	20.8812	20.5329	20.0616	19.6777	(87)
Th 2	19.8062	19.8088	19.8114	19.8233	19.8255	19.8360	19.8360	19.8379	19.8320	19.8255	19.8210	19.8163	(88)
util rest of house													
	0.9897	0.9792	0.9572	0.9032	0.7858	0.5836	0.3894	0.4286	0.6892	0.9137	0.9791	0.9919	(89)
MIT 2	18.1328	18.4116	18.7947	19.2554	19.6085	19.7955	19.8310	19.8302	19.7447	19.3159	18.6484	18.0873	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.4079	18.6716	19.0344	19.4714	19.8105	19.9940	20.0319	20.0303	19.9425	19.5277	18.8944	18.3641	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4079	18.6716	19.0344	19.4714	19.8105	19.9940	20.0319	20.0303	19.9425	19.5277	18.8944	18.3641	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9853	0.9723	0.9479	0.8939	0.7850	0.5983	0.4120	0.4512	0.6987	0.9051	0.9726	0.9883	(94)
Useful gains	827.6946	948.9390	1014.3726	1016.0826	915.6971	675.3599	446.8108	469.4553	701.2090	834.0158	807.1895	783.8740	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W													
	1911.4362	1861.2393	1689.9095	1408.9008	1078.5868	710.0624	451.7778	476.9792	772.1303	1187.2559	1575.3862	1900.5770	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	806.3037	613.0658	502.5994	282.8291	121.1899	0.0000	0.0000	0.0000	0.0000	262.8107	553.1016	830.8270	(98)
Space heating												3972.7273	(98)
Space heating per m2											(98) / (4) =	39.4198	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4276.3480	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	806.3037	613.0658	502.5994	282.8291	121.1899	0.0000	0.0000	0.0000	0.0000	262.8107	553.1016	830.8270	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	867.9265	659.9201	541.0112	304.4447	130.4520	0.0000	0.0000	0.0000	0.0000	282.8963	595.3731	894.3240	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.8116	110.4569	86.5229	42.9702	15.5507	0.3593	0.0000	23.5238	46.3079	90.5043	126.1686	147.8009	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3860	89.3963	89.4153	89.4645	89.5242	86.7000	86.7000	86.7000	86.7000	89.0580	89.2879	89.4016	(217)
Fuel for water heating, kWh/month													
	166.4821	123.5588	96.7652	48.0305	17.3704	0.4144	0.0000	27.1325	53.4116	101.6240	141.3054	165.3224	(219)
Water heating fuel used												941.4172	(219)
Annual totals kWh/year													
Space heating fuel - main system												4276.3480	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097	(233)
Total delivered energy for all uses												5063.0705	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4276.3480	3.4800	148.8169	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	941.4172	3.4800	32.7613	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	412.4150	13.1900	54.3975	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893	(252)
Total energy cost			281.1740	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8101	(257)
SAP value		88.6994	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4276.3480	0.2160	923.6912	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	941.4172	0.2160	203.3461	(264)
Space and water heating			1127.0373	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1046.7507 (272)
CO2 emissions per m2			10.3900 (273)
EI value			90.3783
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.3900 (1b)	x	2.5400 (2b)	=	127.9906	(1b) - (3b)
First floor	50.3900 (1c)	x	2.6300 (2c)	=	132.5257	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	100.7800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	260.5163	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1919	(8)
Pressure test		Yes	
Measured/design AP50		4.4400	
Infiltration rate		0.4139	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3518	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3694	0.3430	0.3518	0.3342	0.3342	0.3254	0.3167	0.3079	0.2991	0.3254	0.3079	0.3254	(22b)
Effective ac	0.5682	0.5588	0.5619	0.5559	0.5559	0.5530	0.5501	0.5474	0.5447	0.5530	0.5474	0.5530	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.6600	1.2357	23.0589			(27)
Opening Type 11			2.1200	1.5000	3.1800			(26a)
Ground floor			50.3900	0.1900	9.5741			(28a)
External Wall	148.7500	20.7800	127.9700	0.2700	34.5519			(29a)
Main Roof	50.3900		50.3900	0.1600	8.0624			(30)
Total net area of external elements Aum(A, m2)			249.5300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4273			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4241	(36)
Total fabric heat loss (33) + (36) =	83.8514	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.8517	48.0436	48.3063	47.7875	47.7875	47.5381	47.2953	47.0592	46.8297	47.5381	47.0592	47.5381	(38)
Heat transfer coeff	132.7031	131.8950	132.1577	131.6389	131.6389	131.3895	131.1467	130.9106	130.6811	131.3895	130.9106	131.3895	(39)
Average = Sum(39)m / 12 =												131.4876	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3168	1.3087	1.3113	1.3062	1.3062	1.3037	1.3013	1.2990	1.2967	1.3037	1.2990	1.3037	(40)
HLP (average)												1.3047	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7466	(42)
Average daily hot water use (litres/day)	99.4325	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.3757	105.3984	101.4211	97.4438	93.4665	89.4892	89.4892	93.4665	97.4438	101.4211	105.3984	109.3757	(44)
Energy conte	162.2010	141.8620	146.3889	127.6254	122.4596	105.6733	97.9219	112.3668	113.7088	132.5167	144.6523	157.0830	(45)
Energy content (annual)										Total = Sum(45)m =		1564.4598	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3302	21.2793	21.9583	19.1438	18.3689	15.8510	14.6883	16.8550	17.0563	19.8775	21.6978	23.5625	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8292	10.6775	11.8055	11.3987	11.7576	11.3540	11.7174	11.7435	11.3784	11.7847	11.4292	11.8216	(61)
Total heat required for water heating calculated for each month													
	174.0303	152.5396	158.1944	139.0242	134.2173	117.0274	109.6393	124.1103	125.0872	144.3014	156.0815	168.9046	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2974	(H8)
Utilisation factor												0.5374	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												99.4325	(H14)
Volume ratio Veff/V												0.7543	(H15)
Solar storage volume factor												0.9436	(H16)
Solar input												-904.9218	(H17)
Solar input	-29.5207	-41.9766	-72.1477	-97.3440	-114.3363	-122.1293	-119.5609	-107.0106	-83.7819	-57.9239	-34.9153	-24.2746	(63)
								Solar input (sum of months) = Sum(63)m =				-904.9218	(63)
Output from w/h													
	144.5095	110.5630	86.0467	41.6802	19.8809	0.0000	0.0000	17.0997	41.3053	86.3774	121.1662	144.6300	(64)
								Total per year (kWh/year) = Sum(64)m =				813.2589	(64)
Heat gains from water heating, kWh/month													
	56.8891	49.8385	51.6257	45.2851	43.6572	37.9749	35.4884	40.2978	40.6528	47.0080	50.9542	55.1855	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	164.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	58.3816	51.8540	42.1705	31.9258	23.8649	20.1478	21.7704	28.2980	37.9814	48.2262	56.2871	60.0042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	384.4517	388.4411	378.3879	356.9859	329.9697	304.5783	287.6152	283.6258	293.6790	315.0810	342.0972	367.4886	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	54.2264	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	-109.8652	(71)
Water heating gains (Table 5)													
	76.4639	74.1644	69.3894	62.8960	58.6791	52.7429	47.6994	54.1637	56.4622	63.1828	70.7697	74.1741	(72)
Total internal gains													
	631.4562	626.6186	602.1068	563.9667	524.6727	489.6280	469.2440	478.2465	500.2817	538.6490	581.3130	613.8259	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6200	13.4839	0.7200	0.7000	0.7700	35.8867	(74)
South	11.0400	56.7559	0.7200	0.7000	0.7700	218.8485	(78)

Solar gains	254.7352	363.0259	491.9273	611.1874	656.8819	713.4537	680.2182	632.1714	560.5478	429.5180	302.5588	215.4165	(83)
Total gains	886.1914	989.6444	1094.0341	1175.1541	1181.5546	1203.0816	1149.4622	1110.4179	1060.8295	968.1669	883.8718	829.2424	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.7389	53.0620	52.9565	53.1652	53.1652	53.2661	53.3648	53.4610	53.5549	53.2661	53.4610	53.2661	
alpha	4.5159	4.5375	4.5304	4.5443	4.5443	4.5511	4.5577	4.5641	4.5703	4.5511	4.5641	4.5511	
util living area													
	0.9889	0.9814	0.9600	0.9062	0.7966	0.5932	0.4387	0.4525	0.7040	0.9094	0.9759	0.9912	(86)
MIT	19.8603	20.0041	20.2758	20.5932	20.8390	20.9681	20.9935	20.9927	20.9306	20.6547	20.2267	19.8394	(87)
Th 2	19.8277	19.8340	19.8320	19.8360	19.8360	19.8379	19.8398	19.8416	19.8434	19.8379	19.8416	19.8379	(88)
util rest of house													
	0.9852	0.9753	0.9465	0.8741	0.7286	0.4851	0.3115	0.3220	0.6023	0.8706	0.9664	0.9882	(89)
MIT 2	18.3602	18.5714	18.9565	19.3935	19.6969	19.8212	19.8382	19.8398	19.7993	19.4851	18.8993	18.3374	(90)
Living area fraction									fLA = Living area / (4) =			0.1740	(91)
MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6213	18.8208	19.1861	19.6023	19.8957	20.0208	20.0392	20.0404	19.9962	19.6886	19.1303	18.5988	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9680	0.9369	0.8664	0.7326	0.5030	0.3338	0.3449	0.6169	0.8645	0.9584	0.9835	(94)
Useful gains	868.2515	957.9912	1025.0453	1018.1140	865.5514	605.1470	383.7057	382.9295	654.4564	836.9873	847.1465	815.5434	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Heat loss rate W

	1820.8542	1783.3222	1610.4860	1329.8535	973.5619	620.2657	385.4716	384.9330	692.1085	1089.0411	1470.1713	1786.7434 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	708.7364	554.6224	435.5679	224.4524	80.3598	0.0000	0.0000	0.0000	0.0000	187.5280	448.5778	722.5728 (98)

Space heating 3362.4176 (98)
Space heating per m2 (98) / (4) = 33.3639 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3619.3946 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	708.7364	554.6224	435.5679	224.4524	80.3598	0.0000	0.0000	0.0000	0.0000	187.5280	448.5778	722.5728	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	762.9025	597.0101	468.8567	241.6065	86.5014	0.0000	0.0000	0.0000	0.0000	201.8601	482.8610	777.7963	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	144.5095	110.5630	86.0467	41.6802	19.8809	0.0000	0.0000	17.0997	41.3053	86.3774	121.1662	144.6300	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3415	89.3518	89.3559	89.3833	89.2467	86.7000	86.7000	86.7000	86.7000	88.8657	89.1998	89.3500	(217)
Fuel for water heating, kWh/month													
	161.7496	123.7389	96.2966	46.6308	22.2764	0.0000	0.0000	19.7228	47.6416	97.2000	135.8368	161.8690	(219)
Water heating fuel used												912.9625	(219)
Annual totals kWh/year													
Space heating fuel - main system												3619.3946	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												412.4150	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =										-768.8767		-768.8767	(233)
Total delivered energy for all uses												4300.8955	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3619.3946	7.3800	267.1113	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	912.9625	7.3800	67.3766	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	412.4150	28.6600	118.1981	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-768.8767	28.6600	-220.3601	(252)
Total energy cost			375.1510	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3619.3946	0.2160	781.7892	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	912.9625	0.2160	197.1999	(264)
Space and water heating			978.9891	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	412.4150	0.5190	214.0434	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	0.5190	-399.0470	(269)
Total kg/year			858.8605	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	3619.3946	1.2200	4415.6615	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	912.9625	1.2200	1113.8143	(264)
Space and water heating			5529.4757	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	412.4150	3.0700	1266.1139	(268)
Energy saving/generation technologies				
PV Unit	-768.8767	3.0700	-2360.4514	(269)
Primary energy kWh/year			4818.8883	(272)
Primary energy kWh/m2/year			47.8159	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	687.76 (P1)
Transmission heat loss coefficient	83.85 (37)
Summer heat loss coefficient	771.61 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.6200	87.1704	0.7200	0.7000	0.7650	230.4935
South	11.0400	118.5567	0.7200	0.7000	0.7650	454.1816
total:						684.6751

	Jun	Jul	Aug	
Solar gains	730	685	634	(P3)
Internal gains	487	466	475	
Total summer gains	1217	1151	1109	(P5)
Summer gain/loss ratio	1.58	1.49	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.23	19.04	18.99	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 443 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 443	**Prop Type Ref**	
Property	2 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.97	**TER**	17.92
Environmental	89 B	**% DER<TER**	22.02		
CO_2 Emissions (t/year)	1.05	**DFEE**	51.32	**TFEE**	55.80
General Requirements Compliance	Pass	**% DFEE<TFEE**	8.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.97	$kgCO_2/m^2$	Pass
	-3.95 (-22.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.80	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.32	$kWh/m^2/yr$	
	-4.5 (-8.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.62 m², No overhang
Windows facing South	11.04 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.44 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	0.81	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 444 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 444	**Prop Type Ref**	
Property	1 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.54	**TER**	16.85
Environmental	88 B	**% DER<TER**	19.62		
CO_2 Emissions (t/year)	1.33	**DFEE**	52.10	**TFEE**	57.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 130 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.85 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.90 m², No overhang
Windows facing North East: 1.02 m², No overhang
Windows facing East: 0.48 m², No overhang
Windows facing South: 9.36 m², No overhang
Windows facing West: 7.62 m², No overhang
Windows facing North West: 1.02 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1488	(8)
Pressure test			Yes	
Measured/design AP50			4.4700	
Infiltration rate			0.3723	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.4679	64.1174	63.7739	62.1602	61.8583	60.4529	60.4529	60.1926	60.9942	61.8583	62.4691	63.1076	(38)
Heat transfer coeff	170.3806	170.0301	169.6866	168.0729	167.7710	166.3656	166.3656	166.1053	166.9069	167.7710	168.3818	169.0203	(39)
Average = Sum(39)m / 12 =												168.0715	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3080	1.3053	1.3027	1.2903	1.2880	1.2772	1.2772	1.2752	1.2813	1.2880	1.2927	1.2976	(40)
HLP (average)												1.2903	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300	(61)
Total heat required for water heating calculated for each month													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Total per year (kWh/year) = Sum(64)m =												1758.9601	(64)
Heat gains from water heating, kWh/month													
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	473.2373	470.9610	453.7903	425.7873	396.7877	369.2547	351.6241	358.2139	372.8194	401.0579	433.5478	458.4586	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908	(83)
Total gains	715.3084	895.3083	1064.3530	1229.3216	1337.4221	1320.3335	1261.4337	1163.5114	1050.0735	878.3163	725.7277	664.1494	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0919	53.2014	53.3091	53.8209	53.9177	54.3732	54.3732	54.4584	54.1969	53.9177	53.7222	53.5192	
alpha	4.5395	4.5468	4.5539	4.5881	4.5945	4.6249	4.6249	4.6306	4.6131	4.5945	4.5815	4.5679	
util living area													
	0.9986	0.9958	0.9874	0.9582	0.8782	0.7242	0.5597	0.6212	0.8576	0.9783	0.9968	0.9990	(86)
MIT	19.5065	19.7057	20.0112	20.3984	20.7287	20.9235	20.9817	20.9709	20.8232	20.3772	19.8636	19.4721	(87)
Th 2	19.8346	19.8367	19.8387	19.8484	19.8503	19.8588	19.8588	19.8603	19.8555	19.8503	19.8466	19.8427	(88)
util rest of house													
	0.9981	0.9943	0.9827	0.9417	0.8302	0.6256	0.4248	0.4843	0.7834	0.9669	0.9954	0.9986	(89)
MIT 2	17.8506	18.1428	18.5879	19.1457	19.5855	19.8084	19.8523	19.8486	19.7132	19.1264	18.3810	17.8059	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.1590	18.4339	18.8530	19.3790	19.7984	20.0161	20.0626	20.0577	19.9199	19.3594	18.6571	18.1162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1590	18.4339	18.8530	19.3790	19.7984	20.0161	20.0626	20.0577	19.9199	19.3594	18.6571	18.1162	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9916	0.9770	0.9330	0.8277	0.6405	0.4500	0.5095	0.7884	0.9599	0.9931	0.9978	(94)
Useful gains	713.1007	887.7881	1039.8584	1146.9496	1106.9412	845.7136	567.6159	592.8487	827.8960	843.1374	720.7471	662.6708	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2361.3023	2301.1646	2096.1315	1761.2427	1358.6820	901.0445	576.0600	607.5556	971.3831	1469.5673	1946.0121	2352.1228	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1226.2619	949.7890	785.8672	442.2910	187.2952	0.0000	0.0000	0.0000	0.0000	466.0638	882.1908	1256.9523	(98)
Space heating												6196.7113	(98)
Space heating per m2											(98) / (4) =	47.5719	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6670.3028	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1226.2619	949.7890	785.8672	442.2910	187.2952	0.0000	0.0000	0.0000	0.0000	466.0638	882.1908	1256.9523	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1319.9806	1022.3778	845.9281	476.0937	201.6095	0.0000	0.0000	0.0000	0.0000	501.6834	949.6134	1353.0164	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4777	89.4303	89.3324	89.0941	88.5107	86.7000	86.7000	86.7000	86.7000	89.1032	89.3902	89.4973	(217)
Fuel for water heating, kWh/month													
	200.9583	176.2233	182.9272	161.1542	156.5786	139.3302	130.4896	147.7758	148.9565	167.2506	180.3759	194.9831	(219)
Water heating fuel used												1987.0034	(219)
Annual totals kWh/year													
Space heating fuel - main system												6670.3028	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												8453.5515	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6670.3028	0.2160	1440.7854	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1987.0034	0.2160	429.1927	(264)
Space and water heating			1869.9781	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1764.2295	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5400	ZC1
Total Floor Area	TFA	130.2600	
Assumed number of occupants	N	2.8957	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5582	ZC2
CO2 emissions from cooking, equation (L16)		1.4471	ZC3
Total CO2 emissions		28.5452	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.5452	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							4 * 10 =		40.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1190	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3690	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.3250	45.7026	47.2260	49.3250	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336 (64)
								Total per year (kWh/year) = Sum(64)m =				2209.5365 (64)
Heat gains from water heating, kWh/month												
	68.5914	60.3551	63.1467	56.2748	54.4985	47.8128	45.5245	51.0232	51.4828	58.3700	62.1378	66.8291 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	92.1927	89.8141	84.8746	78.1594	73.2507	66.4066	61.1889	68.5795	71.5039	78.4543	86.3024	89.8240	(72)
Total internal gains													
	486.3828	484.1091	466.9441	438.9486	409.4069	381.1777	363.5526	370.8383	385.9882	414.2189	446.7000	471.6068	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.6300	0.7000	0.7700	22.4229	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	9.3600	46.7521	0.6300	0.7000	0.7700	133.7360	(78)
West	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	211.8121	371.3039	534.2423	703.0925	823.0551	832.1940	796.0834	704.6353	592.5974	417.6012	255.6574	179.9795 (83)
Total gains	698.1950	855.4130	1001.1864	1142.0412	1232.4620	1213.3717	1159.6360	1075.4736	978.5856	831.8200	702.3574	651.5862 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area													
	0.9988	0.9965	0.9896	0.9645	0.8915	0.7404	0.5726	0.6327	0.8675	0.9810	0.9972	0.9991	(86)
MIT	19.5954	19.7773	20.0604	20.4238	20.7387	20.9278	20.9835	20.9738	20.8342	20.4135	19.9327	19.5644	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house													
	0.9983	0.9953	0.9857	0.9504	0.8479	0.6463	0.4422	0.5009	0.7983	0.9710	0.9960	0.9988	(89)
MIT 2	18.0231	18.2902	18.7033	19.2294	19.6527	19.8722	19.9150	19.9117	19.7815	19.2237	18.5248	17.9835	(90)
Living area fraction										fLA = Living area / (4) =		0.1862	(91)
MIT	18.3159	18.5671	18.9561	19.4519	19.8549	20.0688	20.1140	20.1095	19.9775	19.4453	18.7870	18.2779	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3159	18.5671	18.9561	19.4519	19.8549	20.0688	20.1140	20.1095	19.9775	19.4453	18.7870	18.2779	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9930	0.9809	0.9426	0.8451	0.6605	0.4665	0.5253	0.8029	0.9649	0.9941	0.9981	(94)
Useful gains	696.3512	849.4561	982.0539	1076.5234	1041.5915	801.4022	541.0035	564.8956	785.7069	802.6017	698.2081	650.3390	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2243.8600	2183.3084	1985.6376	1665.3598	1284.6416	853.9472	548.7009	578.2855	920.8938	1393.3951	1848.0631	2234.9619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1151.3465	896.3488	746.6663	423.9622	180.8292	0.0000	0.0000	0.0000	0.0000	439.5502	827.8956	1178.9594	(98)
Space heating												5845.5583	(98)
Space heating per m2											(98) / (4) =	44.8761	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6258.6277	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1151.3465	896.3488	746.6663	423.9622	180.8292	0.0000	0.0000	0.0000	0.0000	439.5502	827.8956	1178.9594	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1232.7051	959.6882	799.4286	453.9210	193.6073	0.0000	0.0000	0.0000	0.0000	470.6105	886.3979	1262.2692	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.9338	192.9393	202.5588	181.4835	176.1438	155.1376	148.6336	165.6917	167.0716	188.1927	199.1165	213.6336	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.6191	88.4299	88.0371	87.1155	85.1173	80.3000	80.3000	80.3000	80.3000	87.1151	88.2480	88.6887	(217)
Fuel for water heating, kWh/month													
	247.0503	218.1833	230.0836	208.3251	206.9424	193.1975	185.0979	206.3408	208.0592	216.0277	225.6329	240.8802	(219)
Water heating fuel used												2585.8208	(219)
Annual totals kWh/year													
Space heating fuel - main system												6258.6277	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Total delivered energy for all uses												9391.3602	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6258.6277	0.2160	1351.8636	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.8208	0.2160	558.5373	(264)
Space and water heating			1910.4009	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Total CO2, kg/m2/year			2194.2480	(272)
Emissions per m2 for space and water heating			14.6661	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8803	(272b)
Emissions per m2 for pumps and fans			0.2988	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6661 * 1.00) + 1.8803 + 0.2988, rounded to 2 d.p.			16.8500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1190	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3425	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2912	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3712	0.3640	0.3567	0.3203	0.3130	0.2766	0.2766	0.2693	0.2912	0.3130	0.3276	0.3421	(22b)
Effective ac	0.5689	0.5662	0.5636	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5536	0.5585	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.0826	62.7859	62.4950	61.1291	60.8735	59.6838	59.6838	59.4635	60.1421	60.8735	61.3905	61.9310	(38)
Heat transfer coeff	168.9953	168.6986	168.4077	167.0418	166.7862	165.5965	165.5965	165.3762	166.0548	166.7862	167.3032	167.8437	(39)
Average = Sum(39)m / 12 =												167.0406	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2974	1.2951	1.2929	1.2824	1.2804	1.2713	1.2713	1.2696	1.2748	1.2804	1.2844	1.2885	(40)
HLP (average)												1.2824	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264 (71)

Water heating gains (Table 5)

	47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629 (72)

Total internal gains

	439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908	(83)
Total gains	681.2378	862.0989	1032.9318	1200.3316	1310.0124	1295.1484	1238.1372	1137.7927	1023.4930	849.2196	693.7896	630.9365	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.5271	53.6213	53.7139	54.1531	54.2361	54.6258	54.6258	54.6985	54.4750	54.2361	54.0685	53.8944	
alpha	4.5685	4.5748	4.5809	4.6102	4.6157	4.6417	4.6417	4.6466	4.6317	4.6157	4.6046	4.5930	
util living area	0.9989	0.9964	0.9887	0.9612	0.8837	0.7318	0.5667	0.6306	0.8655	0.9808	0.9973	0.9992	(86)
MIT	19.4962	19.6956	20.0017	20.3893	20.7229	20.9209	20.9810	20.9695	20.8167	20.3650	19.8503	19.4604	(87)
Th 2	19.8429	19.8447	19.8464	19.8547	19.8562	19.8634	19.8634	19.8647	19.8606	19.8562	19.8531	19.8498	(88)
util rest of house	0.9984	0.9951	0.9845	0.9457	0.8371	0.6338	0.4312	0.4931	0.7935	0.9705	0.9962	0.9989	(89)
MIT 2	18.4762	18.6764	18.9816	19.3655	19.6704	19.8276	19.8588	19.8563	19.7588	19.3494	18.8379	18.4458	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.6661	18.8662	19.1716	19.5562	19.8665	20.0312	20.0678	20.0636	19.9559	19.5385	19.0265	18.6348	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6661	18.8662	19.1716	19.5562	19.8665	20.0312	20.0678	20.0636	19.9559	19.5385	19.0265	18.6348	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9936	0.9811	0.9405	0.8376	0.6497	0.4567	0.5188	0.8007	0.9665	0.9950	0.9985	(94)
Useful gains	679.7614	856.5803	1013.3982	1128.9507	1097.2057	841.4036	565.4347	590.2750	819.5536	820.8033	690.2876	629.9695	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2427.8103	2356.0766	2133.9884	1780.0286	1362.0517	899.3897	574.2529	605.8716	972.3940	1490.8219	1995.3365	2422.7856	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1300.5484	1007.6615	833.7191	468.7761	197.0454	0.0000	0.0000	0.0000	0.0000	498.4939	939.6352	1333.8552	(98)
Space heating												6579.7347	(98)
Space heating per m2										(98) / (4) =		50.5123	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1556.6070	1225.4141	1256.8589	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8418	0.9065	0.8758	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1310.3095	1110.8906	1100.7806	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1632.5958	1563.2542	1448.2232	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	232.0462	336.5585	258.4973	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												827.1020 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.0115	84.1396	64.6243	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												206.7755 (107)
Space cooling per m2												1.5874 (108)
Energy for space heating												50.5123 (99)
Energy for space cooling												1.5874 (108)
Total												52.0997 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1190	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3690	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3137	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686	(22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			26.4000	1.3258	35.0000			(27)
Ground floor			65.7200	0.1300	8.5436			(28a)
External Wall	168.9900	30.6400	138.3500	0.1800	24.9030			(29a)
Main Roof	64.5400		64.5400	0.1300	8.3902			(30)
Lower	1.1700		1.1700	0.1300	0.1521			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.0769			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7060	(36)
Total fabric heat loss (33) + (36) =	95.7829	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.3105	63.9661	63.6285	62.0431	61.7464	60.3655	60.3655	60.1098	60.8974	61.7464	62.3465	62.9739	(38)
Heat transfer coeff	160.0934	159.7490	159.4115	157.8260	157.5294	156.1484	156.1484	155.8927	156.6803	157.5294	158.1295	158.7568	(39)
Average = Sum(39)m / 12 =												157.8246	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2290	1.2264	1.2238	1.2116	1.2093	1.1987	1.1987	1.1968	1.2028	1.2093	1.2140	1.2188	(40)
HLP (average)												1.2116	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

35.6947	31.2188	32.2150	28.0858	26.9490	23.2549	21.5491	24.7279	25.0233	29.1622	31.8328	34.5684	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	144.7830	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.7216	23.7339	19.3017	14.6126	10.9231	9.2217	9.9644	12.9521	17.3843	22.0734	25.7629	27.4643	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

298.0336	301.1263	293.3329	276.7417	255.7982	236.1144	222.9643	219.8717	227.6651	244.2563	265.1997	284.8836	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	37.4783	(69)

Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)

Water heating gains (Table 5)

47.9767	46.4565	43.2997	39.0081	36.2218	32.2985	28.9639	33.2365	34.7545	39.1965	44.2122	46.4629	(72)

Total internal gains

439.1668	437.7516	422.3692	396.7973	369.3780	344.0696	328.3275	332.4952	346.2388	371.9611	401.6098	425.2456	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.6300	0.7000	0.7700	22.4229	(74)
Northeast	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(75)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	9.3600	46.7521	0.6300	0.7000	0.7700	133.7360	(78)
West	7.6200	19.6403	0.6300	0.7000	0.7700	45.7377	(80)
Northwest	1.0200	11.2829	0.6300	0.7000	0.7700	3.5172	(81)

Solar gains	211.8121	371.3039	534.2423	703.0925	823.0551	832.1940	796.0834	704.6353	592.5974	417.6012	255.6574	179.9795	(83)
Total gains	650.9790	809.0555	956.6115	1099.8898	1192.4331	1176.2635	1124.4110	1037.1305	938.8362	789.5623	657.2672	605.2251	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5035	56.6253	56.7452	57.3152	57.4232	57.9310	57.9310	58.0260	57.7343	57.4232	57.2052	56.9792	
alpha	4.7669	4.7750	4.7830	4.8210	4.8282	4.8621	4.8621	4.8684	4.8490	4.8282	4.8137	4.7986	
util living area	0.9991	0.9973	0.9913	0.9691	0.9015	0.7556	0.5881	0.6515	0.8818	0.9845	0.9979	0.9994	(86)
MIT	19.5620	19.7448	20.0302	20.3984	20.7218	20.9210	20.9816	20.9704	20.8192	20.3859	19.9010	19.5315	(87)
Th 2	19.8968	19.8989	19.9010	19.9107	19.9125	19.9210	19.9210	19.9226	19.9177	19.9125	19.9089	19.9050	(88)
util rest of house	0.9988	0.9963	0.9880	0.9565	0.8604	0.6624	0.4554	0.5179	0.8166	0.9762	0.9970	0.9992	(89)
MIT 2	18.5842	18.7683	19.0536	19.4218	19.7215	19.8840	19.9163	19.9140	19.8143	19.4159	18.9324	18.5602	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.7663	18.9502	19.2355	19.6037	19.9078	20.0771	20.1147	20.1107	20.0014	19.5966	19.1128	18.7411	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	18.9502	19.2355	19.6037	19.9078	20.0771	20.1147	20.1107	20.0014	19.5966	19.1128	18.7411	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9951	0.9853	0.9520	0.8601	0.6773	0.4803	0.5429	0.8227	0.9728	0.9960	0.9988	(94)
Useful gains	649.8744	805.0832	942.5971	1047.0583	1025.6579	796.6378	540.0947	563.0643	772.3344	768.1007	654.6638	604.5005	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2315.9668	2244.5005	2030.1876	1689.3185	1292.9693	855.2477	548.8169	578.4788	924.6367	1417.2216	1899.5698	2308.5021	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1239.5727	967.2884	809.1673	462.4273	198.8797	0.0000	0.0000	0.0000	0.0000	482.9460	896.3323	1267.7772	(98)
Space heating												6324.3909	(98)
Space heating per m2											(98) / (4) =	48.5521	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1467.7953	1155.4984	1184.7846	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8366	0.9046	0.8739	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1227.9104	1045.2640	1035.3927	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1493.6395	1430.3275	1330.5661	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	191.3250	286.4873	219.6090	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												697.4212 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	47.8312	71.6218	54.9023	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												174.3553 (107)
Space cooling per m2												1.3385 (108)
Energy for space heating												48.5521 (99)
Energy for space cooling												1.3385 (108)
Total												49.8906 (109)
Target Fabric Energy Efficiency (TFEE)												57.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3323	0.3085	0.3165	0.3006	0.3006	0.2927	0.2848	0.2769	0.2690	0.2927	0.2769	0.2927	(22b)
Effective ac	0.5552	0.5476	0.5501	0.5452	0.5452	0.5428	0.5406	0.5383	0.5362	0.5428	0.5383	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.5634	60.7201	60.9942	60.4529	60.4529	60.1926	59.9393	59.6929	59.4535	60.1926	59.6929	60.1926	(38)
Heat transfer coeff	167.4761	166.6328	166.9069	166.3656	166.3656	166.1053	165.8520	165.6056	165.3662	166.1053	165.6056	166.1053	(39)
Average = Sum(39)m / 12 =												166.2077	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2857	1.2792	1.2813	1.2772	1.2772	1.2752	1.2732	1.2713	1.2695	1.2752	1.2713	1.2752	(40)
HLP (average)												1.2760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
RHI water heating demand												1759 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	13.4839	0.7200	0.7000	0.7700	32.4959	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.4800	25.1925	0.7200	0.7000	0.7700	4.2235	(76)
South	9.3600	56.7559	0.7200	0.7000	0.7700	185.5455	(78)
West	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	299.7289	447.9527	652.4742	869.3110	971.7289	1069.2339	1014.0402	916.3943	766.2179	544.2777	360.7392	250.2798 (83)
Total gains	1006.5893	1149.5784	1326.4424	1500.0707	1557.6394	1615.3643	1537.1771	1449.0793	1323.9952	1145.4990	1010.3001	936.9985 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0127	54.2860	54.1969	54.3732	54.3732	54.4584	54.5416	54.6227	54.7018	54.4584	54.6227	54.4584	
alpha	4.6008	4.6191	4.6131	4.6249	4.6249	4.6306	4.6361	4.6415	4.6468	4.6306	4.6415	4.6306	
util living area													
	0.9932	0.9873	0.9669	0.9060	0.7803	0.5646	0.4163	0.4398	0.7126	0.9279	0.9844	0.9948	(86)
MIT	19.8063	19.9567	20.2577	20.6095	20.8600	20.9755	20.9952	20.9940	20.9306	20.6252	20.1712	19.7836	(87)
Th 2	19.8520	19.8571	19.8555	19.8588	19.8588	19.8603	19.8619	19.8633	19.8648	19.8603	19.8633	19.8603	(88)
util rest of house													
	0.9909	0.9830	0.9555	0.8741	0.7115	0.4614	0.2972	0.3148	0.6125	0.8951	0.9780	0.9930	(89)
MIT 2	18.2994	18.5204	18.9497	19.4334	19.7391	19.8477	19.8606	19.8618	19.8202	19.4680	18.8373	18.2725	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.5800	18.7879	19.1933	19.6525	19.9479	20.0577	20.0719	20.0727	20.0270	19.6835	19.0857	18.5539	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5800	18.7879	19.1933	19.6525	19.9479	20.0577	20.0719	20.0727	20.0270	19.6835	19.0857	18.5539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9774	0.9469	0.8673	0.7175	0.4799	0.3195	0.3382	0.6281	0.8887	0.9718	0.9898	(94)
Useful gains	993.6313	1123.5975	1255.9530	1300.9672	1117.5708	775.2851	491.1829	490.1201	831.5778	1017.9602	981.8248	927.4871	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2291.0797	2247.5295	2035.1477	1689.0225	1239.0678	790.2857	492.9028	492.2911	880.9060	1375.9340	1852.4187	2251.3745	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	965.3016	755.2823	579.7209	279.3998	90.3938	0.0000	0.0000	0.0000	0.0000	266.3325	626.8276	984.9722	(98)
Space heating												4548.2306	(98)
RHI space heating demand												4548	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.4679	64.1174	63.7739	62.1602	61.8583	60.4529	60.4529	60.1926	60.9942	61.8583	62.4691	63.1076	(38)
Heat transfer coeff	170.3806	170.0301	169.6866	168.0729	167.7710	166.3656	166.3656	166.1053	166.9069	167.7710	168.3818	169.0203	(39)
Average = Sum(39)m / 12 =												168.0715	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3080	1.3053	1.3027	1.2903	1.2880	1.2772	1.2772	1.2752	1.2813	1.2880	1.2927	1.2976	(40)
HLP (average)												1.2903	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300 (61)
Total heat required for water heating calculated for each month												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046 (64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601 (64)
Heat gains from water heating, kWh/month												
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	10.6334	0.7200	0.7000	0.7700	25.6262	(74)
Northeast	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(75)
East	0.4800	19.6403	0.7200	0.7000	0.7700	3.2927	(76)
South	9.3600	46.7521	0.7200	0.7000	0.7700	152.8412	(78)
West	7.6200	19.6403	0.7200	0.7000	0.7700	52.2716	(80)
Northwest	1.0200	11.2829	0.7200	0.7000	0.7700	4.0196	(81)

Solar gains	242.0710	424.3473	610.5626	803.5343	940.6344	951.0788	909.8096	805.2975	677.2541	477.2585	292.1799	205.6908 (83)
Total gains	948.9314	1125.9730	1284.5308	1434.2941	1526.5448	1497.2092	1432.9465	1337.9826	1235.0315	1078.4797	941.7408	892.4096 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.0919	53.2014	53.3091	53.8209	53.9177	54.3732	54.3732	54.4584	54.1969	53.9177	53.7222	53.5192	
alpha	4.5395	4.5468	4.5539	4.5881	4.5945	4.6249	4.6249	4.6306	4.6131	4.5945	4.5815	4.5679	
util living area													
	0.9954	0.9896	0.9745	0.9308	0.8301	0.6614	0.4994	0.5520	0.7920	0.9551	0.9907	0.9965	(86)
MIT	19.6679	19.8618	20.1522	20.5088	20.7939	20.9475	20.9884	20.9820	20.8778	20.4973	20.0109	19.6307	(87)
Th 2	19.8346	19.8367	19.8387	19.8484	19.8503	19.8588	19.8588	19.8603	19.8555	19.8503	19.8466	19.8427	(88)
util rest of house													
	0.9939	0.9861	0.9657	0.9064	0.7733	0.5631	0.3757	0.4246	0.7061	0.9341	0.9870	0.9953	(89)
MIT 2	18.0858	18.3688	18.7878	19.2924	19.6577	19.8259	19.8549	19.8535	19.7641	19.2893	18.5942	18.0373	(90)
Living area fraction									fLA = Living area / (4) =			0.1862	(91)
MIT	18.3805	18.6468	19.0419	19.5189	19.8693	20.0348	20.0660	20.0637	19.9715	19.5143	18.8580	18.3340	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3805	18.6468	19.0419	19.5189	19.8693	20.0348	20.0660	20.0637	19.9715	19.5143	18.8580	18.3340	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9809	0.9577	0.8979	0.7744	0.5792	0.3988	0.4483	0.7160	0.9260	0.9823	0.9930	(94)
Useful gains	940.3680	1104.5205	1230.1423	1287.8171	1182.0960	867.2382	571.4728	599.8121	884.2350	998.7081	925.0674	886.1605	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2399.0422	2337.3752	2128.1945	1784.7555	1370.5762	904.1578	576.6191	608.5550	979.9996	1495.5637	1979.8396	2388.9402	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1085.2536	828.4784	668.1509	357.7956	140.2292	0.0000	0.0000	0.0000	0.0000	369.6606	759.4360	1118.0681	(98)
Space heating												5327.0724	(98)
Space heating per m2											(98) / (4) =	40.8957	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5734.2006	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1085.2536	828.4784	668.1509	357.7956	140.2292	0.0000	0.0000	0.0000	0.0000	369.6606	759.4360	1118.0681	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1168.1955	891.7959	719.2151	385.1406	150.9464	0.0000	0.0000	0.0000	0.0000	397.9124	817.4768	1203.5179	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4308	89.3728	89.2526	88.9597	88.2804	86.7000	86.7000	86.7000	86.7000	88.9567	89.3226	89.4543	(217)
Fuel for water heating, kWh/month													
	201.0635	176.3366	183.0907	161.3977	156.9871	139.3302	130.4896	147.7758	148.9565	167.5261	180.5123	195.0769	(219)
Water heating fuel used												1988.5430	(219)
Annual totals kWh/year													
Space heating fuel - main system												5734.2006	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												7518.9891	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5734.2006	3.4800	199.5502	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1988.5430	3.4800	69.2013	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	471.9117	13.1900	62.2452	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			361.8762	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8672	(257)
SAP value		87.9024	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5734.2006	0.2160	1238.5873	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1988.5430	0.2160	429.5253	(264)
Space and water heating			1668.1126	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1562.3640	(272)
CO2 emissions per m2			11.9900	(273)
EI value			88.0545	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4

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Water heating energy efficiency	3.48 / 0.8832 = 3.940, stars = 4
Water heating environmental impact	0.216 / 0.8832 = 0.2446, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7200	(1b)	x 2.5300	(2b) =	166.2716	(1b) - (3b)
First floor	64.5400	(1c)	x 2.6300	(2c) =	169.7402	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.2600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	336.0118	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.1488	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3323	0.3085	0.3165	0.3006	0.3006	0.2927	0.2848	0.2769	0.2690	0.2927	0.2769	0.2927	(22b)
Effective ac	0.5552	0.5476	0.5501	0.5452	0.5452	0.5428	0.5406	0.5383	0.5362	0.5428	0.5383	0.5428	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			26.4000	1.2357	32.6236			(27)
Opening Type 16			4.2400	1.5000	6.3600			(26a)
Ground floor			65.7200	0.1900	12.4868			(28a)
External Wall	168.9900	30.6400	138.3500	0.2700	37.3545			(29a)
Main Roof	64.5400		64.5400	0.1600	10.3264			(30)
Lower	1.1700		1.1700	0.1600	0.1872			(30)
Total net area of external elements Aum(A, m2)			300.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.3385			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5742	(36)
Total fabric heat loss (33) + (36) =	105.9127	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	61.5634	60.7201	60.9942	60.4529	60.4529	60.1926	59.9393	59.6929	59.4535	60.1926	59.6929	60.1926	(38)
Heat transfer coeff	167.4761	166.6328	166.9069	166.3656	166.3656	166.1053	165.8520	165.6056	165.3662	166.1053	165.6056	166.1053	(39)
Average = Sum(39)m / 12 =												166.2077	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2857	1.2792	1.2813	1.2772	1.2772	1.2752	1.2732	1.2713	1.2695	1.2752	1.2713	1.2752	(40)
HLP (average)												1.2760	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8957 (42)
Average daily hot water use (litres/day)	102.9719 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2691	109.1503	105.0314	100.9125	96.7936	92.6747	92.6747	96.7936	100.9125	105.0314	109.1503	113.2691	(44)
Energy conte	167.9749	146.9119	151.5999	132.1685	126.8188	109.4350	101.4076	116.3667	117.7565	137.2338	149.8015	162.6747	(45)
Energy content (annual)										Total = Sum(45)m =		1620.1496	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1962	22.0368	22.7400	19.8253	19.0228	16.4152	15.2111	17.4550	17.6635	20.5851	22.4702	24.4012	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8379	10.6851	11.8133	11.4105	11.7701	11.3643	11.7269	11.7549	11.3888	11.7918	11.4369	11.8300	(61)
Total heat required for water heating calculated for each month													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
								Total per year (kWh/year) = Sum(64)m =				1758.9601	(64)
Heat gains from water heating, kWh/month													
	58.8111	51.5195	53.3603	46.7986	45.1098	39.2282	36.6498	41.6307	42.0012	48.5782	52.6682	57.0468	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	173.7396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	66.8040	59.3347	48.2542	36.5316	27.3078	23.0544	24.9111	32.3803	43.4608	55.1835	64.4073	68.6607	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	444.8263	449.4422	437.8103	413.0473	381.7884	352.4095	332.7826	328.1667	339.7986	364.5616	395.8205	425.1994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	55.2696	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	-115.8264	(71)
Water heating gains (Table 5)													
	79.0472	76.6659	71.7208	64.9981	60.6314	54.4836	49.2604	55.9552	58.3351	65.2933	73.1503	76.6758	(72)
Total internal gains													
	706.8603	701.6257	673.9682	630.7598	585.9104	546.1304	523.1369	532.6851	557.7773	601.2212	649.5609	686.7187	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.9000	13.4839	0.7200	0.7000	0.7700	32.4959	(74)
Northeast	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(75)
East	0.4800	25.1925	0.7200	0.7000	0.7700	4.2235	(76)
South	9.3600	56.7559	0.7200	0.7000	0.7700	185.5455	(78)
West	7.6200	25.1925	0.7200	0.7000	0.7700	67.0488	(80)
Northwest	1.0200	14.6176	0.7200	0.7000	0.7700	5.2076	(81)

Solar gains	299.7289	447.9527	652.4742	869.3110	971.7289	1069.2339	1014.0402	916.3943	766.2179	544.2777	360.7392	250.2798	(83)
Total gains	1006.5893	1149.5784	1326.4424	1500.0707	1557.6394	1615.3643	1537.1771	1449.0793	1323.9952	1145.4990	1010.3001	936.9985	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0127	54.2860	54.1969	54.3732	54.3732	54.4584	54.5416	54.6227	54.7018	54.4584	54.6227	54.4584	
alpha	4.6008	4.6191	4.6131	4.6249	4.6249	4.6306	4.6361	4.6415	4.6468	4.6306	4.6415	4.6306	
util living area													
	0.9932	0.9873	0.9669	0.9060	0.7803	0.5646	0.4163	0.4398	0.7126	0.9279	0.9844	0.9948	(86)
MIT	19.8063	19.9567	20.2577	20.6095	20.8600	20.9755	20.9952	20.9940	20.9306	20.6252	20.1712	19.7836	(87)
Th 2	19.8520	19.8571	19.8555	19.8588	19.8588	19.8603	19.8619	19.8633	19.8648	19.8603	19.8633	19.8603	(88)
util rest of house													
	0.9909	0.9830	0.9555	0.8741	0.7115	0.4614	0.2972	0.3148	0.6125	0.8951	0.9780	0.9930	(89)
MIT 2	18.2994	18.5204	18.9497	19.4334	19.7391	19.8477	19.8606	19.8618	19.8202	19.4680	18.8373	18.2725	(90)
Living area fraction										fLA = Living area / (4) =		0.1862	(91)
MIT	18.5800	18.7879	19.1933	19.6525	19.9479	20.0577	20.0719	20.0727	20.0270	19.6835	19.0857	18.5539	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5800	18.7879	19.1933	19.6525	19.9479	20.0577	20.0719	20.0727	20.0270	19.6835	19.0857	18.5539	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9871	0.9774	0.9469	0.8673	0.7175	0.4799	0.3195	0.3382	0.6281	0.8887	0.9718	0.9898	(94)
Useful gains	993.6313	1123.5975	1255.9530	1300.9672	1117.5708	775.2851	491.1829	490.1201	831.5778	1017.9602	981.8248	927.4871	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	2291.0797	2247.5295	2035.1477	1689.0225	1239.0678	790.2857	492.9028	492.2911	880.9060	1375.9340	1852.4187	2251.3745	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	965.3016	755.2823	579.7209	279.3998	90.3938	0.0000	0.0000	0.0000	0.0000	266.3325	626.8276	984.9722	(98)
Space heating												4548.2306	(98)
Space heating per m2											(98) / (4) =	34.9166	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4895.8349	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	965.3016	755.2823	579.7209	279.3998	90.3938	0.0000	0.0000	0.0000	0.0000	266.3325	626.8276	984.9722	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	1039.0760	813.0057	624.0268	300.7533	97.3022	0.0000	0.0000	0.0000	0.0000	286.6873	674.7337	1060.2500	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.8128	157.5970	163.4132	143.5789	138.5889	120.7993	113.1345	128.1216	129.1453	149.0256	161.2384	174.5046	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3820	89.3308	89.1762	88.7876	87.9356	86.7000	86.7000	86.7000	86.7000	88.7251	89.2262	89.4034	(217)
Fuel for water heating, kWh/month													
	201.1734	176.4195	183.2475	161.7105	157.6026	139.3302	130.4896	147.7758	148.9565	167.9634	180.7074	195.1880	(219)
Water heating fuel used												1990.5646	(219)
Annual totals kWh/year													
Space heating fuel - main system												4895.8349	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												471.9117	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												6582.5361	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4895.8349	7.3800	361.3126	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1990.5646	7.3800	146.9037	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	471.9117	28.6600	135.2499	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			528.1290	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4895.8349	0.2160	1057.5003	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5646	0.2160	429.9619	(264)
Space and water heating			1487.4623	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	471.9117	0.5190	244.9222	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1329.7572	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4895.8349	1.2200	5972.9186	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1990.5646	1.2200	2428.4888	(264)
Space and water heating			8401.4074	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	471.9117	3.0700	1448.7689	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			7468.5467	(272)
Primary energy kWh/m2/year			57.3357	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	SAP increase too small
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 62	-198 kg (14.9%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£157	£0
Mains gas	£615	£615	£0
Space heating	£490	£490	£0
Water heating	£147	£147	£0
Lighting	£135	£135	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£528	£528	£0
Total cost of uses	£528	£528	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	887.07 (P1)
Transmission heat loss coefficient	105.91 (37)
Summer heat loss coefficient	992.98 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
North East	0.850	0.90	1.000	0.765 (P8)
East	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (P8)
North West	0.850	0.90	1.000	0.765 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.9000	87.1704	0.7200	0.7000	0.7650	208.7146
North East	1.0200	106.0502	0.7200	0.7000	0.7650	37.5358
East	0.4800	125.2818	0.7200	0.7000	0.7650	20.8672
South	9.3600	118.5567	0.7200	0.7000	0.7650	385.0670
West	7.6200	125.2818	0.7200	0.7000	0.7650	331.2664
North West	1.0200	106.0502	0.7200	0.7000	0.7650	37.5358
total:						1020.9869

	Jun	Jul	Aug	
Solar gains	1094	1021	920	(P3)
Internal gains	543	520	530	
Total summer gains	1637	1541	1449	(P5)
Summer gain/loss ratio	1.65	1.55	1.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.30	19.10	19.01	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 444 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 444	**Prop Type Ref**	
Property	1 Stock Dove Gardens, Boorley Green, Southampton, SO32 2EA		

SAP Rating	88 B	**DER**	13.54	**TER**	16.85
Environmental	88 B	**% DER<TER**	19.62		
CO_2 Emissions (t/year)	1.33	**DFEE**	52.10	**TFEE**	57.37
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.85	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.54	$kgCO_2/m^2$	Pass
	-3.31 (-19.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.37	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	52.10	$kWh/m^2/yr$	
	-5.3 (-9.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.90 m², No overhang
Windows facing North East	1.02 m², No overhang
Windows facing East	0.48 m², No overhang
Windows facing South	9.36 m², No overhang
Windows facing West	7.62 m², No overhang
Windows facing North West	1.02 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 445 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 445	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 445, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 11.51 m², No overhang
Windows facing East: 0.81 m², No overhang
Windows facing South: 12.05 m², No overhang
Windows facing West: 1.29 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1597	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3847	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3270	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4169	0.4088	0.4006	0.3597	0.3515	0.3107	0.3107	0.3025	0.3270	0.3515	0.3679	0.3842	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6669	0.6588	0.6506	0.6097	0.6015	0.5607	0.5607	0.5525	0.5770	0.6015	0.6179	0.6342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.6600	1.2357	31.7091			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.7500	0.1200	9.2100			(28a)
External Wall	180.3400	29.9400	150.4000	0.2100	31.5840			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4153			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.0387	(36)
Total fabric heat loss	(33) + (36) =	90.4541	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6769	81.6634	80.6500	75.5827	74.5693	69.5020	69.5020	68.4886	71.5289	74.5693	76.5962	78.6231	(38)
Heat transfer coeff	173.1309	172.1175	171.1040	166.0368	165.0233	159.9561	159.9561	158.9426	161.9830	165.0233	167.0502	169.0771	(39)
Average = Sum(39)m / 12 =												165.7834	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1377	1.1311	1.1244	1.0911	1.0845	1.0512	1.0512	1.0445	1.0645	1.0845	1.0978	1.1111	(40)
HLP (average)												1.0895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8336	10.6782	11.7989	11.3874	11.7402	11.3243	11.6786	11.7186	11.3569	11.7684	11.4248	11.8224 (61)

Total heat required for water heating calculated for each month

	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677 (64)
								Total per year (kWh/year) = Sum(64)m =				1774.3254 (64)

Heat gains from water heating, kWh/month

	59.3493	51.9894	53.8434	47.2172	45.5095	39.5695	36.9632	41.9952	42.3713	49.0129	53.1461	57.5672 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)

Water heating gains (Table 5)

	79.7706	77.3652	72.3702	65.5794	61.1686	54.9577	49.6818	56.4451	58.8490	65.8776	73.8141	77.3752	(72)

Total internal gains

	502.4376	500.0584	481.6891	451.7072	420.5024	391.0741	372.3785	379.1156	394.8938	425.1135	459.8440	486.6225	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.5100	10.6334	0.7200	0.7000	0.7700	42.7475	(74)
East	0.8100	19.6403	0.7200	0.7000	0.7700	5.5564	(76)
South	12.0500	46.7521	0.7200	0.7000	0.7700	196.7667	(78)
West	1.2900	19.6403	0.7200	0.7000	0.7700	8.8491	(80)

Solar gains	253.9198	432.1262	595.7182	754.6053	866.7775	871.7308	835.6435	749.0920	649.6860	478.2631	303.9323	217.5074	(83)
Total gains	756.3574	932.1846	1077.4073	1206.3125	1287.2799	1262.8049	1208.0220	1128.2075	1044.5798	903.3766	763.7762	704.1300	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.6321	46.9067	47.1845	48.6246	48.9232	50.4730	50.4730	50.7948	49.8414	48.9232	48.3296	47.7502	
alpha	4.1088	4.1271	4.1456	4.2416	4.2615	4.3649	4.3649	4.3863	4.3228	4.2615	4.2220	4.1833	
util living area													
	0.9970	0.9926	0.9819	0.9507	0.8737	0.7198	0.5583	0.6104	0.8385	0.9682	0.9938	0.9978	(86)
MIT	19.3740	19.5936	19.9141	20.3371	20.6843	20.9110	20.9772	20.9670	20.8130	20.3519	19.8001	19.3636	(87)
Th 2	19.9701	19.9755	19.9809	20.0081	20.0135	20.0409	20.0409	20.0464	20.0299	20.0135	20.0026	19.9918	(88)
util rest of house													
	0.9962	0.9906	0.9768	0.9359	0.8348	0.6404	0.4475	0.4999	0.7766	0.9559	0.9919	0.9972	(89)
MIT 2	17.7866	18.1103	18.5792	19.2026	19.6782	19.9709	20.0297	20.0286	19.8607	19.2355	18.4309	17.7857	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.1252	18.4267	18.8639	19.4446	19.8928	20.1714	20.2318	20.2288	20.0639	19.4736	18.7230	18.1223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1252	18.4267	18.8639	19.4446	19.8928	20.1714	20.2318	20.2288	20.0639	19.4736	18.7230	18.1223	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9862	0.9691	0.9253	0.8293	0.6521	0.4705	0.5222	0.7791	0.9469	0.9881	0.9955	(94)
Useful gains	751.7941	919.2790	1044.1347	1116.2606	1067.4948	823.4583	568.3388	589.1684	813.8229	855.4237	754.6877	700.9571	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2393.5706	2328.1796	2115.5143	1750.7858	1352.0097	891.1787	580.9344	608.5606	966.0444	1464.3540	1941.6217	2353.9451	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1221.4818	946.7812	797.1064	456.8581	211.6790	0.0000	0.0000	0.0000	0.0000	453.0442	854.5924	1229.8231	(98)
Space heating												6171.3663	(98)
Space heating per m2											(98) / (4) =	40.5557	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6614.5405	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1221.4818	946.7812	797.1064	456.8581	211.6790	0.0000	0.0000	0.0000	0.0000	453.0442	854.5924	1229.8231	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1309.1980	1014.7708	854.3477	489.6657	226.8800	0.0000	0.0000	0.0000	0.0000	485.5779	915.9619	1318.1384	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8177	89.7640	89.6620	89.4064	88.8330	86.7000	86.7000	86.7000	86.7000	89.3754	89.7044	89.8329	(217)
Fuel for water heating, kWh/month													
	201.9984	177.1407	183.8713	161.9930	157.3554	140.5028	131.5633	149.0298	150.2311	168.1976	181.3431	195.9948	(219)
Water heating fuel used												1999.2213	(219)
Annual totals kWh/year													
Space heating fuel - main system												6614.5405	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6761.1417	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6614.5405	0.2160	1428.7407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.2213	0.2160	431.8318	(264)
Space and water heating			1860.5725	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			899.0627	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	152.1700	
Assumed number of occupants	N	2.9375	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5733	ZC2
CO2 emissions from cooking, equation (L16)		1.2453	ZC3
Total CO2 emissions		19.7286	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.7286	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			25.6600	1.3258	34.0189			(27)
Ground floor			76.7500	0.1300	9.9775			(28a)
External Wall	180.3400	29.9400	150.4000	0.1800	27.0720			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.1819			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3360	(36)
Total fabric heat loss (33) + (36) =	100.5179	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.2330	70.8738	70.5216	68.8677	68.5583	67.1178	67.1178	66.8510	67.6726	68.5583	69.1843	69.8387	(38)
Heat transfer coeff	171.7509	171.3917	171.0396	169.3857	169.0762	167.6357	167.6357	167.3690	168.1906	169.0762	169.7022	170.3567	(39)
Average = Sum(39)m / 12 =												169.3842	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1263	1.1240	1.1131	1.1111	1.1016	1.1016	1.0999	1.1053	1.1111	1.1152	1.1195	(40)
HLP (average)												1.1131	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8012	46.1439	47.6820	49.8012	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.0297 (64)
Heat gains from water heating, kWh/month												
	69.1306	60.8267	63.6334	56.6991	55.0247	48.2744	45.9641	51.5158	51.8609	58.8106	62.6187	67.3513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)
Water heating gains (Table 5)													
	92.9175	90.5159	85.5288	78.7488	73.9579	67.0478	61.7797	69.2417	72.0290	79.0465	86.9704	90.5260	(72)
Total internal gains													
	515.5845	513.2091	494.8477	464.8765	433.2917	403.1642	384.4764	391.9122	408.0737	438.2824	473.0003	499.7733	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.5100	10.6334	0.6300	0.7000	0.7700	37.4041	(74)
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619	(76)
South	12.0500	46.7521	0.6300	0.7000	0.7700	172.1709	(78)
West	1.2900	19.6403	0.6300	0.7000	0.7700	7.7430	(80)

Solar gains	222.1798	378.1104	521.2535	660.2796	758.4303	762.7644	731.1881	655.4555	568.4753	418.4802	265.9407	190.3190	(83)
Total gains	737.7643	891.3196	1016.1011	1125.1561	1191.7220	1165.9286	1115.6645	1047.3676	976.5490	856.7626	738.9410	690.0923	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5272	61.6562	61.7831	62.3864	62.5006	63.0376	63.0376	63.1381	62.8297	62.5006	62.2700	62.0308	
alpha	5.1018	5.1104	5.1189	5.1591	5.1667	5.2025	5.2025	5.2092	5.1886	5.1667	5.1513	5.1354	
util living area													
	0.9993	0.9979	0.9938	0.9790	0.9294	0.8020	0.6329	0.6891	0.9014	0.9874	0.9983	0.9995	(86)
MIT	19.6797	19.8409	20.0883	20.4110	20.7111	20.9142	20.9804	20.9700	20.8256	20.4328	19.9930	19.6518	(87)
Th 2	19.9775	19.9794	19.9813	19.9901	19.9918	19.9995	19.9995	20.0009	19.9965	19.9918	19.9884	19.9849	(88)
util rest of house													
	0.9990	0.9972	0.9915	0.9702	0.8976	0.7176	0.5031	0.5612	0.8448	0.9806	0.9975	0.9993	(89)
MIT 2	18.2028	18.4399	18.8020	19.2741	19.6893	19.9370	19.9917	19.9874	19.8446	19.3110	18.6693	18.1674	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.5179	18.7388	19.0764	19.5166	19.9073	20.1455	20.2026	20.1970	20.0538	19.5503	18.9516	18.4841	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5179	18.7388	19.0764	19.5166	19.9073	20.1455	20.2026	20.1970	20.0538	19.5503	18.9516	18.4841	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9958	0.9885	0.9647	0.8944	0.7314	0.5309	0.5882	0.8488	0.9763	0.9964	0.9989	(94)
Useful gains	736.6162	887.5676	1004.4492	1085.4645	1065.8488	852.7704	592.2925	616.1136	828.8477	836.4897	736.2460	689.3273	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2441.9324	2371.8519	2151.0661	1798.2950	1387.6577	929.6211	603.9206	635.4966	1001.3783	1513.2799	2011.2514	2433.3888	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1268.7553	997.4391	853.0829	513.2380	239.4258	0.0000	0.0000	0.0000	0.0000	503.5319	918.0039	1297.5818	(98)
Space heating												6591.0586	(98)
Space heating per m2											(98) / (4) =	43.3138	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7056.8079	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1268.7553	997.4391	853.0829	513.2380	239.4258	0.0000	0.0000	0.0000	0.0000	503.5319	918.0039	1297.5818	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1358.4103	1067.9219	913.3650	549.5053	256.3446	0.0000	0.0000	0.0000	0.0000	539.1134	982.8735	1389.2739	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7469	88.5830	88.2575	87.5098	85.8004	80.3000	80.3000	80.3000	80.3000	87.3941	88.4062	88.8109	(217)
Fuel for water heating, kWh/month													
	248.5220	219.4076	231.1674	208.8449	207.2770	195.0629	186.8851	208.3331	209.4752	216.8542	226.8652	242.3174	(219)
Water heating fuel used												2601.0121	(219)
Annual totals kWh/year													
Space heating fuel - main system												7056.8079	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Total delivered energy for all uses												10257.8798	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7056.8079	0.2160	1524.2705	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2601.0121	0.2160	561.8186	(264)
Space and water heating			2086.0891	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Total CO2, kg/m2/year			2397.5202	(272)
Emissions per m2 for space and water heating			13.7089	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7908	(272b)
Emissions per m2 for pumps and fans			0.2558	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7089 * 1.00) + 1.7908 + 0.2558, rounded to 2 d.p.			15.7600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 445 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 445	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 445, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.34 m	76.75 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	180.34	150.40

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.81	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.72	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	West							2.14	100

W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.63	0.065	No
Independently assessed	E3 Sill	16.77	0.004	No
Independently assessed	E4 Jamb	45.90	0.005	No
Independently assessed	E5 Ground floor (normal)	37.34	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 445 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 445	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 445, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.17	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	15.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.49	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.33	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.17	m^2	
DER	16.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.90	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.90	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.54	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.54	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 446 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 446	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 446, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.76 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.91 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 11.51 m², No overhang
Windows facing East: 0.81 m², No overhang
Windows facing South: 12.05 m², No overhang
Windows facing West: 1.29 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1597	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3847	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3270	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4169	0.4088	0.4006	0.3597	0.3515	0.3107	0.3107	0.3025	0.3270	0.3515	0.3679	0.3842	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6669	0.6588	0.6506	0.6097	0.6015	0.5607	0.5607	0.5525	0.5770	0.6015	0.6179	0.6342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.6600	1.2357	31.7091			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.7500	0.1200	9.2100			(28a)
External Wall	180.3400	29.9400	150.4000	0.2100	31.5840			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4153			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.0387	(36)
Total fabric heat loss	(33) + (36) =	90.4541	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6769	81.6634	80.6500	75.5827	74.5693	69.5020	69.5020	68.4886	71.5289	74.5693	76.5962	78.6231	(38)
Heat transfer coeff	173.1309	172.1175	171.1040	166.0368	165.0233	159.9561	159.9561	158.9426	161.9830	165.0233	167.0502	169.0771	(39)
Average = Sum(39)m / 12 =												165.7834	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1377	1.1311	1.1244	1.0911	1.0845	1.0512	1.0512	1.0445	1.0645	1.0845	1.0978	1.1111	(40)
HLP (average)												1.0895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8336	10.6782	11.7989	11.3874	11.7402	11.3243	11.6786	11.7186	11.3569	11.7684	11.4248	11.8224 (61)

Total heat required for water heating calculated for each month

	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677 (64)
								Total per year (kWh/year) = Sum(64)m =				1774.3254 (64)

Heat gains from water heating, kWh/month

	59.3493	51.9894	53.8434	47.2172	45.5095	39.5695	36.9632	41.9952	42.3713	49.0129	53.1461	57.5672 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)

Water heating gains (Table 5)

	79.7706	77.3652	72.3702	65.5794	61.1686	54.9577	49.6818	56.4451	58.8490	65.8776	73.8141	77.3752	(72)

Total internal gains

	502.4376	500.0584	481.6891	451.7072	420.5024	391.0741	372.3785	379.1156	394.8938	425.1135	459.8440	486.6225	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.5100	10.6334	0.7200	0.7000	0.7700	42.7475	(74)
East	0.8100	19.6403	0.7200	0.7000	0.7700	5.5564	(76)
South	12.0500	46.7521	0.7200	0.7000	0.7700	196.7667	(78)
West	1.2900	19.6403	0.7200	0.7000	0.7700	8.8491	(80)

Solar gains	253.9198	432.1262	595.7182	754.6053	866.7775	871.7308	835.6435	749.0920	649.6860	478.2631	303.9323	217.5074	(83)
Total gains	756.3574	932.1846	1077.4073	1206.3125	1287.2799	1262.8049	1208.0220	1128.2075	1044.5798	903.3766	763.7762	704.1300	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.6321	46.9067	47.1845	48.6246	48.9232	50.4730	50.4730	50.7948	49.8414	48.9232	48.3296	47.7502	
alpha	4.1088	4.1271	4.1456	4.2416	4.2615	4.3649	4.3649	4.3863	4.3228	4.2615	4.2220	4.1833	
util living area													
	0.9970	0.9926	0.9819	0.9507	0.8737	0.7198	0.5583	0.6104	0.8385	0.9682	0.9938	0.9978	(86)
MIT	19.3740	19.5936	19.9141	20.3371	20.6843	20.9110	20.9772	20.9670	20.8130	20.3519	19.8001	19.3636	(87)
Th 2	19.9701	19.9755	19.9809	20.0081	20.0135	20.0409	20.0409	20.0464	20.0299	20.0135	20.0026	19.9918	(88)
util rest of house													
	0.9962	0.9906	0.9768	0.9359	0.8348	0.6404	0.4475	0.4999	0.7766	0.9559	0.9919	0.9972	(89)
MIT 2	17.7866	18.1103	18.5792	19.2026	19.6782	19.9709	20.0297	20.0286	19.8607	19.2355	18.4309	17.7857	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.1252	18.4267	18.8639	19.4446	19.8928	20.1714	20.2318	20.2288	20.0639	19.4736	18.7230	18.1223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1252	18.4267	18.8639	19.4446	19.8928	20.1714	20.2318	20.2288	20.0639	19.4736	18.7230	18.1223	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9862	0.9691	0.9253	0.8293	0.6521	0.4705	0.5222	0.7791	0.9469	0.9881	0.9955	(94)
Useful gains	751.7941	919.2790	1044.1347	1116.2606	1067.4948	823.4583	568.3388	589.1684	813.8229	855.4237	754.6877	700.9571	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2393.5706	2328.1796	2115.5143	1750.7858	1352.0097	891.1787	580.9344	608.5606	966.0444	1464.3540	1941.6217	2353.9451	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1221.4818	946.7812	797.1064	456.8581	211.6790	0.0000	0.0000	0.0000	0.0000	453.0442	854.5924	1229.8231	(98)
Space heating												6171.3663	(98)
Space heating per m2											(98) / (4) =	40.5557	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6614.5405	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1221.4818	946.7812	797.1064	456.8581	211.6790	0.0000	0.0000	0.0000	0.0000	453.0442	854.5924	1229.8231	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1309.1980	1014.7708	854.3477	489.6657	226.8800	0.0000	0.0000	0.0000	0.0000	485.5779	915.9619	1318.1384	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8177	89.7640	89.6620	89.4064	88.8330	86.7000	86.7000	86.7000	86.7000	89.3754	89.7044	89.8329	(217)
Fuel for water heating, kWh/month													
	201.9984	177.1407	183.8713	161.9930	157.3554	140.5028	131.5633	149.0298	150.2311	168.1976	181.3431	195.9948	(219)
Water heating fuel used												1999.2213	(219)
Annual totals kWh/year													
Space heating fuel - main system												6614.5405	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6761.1417	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6614.5405	0.2160	1428.7407	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.2213	0.2160	431.8318	(264)
Space and water heating			1860.5725	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			899.0627	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9100	ZC1
Total Floor Area	TFA	152.1700	
Assumed number of occupants	N	2.9375	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5733	ZC2
CO2 emissions from cooking, equation (L16)		1.2453	ZC3
Total CO2 emissions		19.7286	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.7286	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			25.6600	1.3258	34.0189			(27)
Ground floor			76.7500	0.1300	9.9775			(28a)
External Wall	180.3400	29.9400	150.4000	0.1800	27.0720			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.1819			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3360	(36)
Total fabric heat loss (33) + (36) =	100.5179	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.2330	70.8738	70.5216	68.8677	68.5583	67.1178	67.1178	66.8510	67.6726	68.5583	69.1843	69.8387	(38)
Heat transfer coeff	171.7509	171.3917	171.0396	169.3857	169.0762	167.6357	167.6357	167.3690	168.1906	169.0762	169.7022	170.3567	(39)
Average = Sum(39)m / 12 =												169.3842	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1263	1.1240	1.1131	1.1111	1.1016	1.1016	1.0999	1.1053	1.1111	1.1152	1.1195	(40)
HLP (average)												1.1131	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8012	46.1439	47.6820	49.8012	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.0297 (64)
Heat gains from water heating, kWh/month												
	69.1306	60.8267	63.6334	56.6991	55.0247	48.2744	45.9641	51.5158	51.8609	58.8106	62.6187	67.3513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)
Water heating gains (Table 5)													
	92.9175	90.5159	85.5288	78.7488	73.9579	67.0478	61.7797	69.2417	72.0290	79.0465	86.9704	90.5260	(72)
Total internal gains													
	515.5845	513.2091	494.8477	464.8765	433.2917	403.1642	384.4764	391.9122	408.0737	438.2824	473.0003	499.7733	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	11.5100	10.6334	0.6300	0.7000	0.7700	37.4041	(74)
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619	(76)
South	12.0500	46.7521	0.6300	0.7000	0.7700	172.1709	(78)
West	1.2900	19.6403	0.6300	0.7000	0.7700	7.7430	(80)

Solar gains	222.1798	378.1104	521.2535	660.2796	758.4303	762.7644	731.1881	655.4555	568.4753	418.4802	265.9407	190.3190	(83)
Total gains	737.7643	891.3196	1016.1011	1125.1561	1191.7220	1165.9286	1115.6645	1047.3676	976.5490	856.7626	738.9410	690.0923	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5272	61.6562	61.7831	62.3864	62.5006	63.0376	63.0376	63.1381	62.8297	62.5006	62.2700	62.0308	
alpha	5.1018	5.1104	5.1189	5.1591	5.1667	5.2025	5.2025	5.2092	5.1886	5.1667	5.1513	5.1354	
util living area													
	0.9993	0.9979	0.9938	0.9790	0.9294	0.8020	0.6329	0.6891	0.9014	0.9874	0.9983	0.9995	(86)
MIT	19.6797	19.8409	20.0883	20.4110	20.7111	20.9142	20.9804	20.9700	20.8256	20.4328	19.9930	19.6518	(87)
Th 2	19.9775	19.9794	19.9813	19.9901	19.9918	19.9995	19.9995	20.0009	19.9965	19.9918	19.9884	19.9849	(88)
util rest of house													
	0.9990	0.9972	0.9915	0.9702	0.8976	0.7176	0.5031	0.5612	0.8448	0.9806	0.9975	0.9993	(89)
MIT 2	18.2028	18.4399	18.8020	19.2741	19.6893	19.9370	19.9917	19.9874	19.8446	19.3110	18.6693	18.1674	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.5179	18.7388	19.0764	19.5166	19.9073	20.1455	20.2026	20.1970	20.0538	19.5503	18.9516	18.4841	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5179	18.7388	19.0764	19.5166	19.9073	20.1455	20.2026	20.1970	20.0538	19.5503	18.9516	18.4841	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9958	0.9885	0.9647	0.8944	0.7314	0.5309	0.5882	0.8488	0.9763	0.9964	0.9989	(94)
Useful gains	736.6162	887.5676	1004.4492	1085.4645	1065.8488	852.7704	592.2925	616.1136	828.8477	836.4897	736.2460	689.3273	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2441.9324	2371.8519	2151.0661	1798.2950	1387.6577	929.6211	603.9206	635.4966	1001.3783	1513.2799	2011.2514	2433.3888	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1268.7553	997.4391	853.0829	513.2380	239.4258	0.0000	0.0000	0.0000	0.0000	503.5319	918.0039	1297.5818	(98)
Space heating												6591.0586	(98)
Space heating per m2											(98) / (4) =	43.3138	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7056.8079	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1268.7553	997.4391	853.0829	513.2380	239.4258	0.0000	0.0000	0.0000	0.0000	503.5319	918.0039	1297.5818	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1358.4103	1067.9219	913.3650	549.5053	256.3446	0.0000	0.0000	0.0000	0.0000	539.1134	982.8735	1389.2739	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7469	88.5830	88.2575	87.5098	85.8004	80.3000	80.3000	80.3000	80.3000	87.3941	88.4062	88.8109	(217)
Fuel for water heating, kWh/month													
	248.5220	219.4076	231.1674	208.8449	207.2770	195.0629	186.8851	208.3331	209.4752	216.8542	226.8652	242.3174	(219)
Water heating fuel used												2601.0121	(219)
Annual totals kWh/year													
Space heating fuel - main system												7056.8079	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Total delivered energy for all uses												10257.8798	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7056.8079	0.2160	1524.2705	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2601.0121	0.2160	561.8186	(264)
Space and water heating			2086.0891	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Total CO2, kg/m2/year			2397.5202	(272)
Emissions per m2 for space and water heating			13.7089	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7908	(272b)
Emissions per m2 for pumps and fans			0.2558	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7089 * 1.00) + 1.7908 + 0.2558, rounded to 2 d.p.			15.7600	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 446 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 446	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 446, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.34 m	76.75 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	180.34	150.40

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.81	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.72	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	West							2.14	100

W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.63	0.065	No
Independently assessed	E3 Sill	16.77	0.004	No
Independently assessed	E4 Jamb	45.90	0.005	No
Independently assessed	E5 Ground floor (normal)	37.34	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 446 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 446	**Prop Type Ref**	As
Property	L473-R - Det SG, Plot 446, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.91	**TER**	15.76
Environmental	95 A	**% DER<TER**	62.49		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.33	**TFEE**	54.52
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.17	m^2	
DER	5.91	$kgCO_2/yr/m^2$	
TER	15.76	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.91	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.49	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.33	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.17	m^2	
DER	16.08	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.90	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.90	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.72	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.54	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.54	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 447 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 447	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 447, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.29	**TER**	17.38
Environmental	95 A	**% DER<TER**	63.81		
CO_2 Emissions (t/year)	0.24	**DFEE**	43.61	**TFEE**	57.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.38 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.29 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.05 m², No overhang
Windows facing East: 8.41 m², No overhang
Windows facing South: 9.86 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1721	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3971	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4303	0.4219	0.4134	0.3713	0.3628	0.3206	0.3206	0.3122	0.3375	0.3628	0.3797	0.3966	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6803	0.6719	0.6634	0.6213	0.6128	0.5706	0.5706	0.5622	0.5875	0.6128	0.6297	0.6466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.3200	1.2357	33.7605			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.5300	0.1200	7.1436			(28a)
External Wall	169.1800	29.4600	139.7200	0.2100	29.3412			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.3200		1.3200	0.1600	0.2112			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.7405			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7786	(36)
Total fabric heat loss					(33) + (36) =		83.5191	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2373	64.4282	63.6191	59.5735	58.7644	54.7189	54.7189	53.9098	56.3371	58.7644	60.3827	62.0009	(38)
Heat transfer coeff	148.7564	147.9473	147.1382	143.0926	142.2835	138.2380	138.2380	137.4289	139.8562	142.2835	143.9017	145.5200	(39)
Average = Sum(39)m / 12 =												142.8904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2635	1.2567	1.2498	1.2154	1.2086	1.1742	1.1742	1.1673	1.1879	1.2086	1.2223	1.2360	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8541 (42)
Average daily hot water use (litres/day) 101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8268   10.6723   11.7927   11.3819   11.7303   11.3161   11.6710   11.7095   11.3520   11.7629   11.4188   11.8158 (61)
Total heat required for water heating calculated for each month
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1743.0693 (64)
Heat gains from water heating, kWh/month
               58.2730   51.0480   52.8720   46.3702   44.6956   38.8674   36.3126   41.2484   41.6167   48.1336   52.1862   56.5248 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               25.1608   22.3476   18.1743   13.7591   10.2851    8.6831    9.3824   12.1956   16.3689   20.7841   24.2581   25.8601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              282.2278  285.1565  277.7764  262.0651  242.2324  223.5924  211.1397  208.2111  215.5912  231.3025  251.1352  269.7752 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 (71)
Water heating gains (Table 5)
               78.3239   75.9643   71.0645   64.4031   60.0748   53.9824   48.8072   55.4414   57.8010   64.6956   72.4809   75.9742 (72)
Total internal gains
              454.5240  452.2799  435.8267  409.0388  381.4037  355.0694  338.1409  344.6596  358.5726  385.5938  416.6857  440.4210 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                 9.0500            10.6334            0.7200           0.7000           0.7700           33.6112 (74)
East                                  8.4100            19.6403            0.7200           0.7000           0.7700           57.6909 (76)
South                                 9.8600            46.7521            0.7200           0.7000           0.7700          161.0058 (78)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   252.3079  440.7743  630.8934  826.0074  963.9613  973.5953  931.7725  826.6092  698.2656  494.7834  304.2443  214.5859 (83)
Total gains   706.8319  893.0542 1066.7200 1235.0462 1345.3650 1328.6648 1269.9133 1171.2688 1056.8382  880.3772  720.9300  655.0069 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3865   46.6402   46.8966   48.2225   48.4967   49.9160   49.9160   50.2099   49.3384   48.4967   47.9514   47.4181
alpha          4.0924    4.1093    4.1264    4.2148    4.2331    4.3277    4.3277    4.3473    4.2892    4.2331    4.1968    4.1612
util living area
               0.9958    0.9888    0.9705    0.9167    0.8021    0.6226    0.4684    0.5221    0.7724    0.9519    0.9911    0.9969 (86)

MIT           19.4173   19.6657   20.0210   20.4620   20.7806   20.9480   20.9879   20.9812   20.8657   20.4231   19.8474   19.3983 (87)
Th 2          19.8695   19.8749   19.8804   19.9077   19.9132   19.9407   19.9407   19.9462   19.9297   19.9132   19.9022   19.8913 (88)
util rest of house
               0.9946    0.9856    0.9618    0.8922    0.7481    0.5354    0.3607    0.4107    0.6939    0.9326    0.9880    0.9960 (89)
MIT 2         17.7693   18.1339   18.6494   19.2855   19.6996   19.9049   19.9358   19.9378   19.8212   19.2495   18.4186   17.7558 (90)
Living area fraction                                                                          fLA = Living area / (4) =     0.2538 (91)
MIT           18.1875   18.5227   18.9975   19.5841   19.9740   20.1697   20.2028   20.2026   20.0863   19.5473   18.7812   18.1726 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.1875   18.5227   18.9975   19.5841   19.9740   20.1697   20.2028   20.2026   20.0863   19.5473   18.7812   18.1726 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9918    0.9800    0.9527    0.8836    0.7514    0.5552    0.3880    0.4387    0.7066    0.9243    0.9834    0.9939 (94)
Useful gains  701.0363  875.2356 1016.2791 1091.2370 1010.9326  737.6426  492.7395  513.8072  746.7873  813.7113  708.9900  651.0120 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2065.8596 2015.4355 1838.8610 1528.8170 1177.2492  769.9385  498.0455  522.5905  837.2210 1273.0575 1680.9445 2033.2982 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1015.4285  766.2143  612.0010  315.0576  123.7396    0.0000    0.0000    0.0000    0.0000  341.7536  699.8072 1028.4210 (98)
Space heating                                                                                                            4902.4228 (98)
Space heating per m2                                                                                    (98) / (4) =     41.6412 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5254.4725	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1015.4285	766.2143	612.0010	315.0576	123.7396	0.0000	0.0000	0.0000	0.0000	341.7536	699.8072	1028.4210	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1088.3478	821.2372	655.9496	337.6824	132.6255	0.0000	0.0000	0.0000	0.0000	366.2953	750.0613	1102.2733	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1915	156.1759	161.9394	142.2835	137.3334	119.7021	112.1066	126.9607	127.9797	147.6812	159.7843	172.9311	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7437	89.6696	89.5222	89.1484	88.3698	86.7000	86.7000	86.7000	86.7000	89.1826	89.6084	89.7635	(217)
Fuel for water heating, kWh/month													
	198.5560	174.1682	180.8930	159.6030	155.4077	138.0647	129.3040	146.4368	147.6121	165.5941	178.3140	192.6520	(219)
Water heating fuel used												1966.6054	(219)
Annual totals kWh/year													
Space heating fuel - main system												5254.4725	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =										-2098.5959		-2098.5959	(233)
Total delivered energy for all uses												5641.8299	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5254.4725	0.2160	1134.9661	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.6054	0.2160	424.7868	(264)
Space and water heating			1559.7528	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			740.1231	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.2900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.2900	ZC1
Total Floor Area	TFA	117.7300	
Assumed number of occupants	N	2.8541	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2056	ZC2
CO2 emissions from cooking, equation (L16)		1.5926	ZC3
Total CO2 emissions		22.0882	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.0882	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3295	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4201	0.4119	0.4036	0.3625	0.3542	0.3130	0.3130	0.3048	0.3295	0.3542	0.3707	0.3872	(22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			27.3200	1.3258	36.2197			(27)
Ground floor			59.5300	0.1300	7.7389			(28a)
External Wall	169.1800	29.4600	139.7200	0.1800	25.1496			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.3200		1.3200	0.1300	0.1716			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.4138			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7173	(36)
Total fabric heat loss (33) + (36) =	93.1311	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4083	56.0797	55.7576	54.2447	53.9616	52.6439	52.6439	52.3999	53.1515	53.9616	54.5342	55.1329	(38)
Heat transfer coeff	149.5394	149.2108	148.8887	147.3758	147.0927	145.7750	145.7750	145.5310	146.2826	147.0927	147.6653	148.2640	(39)
Average = Sum(39)m / 12 =												147.3744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2702	1.2674	1.2647	1.2518	1.2494	1.2382	1.2382	1.2361	1.2425	1.2494	1.2543	1.2594	(40)
HLP (average)												1.2518	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8541 (42)
Average daily hot water use (litres/day)	101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2880	48.8522	45.2645	46.7733	48.8522	49.2880	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (64)
								Total per year (kWh/year) = Sum(64)m =				2192.1155 (64)
Heat gains from water heating, kWh/month												
	68.0560	59.8868	62.6635	55.8468	53.9761	47.3545	45.0881	50.5341	51.1007	57.9326	61.6603	66.3106 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.1608	22.3476	18.1743	13.7591	10.2851	8.6831	9.3824	12.1956	16.3689	20.7841	24.2581	25.8601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.2278	285.1565	277.7764	262.0651	242.2324	223.5924	211.1397	208.2111	215.5912	231.3025	251.1352	269.7752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	(71)
Water heating gains (Table 5)													
	91.4731	89.1173	84.2251	77.5650	72.5485	65.7701	60.6023	67.9221	70.9732	77.8664	85.6393	89.1271	(72)
Total internal gains													
	467.6733	465.4329	448.9873	422.2006	393.8774	366.8571	349.9360	357.1404	371.7448	398.7645	429.8442	453.5739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0500	10.6334	0.6300	0.7000	0.7700	29.4098	(74)
East	8.4100	19.6403	0.6300	0.7000	0.7700	50.4795	(76)
South	9.8600	46.7521	0.6300	0.7000	0.7700	140.8801	(78)

Solar gains	220.7694	385.6775	552.0317	722.7565	843.4661	851.8959	815.3009	723.2831	610.9824	432.9355	266.2137	187.7627	(83)
Total gains	688.4426	851.1104	1001.0190	1144.9571	1237.3436	1218.7530	1165.2369	1080.4234	982.7272	831.7000	696.0579	641.3366	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6725	54.7929	54.9115	55.4752	55.5819	56.0843	56.0843	56.1784	55.8897	55.5819	55.3664	55.1428	
alpha	4.6448	4.6529	4.6608	4.6983	4.7055	4.7390	4.7390	4.7452	4.7260	4.7055	4.6911	4.6762	
util living area													
	0.9982	0.9948	0.9849	0.9515	0.8634	0.7010	0.5353	0.5936	0.8362	0.9732	0.9959	0.9987	(86)
MIT	19.5870	19.7850	20.0834	20.4566	20.7652	20.9383	20.9862	20.9780	20.8528	20.4356	19.9358	19.5528	(87)
Th 2	19.8643	19.8665	19.8686	19.8788	19.8807	19.8896	19.8896	19.8912	19.8861	19.8807	19.8768	19.8728	(88)
util rest of house													
	0.9975	0.9930	0.9794	0.9331	0.8130	0.6041	0.4079	0.4632	0.7586	0.9597	0.9941	0.9982	(89)
MIT 2	17.9883	18.2787	18.7126	19.2483	19.6542	19.8494	19.8847	19.8825	19.7702	19.2300	18.5069	17.9442	(90)
Living area fraction									fLA = Living area / (4) =			0.2538	(91)
MIT	18.3941	18.6610	19.0605	19.5549	19.9362	20.1258	20.1643	20.1605	20.0450	19.5360	18.8696	18.3525	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3941	18.6610	19.0605	19.5549	19.9362	20.1258	20.1643	20.1605	20.0450	19.5360	18.8696	18.3525	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9902	0.9740	0.9264	0.8159	0.6262	0.4405	0.4964	0.7714	0.9540	0.9918	0.9973	(94)
Useful gains	685.8731	842.7745	974.9936	1060.7319	1009.5594	763.2118	513.2512	536.3395	758.0952	793.4384	690.3220	639.5909	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2107.6181	2053.2916	1870.1222	1570.2789	1211.4864	805.5217	519.5786	547.2681	869.6498	1314.4197	1737.9595	2098.3043	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1057.7783	813.4675	665.9756	366.8739	150.2337	0.0000	0.0000	0.0000	0.0000	387.6100	754.2990	1085.2828	(98)
Space heating												5281.5208	(98)
Space heating per m2											(98) / (4) =	44.8613	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5654.7332	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1057.7783	813.4675	665.9756	366.8739	150.2337	0.0000	0.0000	0.0000	0.0000	387.6100	754.2990	1085.2828	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1132.5249	870.9502	713.0360	392.7986	160.8498	0.0000	0.0000	0.0000	0.0000	415.0001	807.6006	1161.9730	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5027	88.2838	87.8376	86.8039	84.6774	80.3000	80.3000	80.3000	80.3000	86.8467	88.0990	88.5788	(217)
Fuel for water heating, kWh/month													
	245.5557	216.9493	228.9517	207.5824	206.0233	191.3456	183.3236	204.3629	206.6198	215.1806	224.3845	239.4188	(219)
Water heating fuel used												2569.6983	(219)
Annual totals kWh/year													
Space heating fuel - main system												5654.7332	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Total delivered energy for all uses												8743.7793	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5654.7332	0.2160	1221.4224	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2569.6983	0.2160	555.0548	(264)
Space and water heating			1776.4772	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Total CO2, kg/m2/year			2046.0188	(272)
Emissions per m2 for space and water heating			15.0894	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9589	(272b)
Emissions per m2 for pumps and fans			0.3306	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0894 * 1.00) + 1.9589 + 0.3306, rounded to 2 d.p.			17.3800	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 447 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 447	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 447, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.29	**TER**	17.38
Environmental	95 A	**% DER<TER**	63.81		
CO_2 Emissions (t/year)	0.24	**DFEE**	43.61	**TFEE**	57.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	35.08 m	59.53 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	169.18	139.72

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.32	1.32

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.53

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.81	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	North							2.14	100
W3	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.81	100
D2 W14	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
W9	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.88	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.88	100
W13	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.61	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	47.85	0.005	No
Independently assessed	E5 Ground floor (normal)	35.08	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 447 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 447	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 447, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.29	**TER**	17.38
Environmental	95 A	**% DER<TER**	63.81		
CO_2 Emissions (t/year)	0.24	**DFEE**	43.61	**TFEE**	57.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.46		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.73	m^2	
DER	6.29	$kgCO_2/yr/m^2$	
TER	17.38	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.29	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.81	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	43.61	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.6		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.73	m^2	
DER	17.63	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.43	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.43	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.38	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.18	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.18	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 448 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 448	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 448, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.26	**TER**	17.89
Environmental	94 A	**% DER<TER**	59.42		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.14	**TFEE**	60.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.26 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 9.86 m², No overhang
Windows facing South West: 9.05 m², No overhang
Windows facing North West: 8.41 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1721	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3971	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4303	0.4219	0.4134	0.3713	0.3628	0.3206	0.3206	0.3122	0.3375	0.3628	0.3797	0.3966	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6803	0.6719	0.6634	0.6213	0.6128	0.5706	0.5706	0.5622	0.5875	0.6128	0.6297	0.6466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.3200	1.2357	33.7605			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.5300	0.1200	7.1436			(28a)
External Wall	169.1800	29.4600	139.7200	0.2100	29.3412			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.3200		1.3200	0.1600	0.2112			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.7405			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7786	(36)
Total fabric heat loss					(33) + (36) =		83.5191	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2373	64.4282	63.6191	59.5735	58.7644	54.7189	54.7189	53.9098	56.3371	58.7644	60.3827	62.0009	(38)
Heat transfer coeff	148.7564	147.9473	147.1382	143.0926	142.2835	138.2380	138.2380	137.4289	139.8562	142.2835	143.9017	145.5200	(39)
Average = Sum(39)m / 12 =												142.8904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2635	1.2567	1.2498	1.2154	1.2086	1.1742	1.1742	1.1673	1.1879	1.2086	1.2223	1.2360	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8541 (42)
Average daily hot water use (litres/day) 101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8268   10.6723   11.7927   11.3819   11.7303   11.3161   11.6710   11.7095   11.3520   11.7629   11.4188   11.8158 (61)
Total heat required for water heating calculated for each month
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1743.0693 (64)
Heat gains from water heating, kWh/month
               58.2730   51.0480   52.8720   46.3702   44.6956   38.8674   36.3126   41.2484   41.6167   48.1336   52.1862   56.5248 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               25.1608   22.3476   18.1743   13.7591   10.2851    8.6831    9.3824   12.1956   16.3689   20.7841   24.2581   25.8601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              282.2278  285.1565  277.7764  262.0651  242.2324  223.5924  211.1397  208.2111  215.5912  231.3025  251.1352  269.7752 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 (71)
Water heating gains (Table 5)
               78.3239   75.9643   71.0645   64.4031   60.0748   53.9824   48.8072   55.4414   57.8010   64.6956   72.4809   75.9742 (72)
Total internal gains
              454.5240  452.2799  435.8267  409.0388  381.4037  355.0694  338.1409  344.6596  358.5726  385.5938  416.6857  440.4210 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                              9.8600            11.2829            0.7200           0.7000           0.7700          38.8564 (75)
Southwest                              9.0500            36.7938            0.7200           0.7000           0.7700         116.3021 (79)
Northwest                              8.4100            11.2829            0.7200           0.7000           0.7700          33.1423 (81)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   188.3008  344.6609  535.1028  769.4920  959.0794  994.8919  941.3922  793.4160  615.2414  398.0511  229.8960  158.3281 (83)
Total gains   642.8248  796.9408  970.9294 1178.5308 1340.4831 1349.9614 1279.5331 1138.0756  973.8140  783.6448  646.5818  598.7491 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3865   46.6402   46.8966   48.2225   48.4967   49.9160   49.9160   50.2099   49.3384   48.4967   47.9514   47.4181
alpha          4.0924    4.1093    4.1264    4.2148    4.2331    4.3277    4.3277    4.3473    4.2892    4.2331    4.1968    4.1612
util living area
               0.9971    0.9926    0.9785    0.9271    0.8036    0.6148    0.4652    0.5354    0.8072    0.9669    0.9941    0.9978 (86)

MIT           19.3614   19.5837   19.9450   20.4265   20.7789   20.9504   20.9882   20.9793   20.8385   20.3509   19.7830   19.3486 (87)
Th 2          19.8695   19.8749   19.8804   19.9077   19.9132   19.9407   19.9407   19.9462   19.9297   19.9132   19.9022   19.8913 (88)
util rest of house
               0.9962    0.9904    0.9718    0.9049    0.7497    0.5279    0.3581    0.4220    0.7328    0.9528    0.9920    0.9972 (89)
MIT 2         17.6877   18.0153   18.5418   19.2389   19.6977   19.9068   19.9359   19.9369   19.7952   19.1515   18.3254   17.6833 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2538 (91)
MIT           18.1125   18.4134   18.8979   19.5403   19.9721   20.1717   20.2030   20.2014   20.0600   19.4559   18.6954   18.1060 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.1125   18.4134   18.8979   19.5403   19.9721   20.1717   20.2030   20.2014   20.0600   19.4559   18.6954   18.1060 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9941    0.9861    0.9639    0.8958    0.7530    0.5478    0.3852    0.4505    0.7431    0.9448    0.9885    0.9956 (94)
Useful gains 639.0137  785.8977  935.8946 1055.7678 1009.3376  739.5083  492.9106  512.7011  723.6600  740.3614  639.1178  596.0888 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            2054.6952 1999.2701 1824.2102 1522.5457 1176.9868  770.2150  498.0709  522.4279  833.5431 1260.0446 1668.5934 2023.5942 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
            1053.2670  815.3862  660.9068  336.0801  124.7310    0.0000    0.0000    0.0000    0.0000  386.6443  741.2224 1062.0640 (98)
Space heating                                                                                                         5180.3018 (98)
Space heating per m2                                                                                  (98) / (4) =     44.0015 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5552.3063	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1053.2670	815.3862	660.9068	336.0801	124.7310	0.0000	0.0000	0.0000	0.0000	386.6443	741.2224	1062.0640	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1128.9035	873.9402	708.3674	360.2144	133.6881	0.0000	0.0000	0.0000	0.0000	414.4098	794.4506	1138.3322	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1915	156.1759	161.9394	142.2835	137.3334	119.7021	112.1066	126.9607	127.9797	147.6812	159.7843	172.9311	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7607	89.7013	89.5681	89.1984	88.3769	86.7000	86.7000	86.7000	86.7000	89.2754	89.6399	89.7780	(217)
Fuel for water heating, kWh/month													
	198.5184	174.1067	180.8004	159.5135	155.3951	138.0647	129.3040	146.4368	147.6121	165.4220	178.2512	192.6208	(219)
Water heating fuel used												1966.0456	(219)
Annual totals kWh/year													
Space heating fuel - main system												5552.3063	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1029 * 1.00) =										-2000.7390		-2000.7390	(233)
Total delivered energy for all uses												6036.9609	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5552.3063	0.2160	1199.2982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.0456	0.2160	424.6658	(264)
Space and water heating			1623.9640	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Energy saving/generation technologies				
PV Unit	-2000.7390	0.5190	-1038.3835	(269)
Total CO2, kg/year			855.1220	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.2600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.2600	ZC1
Total Floor Area	TFA	117.7300	
Assumed number of occupants	N	2.8541	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2056	ZC2
CO2 emissions from cooking, equation (L16)		1.5926	ZC3
Total CO2 emissions		23.0582	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.0582	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3295	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4201	0.4119	0.4036	0.3625	0.3542	0.3130	0.3130	0.3048	0.3295	0.3542	0.3707	0.3872	(22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			27.3200	1.3258	36.2197			(27)
Ground floor			59.5300	0.1300	7.7389			(28a)
External Wall	169.1800	29.4600	139.7200	0.1800	25.1496			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.3200		1.3200	0.1300	0.1716			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.4138			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7173	(36)
Total fabric heat loss (33) + (36) =	93.1311	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4083	56.0797	55.7576	54.2447	53.9616	52.6439	52.6439	52.3999	53.1515	53.9616	54.5342	55.1329	(38)
Heat transfer coeff	149.5394	149.2108	148.8887	147.3758	147.0927	145.7750	145.7750	145.5310	146.2826	147.0927	147.6653	148.2640	(39)
Average = Sum(39)m / 12 =												147.3744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2702	1.2674	1.2647	1.2518	1.2494	1.2382	1.2382	1.2361	1.2425	1.2494	1.2543	1.2594	(40)
HLP (average)												1.2518	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8541 (42)
Average daily hot water use (litres/day)	101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2880	48.8522	45.2645	46.7733	48.8522	49.2880	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (64)
								Total per year (kWh/year) = Sum(64)m =				2192.1155 (64)
Heat gains from water heating, kWh/month												
	68.0560	59.8868	62.6635	55.8468	53.9761	47.3545	45.0881	50.5341	51.1007	57.9326	61.6603	66.3106 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.1608	22.3476	18.1743	13.7591	10.2851	8.6831	9.3824	12.1956	16.3689	20.7841	24.2581	25.8601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.2278	285.1565	277.7764	262.0651	242.2324	223.5924	211.1397	208.2111	215.5912	231.3025	251.1352	269.7752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	(71)
Water heating gains (Table 5)													
	91.4731	89.1173	84.2251	77.5650	72.5485	65.7701	60.6023	67.9221	70.9732	77.8664	85.6393	89.1271	(72)
Total internal gains													
	467.6733	465.4329	448.9873	422.2006	393.8774	366.8571	349.9360	357.1404	371.7448	398.7645	429.8442	453.5739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.8600	11.2829	0.6300	0.7000	0.7700	33.9994	(75)
Southwest	9.0500	36.7938	0.6300	0.7000	0.7700	101.7643	(79)
Northwest	8.4100	11.2829	0.6300	0.7000	0.7700	28.9995	(81)

Solar gains	164.7632	301.5783	468.2149	673.3055	839.1945	870.5304	823.7182	694.2390	538.3362	348.2947	201.1590	138.5371 (83)
Total gains	632.4364	767.0111	917.2023	1095.5061	1233.0719	1237.3875	1173.6542	1051.3794	910.0810	747.0592	631.0032	592.1110 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6725	54.7929	54.9115	55.4752	55.5819	56.0843	56.0843	56.1784	55.8897	55.5819	55.3664	55.1428	
alpha	4.6448	4.6529	4.6608	4.6983	4.7055	4.7390	4.7390	4.7452	4.7260	4.7055	4.6911	4.6762	
util living area													
	0.9987	0.9966	0.9893	0.9583	0.8646	0.6933	0.5319	0.6074	0.8652	0.9821	0.9973	0.9991	(86)
MIT	19.5436	19.7208	20.0221	20.4256	20.7635	20.9411	20.9865	20.9758	20.8259	20.3763	19.8858	19.5145	(87)
Th 2	19.8643	19.8665	19.8686	19.8788	19.8807	19.8896	19.8896	19.8912	19.8861	19.8807	19.8768	19.8728	(88)
util rest of house													
	0.9983	0.9954	0.9852	0.9420	0.8145	0.5964	0.4051	0.4752	0.7941	0.9726	0.9961	0.9988	(89)
MIT 2	17.9250	18.1853	18.6248	19.2066	19.6523	19.8515	19.8848	19.8815	19.7440	19.1479	18.4342	17.8883	(90)
Living area fraction									fLA = Living area / (4) =			0.2538	(91)
MIT	18.3358	18.5750	18.9795	19.5160	19.9344	20.1280	20.1644	20.1592	20.0186	19.4596	18.8026	18.3010	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3358	18.5750	18.9795	19.5160	19.9344	20.1280	20.1644	20.1592	20.0186	19.4596	18.8026	18.3010	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9934	0.9808	0.9353	0.8173	0.6187	0.4375	0.5088	0.8042	0.9675	0.9944	0.9980	(94)
Useful gains	630.7539	761.9452	899.5812	1024.6521	1007.7570	765.5908	513.4576	534.9735	731.8424	722.7939	627.4418	590.9465	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2098.9045	2040.4590	1858.0488	1564.5345	1211.2139	805.8500	519.6074	547.0800	865.7878	1303.1895	1728.0715	2090.6748	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1092.3040	859.1613	713.0999	388.7153	151.3720	0.0000	0.0000	0.0000	0.0000	431.8144	792.4534	1115.7978	(98)
Space heating												5544.7180	(98)
Space heating per m2											(98) / (4) =	47.0969	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5936.5289	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1092.3040	859.1613	713.0999	388.7153	151.3720	0.0000	0.0000	0.0000	0.0000	431.8144	792.4534	1115.7978	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1169.4904	919.8729	763.4903	416.1834	162.0685	0.0000	0.0000	0.0000	0.0000	462.3280	848.4511	1194.6443	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5517	88.3738	87.9661	86.9366	84.6962	80.3000	80.3000	80.3000	80.3000	87.0913	88.1855	88.6198	(217)
Fuel for water heating, kWh/month													
	245.4199	216.7284	228.6171	207.2654	205.9778	191.3456	183.3236	204.3629	206.6198	214.5763	224.1644	239.3079	(219)
Water heating fuel used												2567.7092	(219)
Annual totals kWh/year													
Space heating fuel - main system												5936.5289	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Total delivered energy for all uses												9023.5860	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5936.5289	0.2160	1282.2903	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2567.7092	0.2160	554.6252	(264)
Space and water heating			1836.9154	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Total CO2, kg/m2/year			2106.4570	(272)
Emissions per m2 for space and water heating			15.6028	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9589	(272b)
Emissions per m2 for pumps and fans			0.3306	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6028 * 1.00) + 1.9589 + 0.3306, rounded to 2 d.p.			17.8900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 448 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 448	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 448, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.26	**TER**	17.89
Environmental	94 A	**% DER<TER**	59.42		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.14	**TFEE**	60.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	35.08 m	59.53 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	169.18	139.72

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.32	1.32

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.53

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.88	100
W4	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.81	100
W6	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South West							2.14	100
W3	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					0.81	100
D2 W14	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.88	100
W9	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00					1.88	100
W10	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	North West	Dark-coloured curtain or roller blind	0.00		1.88	100
W13	Window	[1] External Wall	North East	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	South West	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.61	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	47.85	0.005	No
Independently assessed	E5 Ground floor (normal)	35.08	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 448 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 448	**Prop Type Ref**	AS
Property	L461-R - Det SG, Plot 448, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.26	**TER**	17.89
Environmental	94 A	**% DER<TER**	59.42		
CO_2 Emissions (t/year)	0.35	**DFEE**	46.14	**TFEE**	60.47
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.73	m^2	
DER	7.26	$kgCO_2/yr/m^2$	
TER	17.89	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.26	$kgCO_2/yr/m^2$	
Reduction DER/TER	59.42	%	
CfSH ENE1 credits achieved	6.2		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.14	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.9		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.73	m^2	
DER	18.22	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.02	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.02	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.40	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.20	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.20	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 449 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 449	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 449, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.81 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 12.05 m², No overhang
Windows facing East: 0.81 m², No overhang
Windows facing South: 11.51 m², No overhang
Windows facing West: 1.29 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1597	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3847	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3270	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4169	0.4088	0.4006	0.3597	0.3515	0.3107	0.3107	0.3025	0.3270	0.3515	0.3679	0.3842	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6669	0.6588	0.6506	0.6097	0.6015	0.5607	0.5607	0.5525	0.5770	0.6015	0.6179	0.6342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.6600	1.2357	31.7091			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.7500	0.1200	9.2100			(28a)
External Wall	180.3400	29.9400	150.4000	0.2100	31.5840			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4153			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.0387	(36)
Total fabric heat loss	(33) + (36) =	90.4541	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6769	81.6634	80.6500	75.5827	74.5693	69.5020	69.5020	68.4886	71.5289	74.5693	76.5962	78.6231	(38)
Heat transfer coeff	173.1309	172.1175	171.1040	166.0368	165.0233	159.9561	159.9561	158.9426	161.9830	165.0233	167.0502	169.0771	(39)
Average = Sum(39)m / 12 =												165.7834	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1377	1.1311	1.1244	1.0911	1.0845	1.0512	1.0512	1.0445	1.0645	1.0845	1.0978	1.1111	(40)
HLP (average)												1.0895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8336    10.6782    11.7989    11.3874    11.7402    11.3243    11.6786    11.7186    11.3569    11.7684    11.4248    11.8224 (61)
Total heat required for water heating calculated for each month
              181.4303   159.0086   164.8626   144.8321   139.7835   121.8159   114.0654   129.2088   130.2504   150.3273   162.6727   176.0677 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              181.4303   159.0086   164.8626   144.8321   139.7835   121.8159   114.0654   129.2088   130.2504   150.3273   162.6727   176.0677 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1774.3254 (64)
Heat gains from water heating, kWh/month
               59.3493    51.9894    53.8434    47.2172    45.5095    39.5695    36.9632    41.9952    42.3713    49.0129    53.1461    57.5672 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               29.7311    26.4069    21.4755    16.2583    12.1533    10.2603    11.0866    14.4108    19.3422    24.5594    28.6644    30.5574 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              322.8731   326.2235   317.7805   299.8066   277.1176   255.7932   241.5472   238.1968   246.6397   264.6137   287.3026   308.6271 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010 (71)
Water heating gains (Table 5)
               79.7706    77.3652    72.3702    65.5794    61.1686    54.9577    49.6818    56.4451    58.8490    65.8776    73.8141    77.3752 (72)
Total internal gains
              502.4376   500.0584   481.6891   451.7072   420.5024   391.0741   372.3785   379.1156   394.8938   425.1135   459.8440   486.6225 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data      Specific data      factor                W
                                                           W/m2      or Table 6b        or Table 6c        Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  12.0500            10.6334           0.7200             0.7000           0.7700           44.7530 (74)
East                                    0.8100            19.6403           0.7200             0.7000           0.7700            5.5564 (76)
South                                  11.5100            46.7521           0.7200             0.7000           0.7700          187.9489 (78)
West                                    1.2900            19.6403           0.7200             0.7000           0.7700            8.8491 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    247.1076   421.5177   583.8353   744.2753   859.2040   865.9665   829.3562   740.4824   638.3000   467.2492   295.9543   211.5600 (83)
Total gains    749.5451   921.5761  1065.5244  1195.9825  1279.7063  1257.0406  1201.7347  1119.5980  1033.1938   892.3627   755.7983   698.1825 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           46.6321    46.9067    47.1845    48.6246    48.9232    50.4730    50.4730    50.7948    49.8414    48.9232    48.3296    47.7502
alpha          4.1088     4.1271     4.1456     4.2416     4.2615     4.3649     4.3649     4.3863     4.3228     4.2615     4.2220     4.1833
util living area
               0.9971     0.9929     0.9826     0.9520     0.8756     0.7220     0.5608     0.6142     0.8426     0.9695     0.9941     0.9979 (86)

MIT           19.3689    19.5857    19.9057    20.3307    20.6810    20.9099    20.9768    20.9662    20.8088    20.3446    19.7942    19.3591 (87)
Th 2          19.9701    19.9755    19.9809    20.0081    20.0135    20.0409    20.0409    20.0464    20.0299    20.0135    20.0026    19.9918 (88)
util rest of house
               0.9963     0.9910     0.9777     0.9376     0.8370     0.6426     0.4497     0.5033     0.7814     0.9576     0.9922     0.9973 (89)
MIT 2         17.7791    18.0990    18.5672    19.1939    19.6743    19.9699    20.0295    20.0282    19.8563    19.2253    18.4223    17.7791 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.2133 (91)
MIT           18.1182    18.4161    18.8527    19.4364    19.8890    20.1704    20.2316    20.2283    20.0595    19.4641    18.7149    18.1162 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.1182    18.4161    18.8527    19.4364    19.8890    20.1704    20.2316    20.2283    20.0595    19.4641    18.7149    18.1162 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9942     0.9867     0.9701     0.9270     0.8313     0.6543     0.4727     0.5257     0.7836     0.9487     0.9885     0.9956 (94)
Useful gains 745.1623   909.2862  1033.6996  1108.7045  1063.8659   822.4309   568.0677   588.5806   809.5651   846.6144   747.1182   695.1304 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            2392.3663  2326.3578  2113.5998  1749.4254  1351.3827   891.0204   580.8942   608.4736   965.3416  1462.7763  1940.2749  2352.9076 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1225.5197   952.2721   803.4458   461.3190   213.9125     0.0000     0.0000     0.0000     0.0000   458.4245   859.0729  1233.3863 (98)
Space heating                                                                                                                  6207.3528 (98)
Space heating per m2                                                                                                  (98) / (4) =    40.7922 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6653.1112	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1225.5197	952.2721	803.4458	461.3190	213.9125	0.0000	0.0000	0.0000	0.0000	458.4245	859.0729	1233.3863	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1313.5260	1020.6561	861.1423	494.4469	229.2738	0.0000	0.0000	0.0000	0.0000	491.3446	920.7641	1321.9574	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8191	89.7667	89.6661	89.4129	88.8421	86.7000	86.7000	86.7000	86.7000	89.3835	89.7070	89.8340	(217)
Fuel for water heating, kWh/month													
	201.9953	177.1355	183.8627	161.9812	157.3393	140.5028	131.5633	149.0298	150.2311	168.1824	181.3379	195.9923	(219)
Water heating fuel used												1999.1535	(219)
Annual totals kWh/year													
Space heating fuel - main system												6653.1112	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6799.6447	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6653.1112	0.2160	1437.0720	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.1535	0.2160	431.8172	(264)
Space and water heating			1868.8892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			907.3794	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9600	ZC1
Total Floor Area	TFA	152.1700	
Assumed number of occupants	N	2.9375	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5733	ZC2
CO2 emissions from cooking, equation (L16)		1.2453	ZC3
Total CO2 emissions		19.7786	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.7786	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			25.6600	1.3258	34.0189			(27)
Ground floor			76.7500	0.1300	9.9775			(28a)
External Wall	180.3400	29.9400	150.4000	0.1800	27.0720			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.1819			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3360	(36)
Total fabric heat loss (33) + (36) =	100.5179	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.2330	70.8738	70.5216	68.8677	68.5583	67.1178	67.1178	66.8510	67.6726	68.5583	69.1843	69.8387	(38)
Heat transfer coeff	171.7509	171.3917	171.0396	169.3857	169.0762	167.6357	167.6357	167.3690	168.1906	169.0762	169.7022	170.3567	(39)
Average = Sum(39)m / 12 =												169.3842	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1263	1.1240	1.1131	1.1111	1.1016	1.1016	1.0999	1.1053	1.1111	1.1152	1.1195	(40)
HLP (average)												1.1131	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8012	46.1439	47.6820	49.8012	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.0297 (64)
Heat gains from water heating, kWh/month												
	69.1306	60.8267	63.6334	56.6991	55.0247	48.2744	45.9641	51.5158	51.8609	58.8106	62.6187	67.3513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)
Water heating gains (Table 5)													
	92.9175	90.5159	85.5288	78.7488	73.9579	67.0478	61.7797	69.2417	72.0290	79.0465	86.9704	90.5260	(72)
Total internal gains													
	515.5845	513.2091	494.8477	464.8765	433.2917	403.1642	384.4764	391.9122	408.0737	438.2824	473.0003	499.7733	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	12.0500	10.6334	0.6300	0.7000	0.7700	39.1589	(74)
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619	(76)
South	11.5100	46.7521	0.6300	0.7000	0.7700	164.4553	(78)
West	1.2900	19.6403	0.6300	0.7000	0.7700	7.7430	(80)

Solar gains	216.2191	368.8280	510.8559	651.2409	751.8035	757.7207	725.6867	647.9221	558.5125	408.8430	258.9600	185.1150	(83)
Total gains	731.8036	882.0371	1005.7036	1116.1174	1185.0952	1160.8849	1110.1631	1039.8343	966.5862	847.1254	731.9603	684.8882	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5272	61.6562	61.7831	62.3864	62.5006	63.0376	63.0376	63.1381	62.8297	62.5006	62.2700	62.0308	
alpha	5.1018	5.1104	5.1189	5.1591	5.1667	5.2025	5.2025	5.2092	5.1886	5.1667	5.1513	5.1354	
util living area													
	0.9993	0.9980	0.9941	0.9797	0.9307	0.8040	0.6355	0.6929	0.9045	0.9880	0.9983	0.9995	(86)
MIT	19.6760	19.8352	20.0821	20.4059	20.7082	20.9131	20.9801	20.9692	20.8219	20.4272	19.9888	19.6486	(87)
Th 2	19.9775	19.9794	19.9813	19.9901	19.9918	19.9995	19.9995	20.0009	19.9965	19.9918	19.9884	19.9849	(88)
util rest of house													
	0.9991	0.9973	0.9919	0.9712	0.8994	0.7199	0.5054	0.5649	0.8490	0.9815	0.9976	0.9993	(89)
MIT 2	18.1975	18.4316	18.7930	19.2670	19.6858	19.9361	19.9915	19.9870	19.8406	19.3031	18.6630	18.1627	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.5129	18.7310	19.0680	19.5100	19.9039	20.1445	20.2024	20.1965	20.0499	19.5429	18.9458	18.4797	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5129	18.7310	19.0680	19.5100	19.9039	20.1445	20.2024	20.1965	20.0499	19.5429	18.9458	18.4797	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9960	0.9890	0.9657	0.8960	0.7336	0.5333	0.5919	0.8526	0.9773	0.9965	0.9989	(94)
Useful gains	730.7054	878.4871	994.6372	1077.8594	1061.8802	851.5680	592.0194	615.4848	824.1125	827.9161	729.3987	684.1548	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2441.0709	2370.5254	2149.6246	1797.1762	1387.0851	929.4623	603.8855	635.4162	1000.7166	1512.0249	2010.2598	2432.6403	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1272.5119	1002.6497	859.3106	517.9081	241.9525	0.0000	0.0000	0.0000	0.0000	508.9770	922.2200	1300.8733	(98)
Space heating												6626.4031	(98)
Space heating per m2											(98) / (4) =	43.5461	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7094.6500	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1272.5119	1002.6497	859.3106	517.9081	241.9525	0.0000	0.0000	0.0000	0.0000	508.9770	922.2200	1300.8733	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1362.4325	1073.5008	920.0328	554.5055	259.0498	0.0000	0.0000	0.0000	0.0000	544.9432	987.3875	1392.7979	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7510	88.5907	88.2698	87.5284	85.8267	80.3000	80.3000	80.3000	80.3000	87.4168	88.4135	88.8143	(217)
Fuel for water heating, kWh/month													
	248.5106	219.3884	231.1353	208.8004	207.2135	195.0629	186.8851	208.3331	209.4752	216.7980	226.8464	242.3081	(219)
Water heating fuel used												2600.7571	(219)
Annual totals kWh/year													
Space heating fuel - main system												7094.6500	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Total delivered energy for all uses												10295.4670	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7094.6500	0.2160	1532.4444	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2600.7571	0.2160	561.7635	(264)
Space and water heating			2094.2079	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Total CO2, kg/m2/year			2405.6390	(272)
Emissions per m2 for space and water heating			13.7623	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7908	(272b)
Emissions per m2 for pumps and fans			0.2558	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7623 * 1.00) + 1.7908 + 0.2558, rounded to 2 d.p.			15.8100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 449 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 449	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 449, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.34 m	76.75 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	180.34	150.40

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.81	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.72	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	West							2.14	100

W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.63	0.065	No
Independently assessed	E3 Sill	16.77	0.004	No
Independently assessed	E4 Jamb	45.90	0.005	No
Independently assessed	E5 Ground floor (normal)	37.34	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 449 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 449	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 449, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.17	m^2	
DER	5.96	$kgCO_2/yr/m^2$	
TER	15.81	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.96	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.30	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.57	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.17	m^2	
DER	16.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.96	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.96	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.60	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.60	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 450 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 450	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 450, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 152 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.81 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.96 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 12.05 m², No overhang
Windows facing East: 0.81 m², No overhang
Windows facing South: 11.51 m², No overhang
Windows facing West: 1.29 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.018 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							6 * 10	=	60.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	60.0000	/ (5) =	0.1597	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3847	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3270	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4169	0.4088	0.4006	0.3597	0.3515	0.3107	0.3107	0.3025	0.3270	0.3515	0.3679	0.3842	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6669	0.6588	0.6506	0.6097	0.6015	0.5607	0.5607	0.5525	0.5770	0.6015	0.6179	0.6342	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.6600	1.2357	31.7091			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			76.7500	0.1200	9.2100			(28a)
External Wall	180.3400	29.9400	150.4000	0.2100	31.5840			(29a)
Main Roof	75.4200		75.4200	0.0700	5.2794			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.4153			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		191.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.0387	(36)
Total fabric heat loss	(33) + (36) =	90.4541	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	82.6769	81.6634	80.6500	75.5827	74.5693	69.5020	69.5020	68.4886	71.5289	74.5693	76.5962	78.6231	(38)
Heat transfer coeff	173.1309	172.1175	171.1040	166.0368	165.0233	159.9561	159.9561	158.9426	161.9830	165.0233	167.0502	169.0771	(39)
Average = Sum(39)m / 12 =												165.7834	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1377	1.1311	1.1244	1.0911	1.0845	1.0512	1.0512	1.0445	1.0645	1.0845	1.0978	1.1111	(40)
HLP (average)												1.0895	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8336    10.6782    11.7989    11.3874    11.7402    11.3243    11.6786    11.7186    11.3569    11.7684    11.4248    11.8224 (61)
Total heat required for water heating calculated for each month
              181.4303   159.0086   164.8626   144.8321   139.7835   121.8159   114.0654   129.2088   130.2504   150.3273   162.6727   176.0677 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              181.4303   159.0086   164.8626   144.8321   139.7835   121.8159   114.0654   129.2088   130.2504   150.3273   162.6727   176.0677 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   1774.3254 (64)
Heat gains from water heating, kWh/month
               59.3493    51.9894    53.8434    47.2172    45.5095    39.5695    36.9632    41.9952    42.3713    49.0129    53.1461    57.5672 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762   146.8762 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               29.7311    26.4069    21.4755    16.2583    12.1533    10.2603    11.0866    14.4108    19.3422    24.5594    28.6644    30.5574 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              322.8731   326.2235   317.7805   299.8066   277.1176   255.7932   241.5472   238.1968   246.6397   264.6137   287.3026   308.6271 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876    37.6876 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010  -117.5010 (71)
Water heating gains (Table 5)
               79.7706    77.3652    72.3702    65.5794    61.1686    54.9577    49.6818    56.4451    58.8490    65.8776    73.8141    77.3752 (72)
Total internal gains
              502.4376   500.0584   481.6891   451.7072   420.5024   391.0741   372.3785   379.1156   394.8938   425.1135   459.8440   486.6225 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data      Specific data      factor                W
                                                           W/m2      or Table 6b        or Table 6c        Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                  12.0500            10.6334           0.7200             0.7000           0.7700           44.7530 (74)
East                                    0.8100            19.6403           0.7200             0.7000           0.7700            5.5564 (76)
South                                  11.5100            46.7521           0.7200             0.7000           0.7700          187.9489 (78)
West                                    1.2900            19.6403           0.7200             0.7000           0.7700            8.8491 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    247.1076   421.5177   583.8353   744.2753   859.2040   865.9665   829.3562   740.4824   638.3000   467.2492   295.9543   211.5600 (83)
Total gains    749.5451   921.5761  1065.5244  1195.9825  1279.7063  1257.0406  1201.7347  1119.5980  1033.1938   892.3627   755.7983   698.1825 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           46.6321    46.9067    47.1845    48.6246    48.9232    50.4730    50.4730    50.7948    49.8414    48.9232    48.3296    47.7502
alpha          4.1088     4.1271     4.1456     4.2416     4.2615     4.3649     4.3649     4.3863     4.3228     4.2615     4.2220     4.1833
util living area
               0.9971     0.9929     0.9826     0.9520     0.8756     0.7220     0.5608     0.6142     0.8426     0.9695     0.9941     0.9979 (86)

MIT           19.3689    19.5857    19.9057    20.3307    20.6810    20.9099    20.9768    20.9662    20.8088    20.3446    19.7942    19.3591 (87)
Th 2          19.9701    19.9755    19.9809    20.0081    20.0135    20.0409    20.0409    20.0464    20.0299    20.0135    20.0026    19.9918 (88)
util rest of house
               0.9963     0.9910     0.9777     0.9376     0.8370     0.6426     0.4497     0.5033     0.7814     0.9576     0.9922     0.9973 (89)
MIT 2         17.7791    18.0990    18.5672    19.1939    19.6743    19.9699    20.0295    20.0282    19.8563    19.2253    18.4223    17.7791 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.2133 (91)
MIT           18.1182    18.4161    18.8527    19.4364    19.8890    20.1704    20.2316    20.2283    20.0595    19.4641    18.7149    18.1162 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.1182    18.4161    18.8527    19.4364    19.8890    20.1704    20.2316    20.2283    20.0595    19.4641    18.7149    18.1162 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9942     0.9867     0.9701     0.9270     0.8313     0.6543     0.4727     0.5257     0.7836     0.9487     0.9885     0.9956 (94)
Useful gains 745.1623   909.2862  1033.6996  1108.7045  1063.8659   822.4309   568.0677   588.5806   809.5651   846.6144   747.1182   695.1304 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            2392.3663  2326.3578  2113.5998  1749.4254  1351.3827   891.0204   580.8942   608.4736   965.3416  1462.7763  1940.2749  2352.9076 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
            1225.5197   952.2721   803.4458   461.3190   213.9125     0.0000     0.0000     0.0000     0.0000   458.4245   859.0729  1233.3863 (98)
Space heating                                                                                                                  6207.3528 (98)
Space heating per m2                                                                                                  (98) / (4) =    40.7922 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6653.1112	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1225.5197	952.2721	803.4458	461.3190	213.9125	0.0000	0.0000	0.0000	0.0000	458.4245	859.0729	1233.3863	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1313.5260	1020.6561	861.1423	494.4469	229.2738	0.0000	0.0000	0.0000	0.0000	491.3446	920.7641	1321.9574	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.4303	159.0086	164.8626	144.8321	139.7835	121.8159	114.0654	129.2088	130.2504	150.3273	162.6727	176.0677	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.8191	89.7667	89.6661	89.4129	88.8421	86.7000	86.7000	86.7000	86.7000	89.3835	89.7070	89.8340	(217)
Fuel for water heating, kWh/month													
	201.9953	177.1355	183.8627	161.9812	157.3393	140.5028	131.5633	149.0298	150.2311	168.1824	181.3379	195.9923	(219)
Water heating fuel used												1999.1535	(219)
Annual totals kWh/year													
Space heating fuel - main system												6653.1112	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 1080 * 1.00) =										-2452.6799		-2452.6799	(233)
Total delivered energy for all uses												6799.6447	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6653.1112	0.2160	1437.0720	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.1535	0.2160	431.8172	(264)
Space and water heating			1868.8892	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Energy saving/generation technologies				
PV Unit	-2452.6799	0.5190	-1272.9409	(269)
Total CO2, kg/year			907.3794	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9600	ZC1
Total Floor Area	TFA	152.1700	
Assumed number of occupants	N	2.9375	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5733	ZC2
CO2 emissions from cooking, equation (L16)		1.2453	ZC3
Total CO2 emissions		19.7786	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		19.7786	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.7500 (1b)	x	2.3100 (2b)	=	177.2925	(1b) - (3b)
First floor	75.4200 (1c)	x	2.6300 (2c)	=	198.3546	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.1700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	375.6471	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1065	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3565	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3863	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			25.6600	1.3258	34.0189			(27)
Ground floor			76.7500	0.1300	9.9775			(28a)
External Wall	180.3400	29.9400	150.4000	0.1800	27.0720			(29a)
Main Roof	75.4200		75.4200	0.1300	9.8046			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			333.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.1819			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3360	(36)
Total fabric heat loss (33) + (36) =	100.5179	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	71.2330	70.8738	70.5216	68.8677	68.5583	67.1178	67.1178	66.8510	67.6726	68.5583	69.1843	69.8387	(38)
Heat transfer coeff	171.7509	171.3917	171.0396	169.3857	169.0762	167.6357	167.6357	167.3690	168.1906	169.0762	169.7022	170.3567	(39)
Average = Sum(39)m / 12 =												169.3842	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1287	1.1263	1.1240	1.1131	1.1111	1.1016	1.1016	1.0999	1.1053	1.1111	1.1152	1.1195	(40)
HLP (average)												1.1131	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9375 (42)
Average daily hot water use (litres/day)	103.9662 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3628	110.2042	106.0455	101.8869	97.7282	93.5696	93.5696	97.7282	101.8869	106.0455	110.2042	114.3628	(44)
Energy conte	169.5967	148.3304	153.0637	133.4446	128.0433	110.4916	102.3867	117.4903	118.8935	138.5589	151.2479	164.2454	(45)
Energy content (annual)										Total = Sum(45)m =		1635.7931	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4395	22.2496	22.9596	20.0167	19.2065	16.5737	15.3580	17.6235	17.8340	20.7838	22.6872	24.6368	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8012	46.1439	47.6820	49.8012	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.0297 (64)
Heat gains from water heating, kWh/month												
	69.1306	60.8267	63.6334	56.6991	55.0247	48.2744	45.9641	51.5158	51.8609	58.8106	62.6187	67.3513 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	146.8762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.7311	26.4069	21.4755	16.2583	12.1533	10.2603	11.0866	14.4108	19.3422	24.5594	28.6644	30.5574	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.8731	326.2235	317.7805	299.8066	277.1176	255.7932	241.5472	238.1968	246.6397	264.6137	287.3026	308.6271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	37.6876	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	-117.5010	(71)
Water heating gains (Table 5)													
	92.9175	90.5159	85.5288	78.7488	73.9579	67.0478	61.7797	69.2417	72.0290	79.0465	86.9704	90.5260	(72)
Total internal gains													
	515.5845	513.2091	494.8477	464.8765	433.2917	403.1642	384.4764	391.9122	408.0737	438.2824	473.0003	499.7733	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	12.0500	10.6334	0.6300	0.7000	0.7700	39.1589	(74)
East	0.8100	19.6403	0.6300	0.7000	0.7700	4.8619	(76)
South	11.5100	46.7521	0.6300	0.7000	0.7700	164.4553	(78)
West	1.2900	19.6403	0.6300	0.7000	0.7700	7.7430	(80)

Solar gains	216.2191	368.8280	510.8559	651.2409	751.8035	757.7207	725.6867	647.9221	558.5125	408.8430	258.9600	185.1150	(83)
Total gains	731.8036	882.0371	1005.7036	1116.1174	1185.0952	1160.8849	1110.1631	1039.8343	966.5862	847.1254	731.9603	684.8882	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5272	61.6562	61.7831	62.3864	62.5006	63.0376	63.0376	63.1381	62.8297	62.5006	62.2700	62.0308	
alpha	5.1018	5.1104	5.1189	5.1591	5.1667	5.2025	5.2025	5.2092	5.1886	5.1667	5.1513	5.1354	
util living area													
	0.9993	0.9980	0.9941	0.9797	0.9307	0.8040	0.6355	0.6929	0.9045	0.9880	0.9983	0.9995	(86)
MIT	19.6760	19.8352	20.0821	20.4059	20.7082	20.9131	20.9801	20.9692	20.8219	20.4272	19.9888	19.6486	(87)
Th 2	19.9775	19.9794	19.9813	19.9901	19.9918	19.9995	19.9995	20.0009	19.9965	19.9918	19.9884	19.9849	(88)
util rest of house													
	0.9991	0.9973	0.9919	0.9712	0.8994	0.7199	0.5054	0.5649	0.8490	0.9815	0.9976	0.9993	(89)
MIT 2	18.1975	18.4316	18.7930	19.2670	19.6858	19.9361	19.9915	19.9870	19.8406	19.3031	18.6630	18.1627	(90)
Living area fraction									fLA = Living area / (4) =			0.2133	(91)
MIT	18.5129	18.7310	19.0680	19.5100	19.9039	20.1445	20.2024	20.1965	20.0499	19.5429	18.9458	18.4797	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5129	18.7310	19.0680	19.5100	19.9039	20.1445	20.2024	20.1965	20.0499	19.5429	18.9458	18.4797	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9960	0.9890	0.9657	0.8960	0.7336	0.5333	0.5919	0.8526	0.9773	0.9965	0.9989	(94)
Useful gains	730.7054	878.4871	994.6372	1077.8594	1061.8802	851.5680	592.0194	615.4848	824.1125	827.9161	729.3987	684.1548	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2441.0709	2370.5254	2149.6246	1797.1762	1387.0851	929.4623	603.8855	635.4162	1000.7166	1512.0249	2010.2598	2432.6403	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1272.5119	1002.6497	859.3106	517.9081	241.9525	0.0000	0.0000	0.0000	0.0000	508.9770	922.2200	1300.8733	(98)
Space heating												6626.4031	(98)
Space heating per m2											(98) / (4) =	43.5461	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												7094.6500	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1272.5119	1002.6497	859.3106	517.9081	241.9525	0.0000	0.0000	0.0000	0.0000	508.9770	922.2200	1300.8733	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1362.4325	1073.5008	920.0328	554.5055	259.0498	0.0000	0.0000	0.0000	0.0000	544.9432	987.3875	1392.7979	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.5557	194.3578	204.0226	182.7597	177.8445	156.6355	150.0688	167.2915	168.2086	189.5178	200.5629	215.2043	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.7510	88.5907	88.2698	87.5284	85.8267	80.3000	80.3000	80.3000	80.3000	87.4168	88.4135	88.8143	(217)
Fuel for water heating, kWh/month													
	248.5106	219.3884	231.1353	208.8004	207.2135	195.0629	186.8851	208.3331	209.4752	216.7980	226.8464	242.3081	(219)
Water heating fuel used												2600.7571	(219)
Annual totals kWh/year													
Space heating fuel - main system												7094.6500	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												525.0599	(232)
Total delivered energy for all uses												10295.4670	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	7094.6500	0.2160	1532.4444	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2600.7571	0.2160	561.7635	(264)
Space and water heating			2094.2079	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	525.0599	0.5190	272.5061	(268)
Total CO2, kg/m2/year			2405.6390	(272)
Emissions per m2 for space and water heating			13.7623	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.7908	(272b)
Emissions per m2 for pumps and fans			0.2558	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7623 * 1.00) + 1.7908 + 0.2558, rounded to 2 d.p.			15.8100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 450 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 450	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 450, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.34 m	76.75 m²	2.31 m
1st Storey:	35.84 m	75.42 m²	2.63 m

7.0 Living Area	32.46	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	191.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	180.34	150.40

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	75.42	75.42
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	76.75

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.81	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.17	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					2.72	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.48	100
W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					2.05	100
D3 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100
D2	Half Glazed Door	[1] External Wall	West							2.14	100

W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		2.72	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	20.63	0.065	No
Independently assessed	E3 Sill	16.77	0.004	No
Independently assessed	E4 Jamb	45.90	0.005	No
Independently assessed	E5 Ground floor (normal)	37.34	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	35.84	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.16	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	19.68	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.018	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 450 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 450	**Prop Type Ref**	Opp
Property	L473-R - Det SG, Plot 450, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.96	**TER**	15.81
Environmental	95 A	**% DER<TER**	62.30		
CO_2 Emissions (t/year)	0.30	**DFEE**	41.57	**TFEE**	54.79
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	152.17	m^2	
DER	5.96	$kgCO_2/yr/m^2$	
TER	15.81	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.96	$kgCO_2/yr/m^2$	
Reduction DER/TER	62.30	%	
CfSH ENE1 credits achieved	6.4		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	41.57	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.1		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	152.17	m^2	
DER	16.14	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	29.96	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	29.96	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.78	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	12.57	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	21.60	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	21.60	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 451 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 451	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 451, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.39	**TER**	17.47
Environmental	95 A	**% DER<TER**	63.43		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.02	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.39 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.86 m², No overhang
Windows facing East: 8.41 m², No overhang
Windows facing South: 9.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1721	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3971	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4303	0.4219	0.4134	0.3713	0.3628	0.3206	0.3206	0.3122	0.3375	0.3628	0.3797	0.3966	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6803	0.6719	0.6634	0.6213	0.6128	0.5706	0.5706	0.5622	0.5875	0.6128	0.6297	0.6466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.3200	1.2357	33.7605			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.5300	0.1200	7.1436			(28a)
External Wall	169.1800	29.4600	139.7200	0.2100	29.3412			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.3200		1.3200	0.1600	0.2112			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.7405			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7786	(36)
Total fabric heat loss					(33) + (36) =		83.5191	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2373	64.4282	63.6191	59.5735	58.7644	54.7189	54.7189	53.9098	56.3371	58.7644	60.3827	62.0009	(38)
Heat transfer coeff	148.7564	147.9473	147.1382	143.0926	142.2835	138.2380	138.2380	137.4289	139.8562	142.2835	143.9017	145.5200	(39)
Average = Sum(39)m / 12 =												142.8904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2635	1.2567	1.2498	1.2154	1.2086	1.1742	1.1742	1.1673	1.1879	1.2086	1.2223	1.2360	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8541 (42)
Average daily hot water use (litres/day) 101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8268   10.6723   11.7927   11.3819   11.7303   11.3161   11.6710   11.7095   11.3520   11.7629   11.4188   11.8158 (61)
Total heat required for water heating calculated for each month
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1743.0693 (64)
Heat gains from water heating, kWh/month
               58.2730   51.0480   52.8720   46.3702   44.6956   38.8674   36.3126   41.2484   41.6167   48.1336   52.1862   56.5248 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               25.1608   22.3476   18.1743   13.7591   10.2851    8.6831    9.3824   12.1956   16.3689   20.7841   24.2581   25.8601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              282.2278  285.1565  277.7764  262.0651  242.2324  223.5924  211.1397  208.2111  215.5912  231.3025  251.1352  269.7752 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 (71)
Water heating gains (Table 5)
               78.3239   75.9643   71.0645   64.4031   60.0748   53.9824   48.8072   55.4414   57.8010   64.6956   72.4809   75.9742 (72)
Total internal gains
              454.5240  452.2799  435.8267  409.0388  381.4037  355.0694  338.1409  344.6596  358.5726  385.5938  416.6857  440.4210 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
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[Jan]                                  Area        Solar flux              g              FF          Access          Gains
                                       m2          Table 6a     Specific data  Specific data      factor               W
                                                     W/m2       or Table 6b    or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                 9.8600          10.6334          0.7200          0.7000          0.7700          36.6195 (74)
East                                  8.4100          19.6403          0.7200          0.7000          0.7700          57.6909 (76)
South                                 9.0500          46.7521          0.7200          0.7000          0.7700         147.7791 (78)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains   242.0895  424.8615  613.0690  810.5124  952.6009  964.9489  922.3416  813.6949  681.1866  478.2626  292.2773  205.6648 (83)
Total gains   696.6135  877.1414 1048.8957 1219.5512 1334.0046 1320.0184 1260.4824 1158.3545 1039.7592  863.8563  708.9630  646.0858 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3865   46.6402   46.8966   48.2225   48.4967   49.9160   49.9160   50.2099   49.3384   48.4967   47.9514   47.4181
alpha          4.0924    4.1093    4.1264    4.2148    4.2331    4.3277    4.3277    4.3473    4.2892    4.2331    4.1968    4.1612
util living area
               0.9960    0.9895    0.9721    0.9196    0.8056    0.6259    0.4717    0.5272    0.7795    0.9546    0.9917    0.9971 (86)

MIT           19.4084   19.6522   20.0070   20.4524   20.7766   20.9470   20.9876   20.9805   20.8605   20.4111   19.8371   19.3904 (87)
Th 2          19.8695   19.8749   19.8804   19.9077   19.9132   19.9407   19.9407   19.9462   19.9297   19.9132   19.9022   19.8913 (88)
util rest of house
               0.9949    0.9865    0.9638    0.8958    0.7519    0.5384    0.3634    0.4150    0.7017    0.9363    0.9887    0.9962 (89)
MIT 2         17.7563   18.1144   18.6298   19.2730   19.6952   19.9041   19.9356   19.9374   19.8163   19.2334   18.4037   17.7443 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2538 (91)
MIT           18.1756   18.5047   18.9793   19.5723   19.9696   20.1688   20.2026   20.2022   20.0813   19.5323   18.7675   18.1621 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.1756   18.5047   18.9793   19.5723   19.9696   20.1688   20.2026   20.2022   20.0813   19.5323   18.7675   18.1621 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9922    0.9811    0.9549    0.8870    0.7550    0.5582    0.3908    0.4432    0.7140    0.9280    0.9843    0.9942 (94)
Useful gains  691.1765  860.6051 1001.6022 1081.6985 1007.2009  736.8537  492.5660  513.3926  742.4060  801.6302  697.8468  642.3299 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            2064.0827 2012.7830 1836.1832 1527.1330 1176.6349  769.8215  498.0197  522.5296  836.5289 1270.9160 1678.9713 2031.7628 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
            1021.4422  774.2635  620.9282  320.7129  126.0589    0.0000    0.0000    0.0000    0.0000  349.1487  706.4096 1033.7381 (98)
Space heating                                                                                                         4952.7021 (98)
Space heating per m2                                                                                  (98) / (4) =     42.0683 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5308.3624	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1021.4422	774.2635	620.9282	320.7129	126.0589	0.0000	0.0000	0.0000	0.0000	349.1487	706.4096	1033.7381	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1094.7934	829.8645	665.5180	343.7437	135.1113	0.0000	0.0000	0.0000	0.0000	374.2215	757.1378	1107.9722	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1915	156.1759	161.9394	142.2835	137.3334	119.7021	112.1066	126.9607	127.9797	147.6812	159.7843	172.9311	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7465	89.6750	89.5310	89.1623	88.3864	86.7000	86.7000	86.7000	86.7000	89.1991	89.6136	89.7658	(217)
Fuel for water heating, kWh/month													
	198.5499	174.1577	180.8753	159.5781	155.3784	138.0647	129.3040	146.4368	147.6121	165.5636	178.3036	192.6469	(219)
Water heating fuel used												1966.4710	(219)
Annual totals kWh/year													
Space heating fuel - main system												5308.3624	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 1080 * 1.00) =											-2098.5959	-2098.5959	(233)
Total delivered energy for all uses												5695.5854	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5308.3624	0.2160	1146.6063	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1966.4710	0.2160	424.7577	(264)
Space and water heating			1571.3640	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Energy saving/generation technologies				
PV Unit	-2098.5959	0.5190	-1089.1713	(269)
Total CO2, kg/year			751.7343	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.3900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.3900	ZC1
Total Floor Area	TFA	117.7300	
Assumed number of occupants	N	2.8541	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2056	ZC2
CO2 emissions from cooking, equation (L16)		1.5926	ZC3
Total CO2 emissions		22.1882	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.1882	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3295	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4201	0.4119	0.4036	0.3625	0.3542	0.3130	0.3130	0.3048	0.3295	0.3542	0.3707	0.3872	(22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			27.3200	1.3258	36.2197			(27)
Ground floor			59.5300	0.1300	7.7389			(28a)
External Wall	169.1800	29.4600	139.7200	0.1800	25.1496			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.3200		1.3200	0.1300	0.1716			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.4138			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7173	(36)
Total fabric heat loss (33) + (36) =	93.1311	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4083	56.0797	55.7576	54.2447	53.9616	52.6439	52.6439	52.3999	53.1515	53.9616	54.5342	55.1329	(38)
Heat transfer coeff	149.5394	149.2108	148.8887	147.3758	147.0927	145.7750	145.7750	145.5310	146.2826	147.0927	147.6653	148.2640	(39)
Average = Sum(39)m / 12 =												147.3744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2702	1.2674	1.2647	1.2518	1.2494	1.2382	1.2382	1.2361	1.2425	1.2494	1.2543	1.2594	(40)
HLP (average)												1.2518	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8541 (42)
Average daily hot water use (litres/day)	101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2880	48.8522	45.2645	46.7733	48.8522	49.2880	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (64)
								Total per year (kWh/year) = Sum(64)m =				2192.1155 (64)
Heat gains from water heating, kWh/month												
	68.0560	59.8868	62.6635	55.8468	53.9761	47.3545	45.0881	50.5341	51.1007	57.9326	61.6603	66.3106 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.1608	22.3476	18.1743	13.7591	10.2851	8.6831	9.3824	12.1956	16.3689	20.7841	24.2581	25.8601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.2278	285.1565	277.7764	262.0651	242.2324	223.5924	211.1397	208.2111	215.5912	231.3025	251.1352	269.7752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	(71)
Water heating gains (Table 5)													
	91.4731	89.1173	84.2251	77.5650	72.5485	65.7701	60.6023	67.9221	70.9732	77.8664	85.6393	89.1271	(72)
Total internal gains													
	467.6733	465.4329	448.9873	422.2006	393.8774	366.8571	349.9360	357.1404	371.7448	398.7645	429.8442	453.5739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.8600	10.6334	0.6300	0.7000	0.7700	32.0421	(74)
East	8.4100	19.6403	0.6300	0.7000	0.7700	50.4795	(76)
South	9.0500	46.7521	0.6300	0.7000	0.7700	129.3068	(78)

Solar gains	211.8283	371.7538	536.4354	709.1984	833.5258	844.3303	807.0489	711.9830	596.0382	418.4797	255.7426	179.9567 (83)
Total gains	679.5016	837.1867	985.4227	1131.3990	1227.4033	1211.1874	1156.9849	1069.1234	967.7831	817.2442	685.5868	633.5306 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6725	54.7929	54.9115	55.4752	55.5819	56.0843	56.0843	56.1784	55.8897	55.5819	55.3664	55.1428	
alpha	4.6448	4.6529	4.6608	4.6983	4.7055	4.7390	4.7390	4.7452	4.7260	4.7055	4.6911	4.6762	
util living area													
	0.9983	0.9952	0.9858	0.9534	0.8663	0.7041	0.5388	0.5989	0.8422	0.9749	0.9961	0.9988	(86)
MIT	19.5800	19.7744	20.0721	20.4482	20.7613	20.9371	20.9858	20.9771	20.8476	20.4257	19.9278	19.5467	(87)
Th 2	19.8643	19.8665	19.8686	19.8788	19.8807	19.8896	19.8896	19.8912	19.8861	19.8807	19.8768	19.8728	(88)
util rest of house													
	0.9977	0.9935	0.9806	0.9356	0.8165	0.6072	0.4107	0.4678	0.7659	0.9621	0.9945	0.9983	(89)
MIT 2	17.9782	18.2633	18.6965	19.2370	19.6498	19.8486	19.8845	19.8821	19.7653	19.2164	18.4953	17.9354	(90)
Living area fraction									fLA = Living area / (4) =			0.2538	(91)
MIT	18.3848	18.6468	19.0456	19.5444	19.9319	20.1248	20.1641	20.1600	20.0400	19.5233	18.8589	18.3443	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3848	18.6468	19.0456	19.5444	19.9319	20.1248	20.1641	20.1600	20.0400	19.5233	18.8589	18.3443	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9908	0.9754	0.9289	0.8191	0.6293	0.4434	0.5012	0.7781	0.9565	0.9922	0.9974	(94)
Useful gains	677.0934	829.4780	961.1386	1050.9837	1005.3456	762.2080	513.0420	535.8271	753.0694	781.6803	680.2547	631.8895	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2106.2292	2051.1777	1867.9011	1568.7278	1210.8491	805.3831	519.5494	547.1975	868.9149	1312.5496	1736.3745	2097.0958	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1063.2770	820.9822	674.6313	372.7758	152.8947	0.0000	0.0000	0.0000	0.0000	394.9668	760.4062	1090.1135	(98)
Space heating												5330.0475	(98)
Space heating per m2											(98) / (4) =	45.2735	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5706.6889	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1063.2770	820.9822	674.6313	372.7758	152.8947	0.0000	0.0000	0.0000	0.0000	394.9668	760.4062	1090.1135	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1138.4122	878.9959	722.3033	399.1175	163.6988	0.0000	0.0000	0.0000	0.0000	422.8767	814.1394	1167.1450	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5107	88.2991	87.8622	86.8407	84.7210	80.3000	80.3000	80.3000	80.3000	86.8899	88.1133	88.5854	(217)
Fuel for water heating, kWh/month													
	245.5336	216.9116	228.8875	207.4943	205.9173	191.3456	183.3236	204.3629	206.6198	215.0737	224.3481	239.4009	(219)
Water heating fuel used												2569.2189	(219)
Annual totals kWh/year													
Space heating fuel - main system												5706.6889	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Total delivered energy for all uses												8795.2557	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5706.6889	0.2160	1232.6448	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2569.2189	0.2160	554.9513	(264)
Space and water heating			1787.5961	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Total CO2, kg/m2/year			2057.1376	(272)
Emissions per m2 for space and water heating			15.1839	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9589	(272b)
Emissions per m2 for pumps and fans			0.3306	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1839 * 1.00) + 1.9589 + 0.3306, rounded to 2 d.p.			17.4700	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 451 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 451	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 451, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.39	**TER**	17.47
Environmental	95 A	**% DER<TER**	63.43		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.02	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	35.08 m	59.53 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	169.18	139.72

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.32	1.32

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.53

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W4	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.81	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.81	100
D2 W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.88	100
W13	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.61	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	47.85	0.005	No
Independently assessed	E5 Ground floor (normal)	35.08	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value 0.020 W/m²K

18.0 Pressure Testing Yes

Designed AP_{50} 4.50 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP_{50} m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather: Windows fully open

Cross ventilation possible: Yes

Night Ventilation: No

Air change rate: 8.00

Mechanical Ventilation

Mechanical Ventilation System Present: Yes

Approved Installation: No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 451 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 451	**Prop Type Ref**	Opp
Property	L461-R - Det SG, Plot 451, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	6.39	**TER**	17.47
Environmental	95 A	**% DER<TER**	63.43		
CO_2 Emissions (t/year)	0.25	**DFEE**	44.02	**TFEE**	58.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.36		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.73	m^2	
DER	6.39	$kgCO_2/yr/m^2$	
TER	17.47	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	6.39	$kgCO_2/yr/m^2$	
Reduction DER/TER	63.43	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	44.02	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.5		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.73	m^2	
DER	17.74	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	33.54	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	33.54	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.49	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.29	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.29	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	28	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 452 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 452	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 452, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.93	**TER**	18.32
Environmental	93 A	**% DER<TER**	51.25		
CO_2 Emissions (t/year)	0.44	**DFEE**	43.24	**TFEE**	56.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 94 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.32 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.93 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.53 m², No overhang
Windows facing East: 5.74 m², No overhang
Windows facing South: 9.05 m², No overhang
Windows facing West: 6.29 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000	(1b)	x 2.3100	(2b) =	109.9560	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.8700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	231.6461	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2158	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.4408	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3747	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4778	0.4684	0.4590	0.4122	0.4028	0.3560	0.3560	0.3466	0.3747	0.4028	0.4216	0.4403	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.7278	0.7184	0.7090	0.6622	0.6528	0.6060	0.6060	0.5966	0.6247	0.6528	0.6716	0.6903	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			22.6100	1.2357	27.9401			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			47.6000	0.1200	5.7120			(28a)
External Wall	140.3600	26.8900	113.4700	0.2100	23.8287			(29a)
Main Roof	46.2700		46.2700	0.0700	3.2389			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			235.6500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3525			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	218.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.3811	(36)
Total fabric heat loss	(33) + (36) = 72.7336	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.6329	54.9168	54.2006	50.6200	49.9039	46.3233	46.3233	45.6072	47.7556	49.9039	51.3362	52.7684	(38)
Heat transfer coeff	128.3665	127.6504	126.9342	123.3536	122.6375	119.0569	119.0569	118.3408	120.4892	122.6375	124.0698	125.5020	(39)
Average = Sum(39)m / 12 =												123.1746	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3675	1.3599	1.3522	1.3141	1.3065	1.2683	1.2683	1.2607	1.2836	1.3065	1.3217	1.3370	(40)
HLP (average)												1.3122	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6751	(42)
Average daily hot water use (litres/day)	97.7330	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.5063	103.5970	99.6877	95.7784	91.8690	87.9597	87.9597	91.8690	95.7784	99.6877	103.5970	107.5063	(44)
Energy conte	159.4288	139.4374	143.8869	125.4441	120.3666	103.8672	96.2483	110.4463	111.7654	130.2518	142.1800	154.3983	(45)
Energy content (annual)										Total = Sum(45)m =		1537.7211	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9143	20.9156	21.5830	18.8166	18.0550	15.5801	14.4372	16.5669	16.7648	19.5378	21.3270	23.1597	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8122	10.6595	11.7787	11.3595	11.7097	11.2991	11.6552	11.6905	11.3320	11.7501	11.4058	11.8017 (61)

Total heat required for water heating calculated for each month

	171.2410	150.0970	155.6656	136.8036	132.0763	115.1663	107.9035	122.1368	123.0974	142.0019	153.5858	166.1999 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	171.2410	150.0970	155.6656	136.8036	132.0763	115.1663	107.9035	122.1368	123.0974	142.0019	153.5858	166.1999 (64)
								Total per year (kWh/year) = Sum(64)m =				1675.9751 (64)

Heat gains from water heating, kWh/month

	55.9631	49.0278	50.7871	44.5500	42.9493	37.3606	34.9164	39.6460	39.9950	46.2462	50.1263	54.2878 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.9329	19.4806	15.8427	11.9939	8.9656	7.5691	8.1787	10.6310	14.2689	18.1177	21.1460	22.5425	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	246.0202	248.5731	242.1399	228.4442	211.1558	194.9072	184.0522	181.4992	187.9325	201.6282	218.9165	235.1651	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	(71)

Water heating gains (Table 5)

	75.2193	72.9581	68.2622	61.8751	57.7276	51.8898	46.9306	53.2877	55.5486	62.1589	69.6198	72.9675	(72)

Total internal gains

	409.2985	407.1379	392.3709	368.4393	343.9751	320.4922	305.2876	311.5440	323.8762	348.0309	375.8085	396.8013	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.7200	0.7000	0.7700	5.6823	(74)
East	5.7400	19.6403	0.7200	0.7000	0.7700	39.3752	(76)
South	9.0500	46.7521	0.7200	0.7000	0.7700	147.7791	(78)
West	6.2900	19.6403	0.7200	0.7000	0.7700	43.1481	(80)

Solar gains	235.9848	414.3165	592.6057	765.8178	878.2108	878.6127	844.4309	761.0262	653.4404	465.5263	285.0755	200.2950	(83)
Total gains	645.2833	821.4544	984.9766	1134.2571	1222.1859	1199.1049	1149.7185	1072.5703	977.3166	813.5572	660.8840	597.0963	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.2822	44.5306	44.7818	46.0817	46.3508	47.7448	47.7448	48.0337	47.1773	46.3508	45.8158	45.2929	
alpha	3.9521	3.9687	3.9855	4.0721	4.0901	4.1830	4.1830	4.2022	4.1452	4.0901	4.0544	4.0195	
util living area													
	0.9939	0.9841	0.9597	0.8956	0.7748	0.5970	0.4462	0.4926	0.7356	0.9359	0.9873	0.9955	(86)
MIT	19.3983	19.6688	20.0427	20.4864	20.7912	20.9499	20.9882	20.9826	20.8782	20.4454	19.8468	19.3762	(87)
Th 2	19.7883	19.7942	19.8001	19.8298	19.8358	19.8657	19.8657	19.8718	19.8537	19.8358	19.8239	19.8120	(88)
util rest of house													
	0.9921	0.9794	0.9478	0.8655	0.7148	0.5057	0.3358	0.3788	0.6495	0.9106	0.9828	0.9941	(89)
MIT 2	17.6834	18.0791	18.6182	19.2515	19.6397	19.8330	19.8613	19.8645	19.7608	19.2166	18.3600	17.6666	(90)
Living area fraction									fLA = Living area / (4) =			0.1921	(91)
MIT	18.0128	18.3844	18.8918	19.4887	19.8609	20.0475	20.0778	20.0793	19.9754	19.4527	18.6455	17.9950	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0128	18.3844	18.8918	19.4887	19.8609	20.0475	20.0778	20.0793	19.9754	19.4527	18.6455	17.9950	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9879	0.9715	0.9359	0.8551	0.7163	0.5211	0.3569	0.4004	0.6596	0.9000	0.9761	0.9909	(94)
Useful gains	637.4847	798.0658	921.8579	969.8654	875.4166	624.8092	410.3375	429.5024	644.6118	732.1696	645.1034	591.6500	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1760.2600	1721.2932	1572.9448	1306.1499	1000.8279	648.5655	414.0531	435.4104	707.9241	1085.6679	1432.4519	1731.3013	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	835.3448	620.4088	484.4086	242.1249	93.3060	0.0000	0.0000	0.0000	0.0000	263.0027	566.8909	847.9006	(98)
Space heating												3953.3872	(98)
Space heating per m2											(98) / (4) =	42.1156	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4237.2853	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	835.3448	620.4088	484.4086	242.1249	93.3060	0.0000	0.0000	0.0000	0.0000	263.0027	566.8909	847.9006	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	895.3320	664.9612	519.1947	259.5122	100.0064	0.0000	0.0000	0.0000	0.0000	281.8893	607.6001	908.7895	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	171.2410	150.0970	155.6656	136.8036	132.0763	115.1663	107.9035	122.1368	123.0974	142.0019	153.5858	166.1999	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6666	89.5754	89.3972	88.9663	88.1550	86.7000	86.7000	86.7000	86.7000	89.0042	89.5077	89.6897	(217)
Fuel for water heating, kWh/month													
	190.9752	167.5649	174.1280	153.7701	149.8229	132.8331	124.4562	140.8729	141.9808	159.5451	171.5894	185.3056	(219)
Water heating fuel used												1892.8441	(219)
Annual totals kWh/year													
Space heating fuel - main system												4237.2853	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												387.3415	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 1080 * 1.00) =										-1399.0639		-1399.0639	(233)
Total delivered energy for all uses												5193.4071	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4237.2853	0.2160	915.2536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1892.8441	0.2160	408.8543	(264)
Space and water heating			1324.1080	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	387.3415	0.5190	201.0303	(268)
Energy saving/generation technologies				
PV Unit	-1399.0639	0.5190	-726.1142	(269)
Total CO2, kg/year			837.9490	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.9300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.9300	ZC1
Total Floor Area	TFA	93.8700	
Assumed number of occupants	N	2.6751	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5307	ZC2
CO2 emissions from cooking, equation (L16)		1.9517	ZC3
Total CO2 emissions		26.4123	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.4123	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.6000	(1b)	x 2.3100	(2b) =	109.9560	(1b) - (3b)
First floor	46.2700	(1c)	x 2.6300	(2c) =	121.6901	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.8700					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	231.6461	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1295	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3795	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3226	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4113	0.4032	0.3952	0.3548	0.3468	0.3065	0.3065	0.2984	0.3226	0.3468	0.3629	0.3790	(22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5601	0.5470	0.5470	0.5445	0.5520	0.5601	0.5658	0.5718	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			19.2100	1.3258	25.4678			(27)
Ground floor			47.6000	0.1300	6.1880			(28a)
External Wall	140.3600	23.4900	116.8700	0.1800	21.0366			(29a)
Main Roof	46.2700		46.2700	0.1300	6.0151			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			235.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.0164			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.3485	(36)
Total fabric heat loss (33) + (36) =	76.3649	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6872	44.4361	44.1900	43.0341	42.8179	41.8111	41.8111	41.6247	42.1989	42.8179	43.2554	43.7128	(38)
Heat transfer coeff	121.0521	120.8010	120.5549	119.3990	119.1828	118.1760	118.1760	117.9896	118.5638	119.1828	119.6203	120.0777	(39)
Average = Sum(39)m / 12 =												119.3980	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2896	1.2869	1.2843	1.2720	1.2697	1.2589	1.2589	1.2569	1.2631	1.2697	1.2743	1.2792	(40)
HLP (average)												1.2720	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6751 (42)
Average daily hot water use (litres/day)	97.7330 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.5063	103.5970	99.6877	95.7784	91.8690	87.9597	87.9597	91.8690	95.7784	99.6877	103.5970	107.5063	(44)
Energy conte	159.4288	139.4374	143.8869	125.4441	120.3666	103.8672	96.2483	110.4463	111.7654	130.2518	142.1800	154.3983	(45)
Energy content (annual)										Total = Sum(45)m =		1537.7211	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9143	20.9156	21.5830	18.8166	18.0550	15.5801	14.4372	16.5669	16.7648	19.5378	21.3270	23.1597	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7998	47.2332	46.8155	43.3774	44.8233	46.8155	47.2332	50.7998	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	210.3877	185.4648	194.6867	172.6773	167.1821	147.2446	141.0716	157.2618	158.9985	181.0515	191.4951	205.3572 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	210.3877	185.4648	194.6867	172.6773	167.1821	147.2446	141.0716	157.2618	158.9985	181.0515	191.4951	205.3572 (64)
									Total per year (kWh/year) = Sum(64)m =			2112.8789 (64)
Heat gains from water heating, kWh/month												
	65.7498	57.8698	60.5423	53.5185	51.7258	45.3802	43.2084	48.4273	48.9703	56.0087	59.6036	64.0771 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	133.7537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0384	19.5743	15.9189	12.0516	9.0087	7.6055	8.2181	10.6821	14.3375	18.2048	21.2477	22.6509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	246.0202	248.5731	242.1399	228.4442	211.1558	194.9072	184.0522	181.4992	187.9325	201.6282	218.9165	235.1651	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	36.3754	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	-107.0030	(71)
Water heating gains (Table 5)													
	88.3734	86.1158	81.3741	74.3312	69.5239	63.0281	58.0758	65.0904	68.0143	75.2804	82.7828	86.1252	(72)
Total internal gains													
	422.5581	420.3893	405.5590	380.9531	355.8146	331.6670	316.4721	323.3979	336.4105	361.2396	389.0732	410.0674	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.6300	0.7000	0.7700	4.2246	(74)
East	4.8700	19.6403	0.6300	0.7000	0.7700	29.2313	(76)
South	7.7000	46.7521	0.6300	0.7000	0.7700	110.0179	(78)
West	5.3400	19.6403	0.6300	0.7000	0.7700	32.0524	(80)

Solar gains	175.5262	308.1383	440.6691	569.3841	652.8854	653.1609	627.7595	565.7962	485.8749	346.2048	212.0339	148.9842	(83)
Total gains	598.0843	728.5276	846.2280	950.3372	1008.7000	984.8279	944.2317	889.1941	822.2854	707.4444	601.1071	559.0515	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8508	53.9627	54.0729	54.5963	54.6954	55.1614	55.1614	55.2485	54.9809	54.6954	54.4954	54.2878	
alpha	4.5901	4.5975	4.6049	4.6398	4.6464	4.6774	4.6774	4.6832	4.6654	4.6464	4.6330	4.6192	
util living area													
	0.9974	0.9931	0.9814	0.9459	0.8593	0.7012	0.5350	0.5853	0.8214	0.9669	0.9943	0.9981	(86)
MIT	19.6096	19.8078	20.1039	20.4658	20.7635	20.9355	20.9854	20.9781	20.8601	20.4561	19.9580	19.5735	(87)
Th 2	19.8490	19.8511	19.8532	19.8629	19.8647	19.8731	19.8731	19.8747	19.8699	19.8647	19.8610	19.8572	(88)
util rest of house													
	0.9965	0.9908	0.9748	0.9258	0.8078	0.6032	0.4059	0.4544	0.7404	0.9506	0.9919	0.9974	(89)
MIT 2	18.0109	18.3009	18.7304	19.2477	19.6377	19.8314	19.8681	19.8662	19.7618	19.2456	18.5280	17.9638	(90)
Living area fraction										fLA = Living area / (4) =		0.1921	(91)
MIT	18.3179	18.5903	18.9942	19.4816	19.8539	20.0435	20.0827	20.0797	19.9728	19.4781	18.8027	18.2730	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3179	18.5903	18.9942	19.4816	19.8539	20.0435	20.0827	20.0797	19.9728	19.4781	18.8027	18.2730	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9870	0.9679	0.9173	0.8072	0.6193	0.4308	0.4794	0.7489	0.9431	0.9885	0.9960	(94)
Useful gains	594.8446	719.0263	819.0916	871.7305	814.2487	609.8736	406.7513	426.2980	615.8279	667.1831	594.2197	556.7878	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1696.9023	1653.8012	1506.2436	1263.4365	971.8079	643.2855	411.5695	434.1700	696.2975	1058.1156	1399.8793	1689.8526	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	819.9309	628.1687	511.2411	282.0283	117.2240	0.0000	0.0000	0.0000	0.0000	290.8538	580.0749	843.0002	(98)
Space heating												4072.5219	(98)
Space heating per m2											(98) / (4) =	43.3847	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4360.3018	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	819.9309	628.1687	511.2411	282.0283	117.2240	0.0000	0.0000	0.0000	0.0000	290.8538	580.0749	843.0002	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	877.8704	672.5575	547.3673	301.9575	125.5075	0.0000	0.0000	0.0000	0.0000	311.4066	621.0652	902.5698	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	210.3877	185.4648	194.6867	172.6773	167.1821	147.2446	141.0716	157.2618	158.9985	181.0515	191.4951	205.3572	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1363	87.8804	87.3693	86.2789	84.1763	80.3000	80.3000	80.3000	80.3000	86.2385	87.6634	88.2263	(217)
Fuel for water heating, kWh/month													
	238.7071	211.0423	222.8319	200.1385	198.6094	183.3682	175.6807	195.8428	198.0057	209.9429	218.4435	232.7619	(219)
Water heating fuel used												2485.3748	(219)
Annual totals kWh/year													
Space heating fuel - main system												4360.3018	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												389.2045	(232)
Total delivered energy for all uses												7309.8811	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4360.3018	0.2160	941.8252	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.3748	0.2160	536.8410	(264)
Space and water heating			1478.6661	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	389.2045	0.5190	201.9971	(268)
Total CO2, kg/m2/year			1719.5883	(272)
Emissions per m2 for space and water heating			15.7523	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1519	(272b)
Emissions per m2 for pumps and fans			0.4147	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7523 * 1.00) + 2.1519 + 0.4147, rounded to 2 d.p.			18.3200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 452 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 452	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 452, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.93	**TER**	18.32
Environmental	93 A	**% DER<TER**	51.25		
CO_2 Emissions (t/year)	0.44	**DFEE**	43.24	**TFEE**	56.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.24 m	47.60 m²	2.31 m
1st Storey:	27.74 m	46.27 m²	2.63 m

7.0 Living Area	18.03	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	218.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	140.36	113.47

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	46.27	46.27
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	47.60

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.81	100
W5	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					3.47	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.81	100
D1	Half Glazed Door	[1] External Wall	South							2.14	100
W3	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.20	100
D2 W14	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W8	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D3	Half Glazed Door	[1] External Wall	North							2.14	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.20	100

W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.72	100
W12	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100
W13	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.16	0.065	No
Independently assessed	E3 Sill	14.53	0.004	No
Independently assessed	E4 Jamb	46.50	0.005	No
Independently assessed	E5 Ground floor (normal)	29.24	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	27.74	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	16.57	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.17	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.023	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery	No	

Instantaneous System 1	
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder None

32.0 Photovoltaic Unit One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 452 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 452	**Prop Type Ref**	Opp
Property	L361-R - Det SG, Plot 452, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.93	**TER**	18.32
Environmental	93 A	**% DER<TER**	51.25		
CO_2 Emissions (t/year)	0.44	**DFEE**	43.24	**TFEE**	56.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.65		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	93.87	m^2	
DER	8.93	$kgCO_2/yr/m^2$	
TER	18.32	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.93	$kgCO_2/yr/m^2$	
Reduction DER/TER	51.25	%	
CfSH ENE1 credits achieved	5.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	43.24	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	93.87	m^2	
DER	19.16	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.53	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.64	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.64	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.53	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.95	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.91	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.91	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	21	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 453 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 453	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 453, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.25	**TER**	17.82
Environmental	94 A	**% DER<TER**	53.69		
CO_2 Emissions (t/year)	0.35	**DFEE**	37.99	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 84 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.25 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.10 m², No overhang
Windows facing South: 1.44 m², No overhang
Windows facing West: 5.38 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3923	0.3844	0.3452	0.3373	0.2981	0.2981	0.2903	0.3138	0.3373	0.3530	0.3687	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6501	0.6423	0.6344	0.5952	0.5873	0.5481	0.5481	0.5403	0.5638	0.5873	0.6030	0.6187	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.9200	1.2357	17.2015			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			42.1200	0.1200	5.0544			(28a)
External Wall	90.6000	16.0600	74.5400	0.2100	15.6534			(29a)
Main Roof	42.1200		42.1200	0.0700	2.9484			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0677			(33)
Party Wall			45.8900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	196.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3425	(36)
Total fabric heat loss (33) + (36) =	48.4102	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6384	44.0997	43.5611	40.8677	40.3290	37.6357	37.6357	37.0970	38.7130	40.3290	41.4064	42.4837	(38)
Heat transfer coeff	93.0486	92.5100	91.9713	89.2779	88.7392	86.0459	86.0459	85.5072	87.1232	88.7392	89.8166	90.8939	(39)
Average = Sum(39)m / 12 =												89.1432	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1046	1.0982	1.0918	1.0598	1.0534	1.0214	1.0214	1.0150	1.0342	1.0534	1.0662	1.0790	(40)
HLP (average)												1.0582	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8011   10.6498   11.7590   11.3430   11.6945   11.2865   11.6436   11.6766   11.3173   11.7323   11.3959   11.7909 (61)
Total heat required for water heating calculated for each month
              165.9350  145.4563  150.8672  132.6209  128.0635  111.7042  104.6953  118.4548  119.3708  137.6582  148.8538  161.0614 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              165.9350  145.4563  150.8672  132.6209  128.0635  111.7042  104.6953  118.4548  119.3708  137.6582  148.8538  161.0614 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1624.7415 (64)
Heat gains from water heating, kWh/month
               54.1998   47.4856   49.1932   43.1607   41.6163   36.2105   33.8506   38.4229   38.7571   44.8034   48.5537   52.5802 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203  126.9203 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               21.0811   18.7241   15.2274   11.5281    8.6174    7.2752    7.8611   10.2182   13.7148   17.4141   20.3248   21.6670 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              228.0736  230.4403  224.4763  211.7797  195.7525  180.6892  170.6260  168.2593  174.2233  186.9199  202.9471  218.0104 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920   35.6920 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 -101.5363 (71)
Water heating gains (Table 5)
               72.8492   70.6631   66.1199   59.9454   55.9359   50.2924   45.4981   51.6437   53.8293   60.2197   67.4357   70.6722 (72)
Total internal gains
              386.0800  383.9035  369.8997  347.3293  324.3819  302.3328  288.0613  294.1972  305.8435  328.6297  354.7837  374.4257 (73)


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6. Solar gains
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[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
East                                  7.1000           19.6403            0.7200           0.7000           0.7700           48.7045 (76)
South                                 1.4400           46.7521            0.7200           0.7000           0.7700           23.5140 (78)
West                                  5.3800           19.6403            0.7200           0.7000           0.7700           36.9057 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   109.1243  205.9817  324.8570  457.6836  550.7361  560.2340  534.7567  465.4408  372.0129  240.2559  134.6180   90.7200 (83)
Total gains   495.2042  589.8852  694.7567  805.0129  875.1180  862.5668  822.8180  759.6380  677.8563  568.8857  489.4017  465.1457 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           49.2904   49.5774   49.8677   51.3722   51.6840   53.3018   53.3018   53.6376   52.6427   51.6840   51.0641   50.4588
alpha          4.2860    4.3052    4.3245    4.4248    4.4456    4.5535    4.5535    4.5758    4.5095    4.4456    4.4043    4.3639
util living area
               0.9949    0.9887    0.9705    0.9130    0.7917    0.6058    0.4528    0.5052    0.7662    0.9519    0.9901    0.9961 (86)

MIT           19.5589   19.7677   20.1021   20.5264   20.8180   20.9611   20.9916   20.9867   20.8872   20.4762   19.9537   19.5473 (87)
Th 2          19.9971   20.0023   20.0076   20.0338   20.0391   20.0655   20.0655   20.0708   20.0549   20.0391   20.0285   20.0180 (88)
util rest of house
               0.9936    0.9857    0.9626    0.8903    0.7421    0.5290    0.3601    0.4089    0.6956    0.9346    0.9870    0.9951 (89)
MIT 2         18.0706   18.3777   18.8636   19.4767   19.8569   20.0372   20.0617   20.0642   19.9594   19.4236   18.6681   18.0679 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.1819 (91)
MIT           18.3413   18.6305   19.0888   19.6676   20.0317   20.2052   20.2308   20.2320   20.1281   19.6150   18.9019   18.3369 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.3413   18.6305   19.0888   19.6676   20.0317   20.2052   20.2308   20.2320   20.1281   19.6150   18.9019   18.3369 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9902    0.9799    0.9530    0.8800    0.7417    0.5410    0.3768    0.4261    0.7016    0.9248    0.9818    0.9924 (94)
Useful gains  490.3670  578.0544  662.0796  708.4379  649.1041  466.6155  310.0497  323.6512  475.6077  526.0985  480.5068  461.6100 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1306.5232 1270.2089 1157.8096  961.3058  739.3498  482.3027  312.4173  327.6626  525.1871  799.9841 1060.0089 1284.9625 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              607.2202  465.1278  368.8231  182.0649   67.1428    0.0000    0.0000    0.0000    0.0000  203.7709  417.2415  612.5743 (98)
Space heating                                                                                                         2923.9655 (98)
Space heating per m2                                                                                  (98) / (4) =     34.7099 (99)


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8c. Space cooling requirement
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Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3133.9394	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.2202	465.1278	368.8231	182.0649	67.1428	0.0000	0.0000	0.0000	0.0000	203.7709	417.2415	612.5743	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	650.8255	498.5293	395.3088	195.1392	71.9644	0.0000	0.0000	0.0000	0.0000	218.4039	447.2042	656.5641	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5024	89.4155	89.2245	88.7470	87.9054	86.7000	86.7000	86.7000	86.7000	88.8132	89.3247	89.5261	(217)
Fuel for water heating, kWh/month													
	185.3973	162.6745	169.0872	149.4371	145.6833	128.8399	120.7558	136.6261	137.6826	154.9975	166.6435	179.9044	(219)
Water heating fuel used												1837.7292	(219)
Annual totals kWh/year													
Space heating fuel - main system												3133.9394	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.2992	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4242.3887	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3133.9394	0.2160	676.9309	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1837.7292	0.2160	396.9495	(264)
Space and water heating			1073.8804	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	372.2992	0.5190	193.2233	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			695.3842	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.2500	ZC1
Total Floor Area	TFA	84.2400	
Assumed number of occupants	N	2.5384	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0436	ZC2
CO2 emissions from cooking, equation (L16)		2.1358	ZC3
Total CO2 emissions		26.4295	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.4295	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3942	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3351	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4272	0.4188	0.4104	0.3686	0.3602	0.3183	0.3183	0.3099	0.3351	0.3602	0.3769	0.3937	(22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5710	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.9200	1.3258	18.4545			(27)
Ground floor			42.1200	0.1300	5.4756			(28a)
External Wall	90.6000	16.0600	74.5400	0.1800	13.4172			(29a)
Main Roof	42.1200		42.1200	0.1300	5.4756			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3909			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.5272	(36)
Total fabric heat loss (33) + (36) =	54.9181	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5974	40.3541	40.1156	38.9955	38.7859	37.8104	37.8104	37.6297	38.1861	38.7859	39.2099	39.6531	(38)
Heat transfer coeff	95.5155	95.2722	95.0338	93.9137	93.7041	92.7285	92.7285	92.5479	93.1043	93.7041	94.1280	94.5713	(39)
Average = Sum(39)m / 12 =												93.9127	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1339	1.1310	1.1281	1.1148	1.1123	1.1008	1.1008	1.0986	1.1052	1.1123	1.1174	1.1226	(40)
HLP (average)												1.1148	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1126	45.6645	45.2606	41.9368	43.3347	45.2606	45.6645	49.1126	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
								Total per year (kWh/year) = Sum(64)m =				2049.2581	(64)
Heat gains from water heating, kWh/month													
	63.9892	56.3300	58.5316	51.7410	50.0079	43.8731	41.7734	46.8189	47.3439	54.1485	58.0335	62.3721	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.0811	18.7241	15.2274	11.5281	8.6174	7.2752	7.8611	10.2182	13.7148	17.4141	20.3248	21.6670	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)
Water heating gains (Table 5)													
	86.0071	83.8244	78.6716	71.8625	67.2149	60.9348	56.1470	62.9286	65.7554	72.7803	80.6021	83.8335	(72)
Total internal gains													
	399.2378	397.0648	382.4514	359.2465	335.6609	312.9753	298.7102	305.4822	317.7696	341.1903	367.9501	387.5870	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(76)
South	1.4400	46.7521	0.6300	0.7000	0.7700	20.5748	(78)
West	5.3800	19.6403	0.6300	0.7000	0.7700	32.2925	(80)

Solar gains	95.4837	180.2340	284.2498	400.4731	481.8940	490.2047	467.9121	407.2607	325.5113	210.2239	117.7908	79.3800	(83)
Total gains	494.7216	577.2988	666.7012	759.7196	817.5549	803.1800	766.6223	712.7429	643.2808	551.4142	485.7409	466.9670	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2466	61.4030	61.5571	62.2913	62.4306	63.0874	63.0874	63.2105	62.8328	62.4306	62.1494	61.8581	
alpha	5.0831	5.0935	5.1038	5.1528	5.1620	5.2058	5.2058	5.2140	5.1889	5.1620	5.1433	5.1239	
util living area													
	0.9982	0.9957	0.9872	0.9546	0.8632	0.6918	0.5227	0.5802	0.8379	0.9763	0.9961	0.9987	(86)
MIT	19.7686	19.9270	20.1943	20.5387	20.8140	20.9574	20.9918	20.9863	20.8837	20.5104	20.0753	19.7424	(87)
Th 2	19.9733	19.9756	19.9779	19.9887	19.9908	20.0002	20.0002	20.0020	19.9966	19.9908	19.9867	19.9824	(88)
util rest of house													
	0.9976	0.9942	0.9826	0.9378	0.8156	0.6023	0.4089	0.4629	0.7655	0.9646	0.9946	0.9982	(89)
MIT 2	18.3298	18.5626	18.9520	19.4482	19.8098	19.9722	19.9972	19.9963	19.9034	19.4185	18.7877	18.2980	(90)
Living area fraction										fLA = Living area / (4) =		0.1819	(91)
MIT	18.5915	18.8108	19.1779	19.6465	19.9924	20.1513	20.1781	20.1764	20.0817	19.6170	19.0219	18.5606	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5915	18.8108	19.1779	19.6465	19.9924	20.1513	20.1781	20.1764	20.0817	19.6170	19.0219	18.5606	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9918	0.9776	0.9307	0.8157	0.6167	0.4296	0.4842	0.7726	0.9586	0.9923	0.9972	(94)
Useful gains	492.9052	572.5411	651.7689	707.0752	666.8776	495.2954	329.3710	345.1084	496.9680	528.6092	482.0063	465.6750	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1365.0595	1325.3112	1204.8307	1009.2438	777.0327	514.7675	331.7896	349.4960	556.9235	844.9342	1122.1824	1358.1040	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	648.8828	505.8615	411.4780	217.5614	81.9554	0.0000	0.0000	0.0000	0.0000	235.3458	460.9268	663.9672	(98)
Space heating												3225.9789	(98)
Space heating per m2											(98) / (4) =	38.2951	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3453.9389	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	648.8828	505.8615	411.4780	217.5614	81.9554	0.0000	0.0000	0.0000	0.0000	235.3458	460.9268	663.9672	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	694.7354	541.6076	440.5546	232.9351	87.7467	0.0000	0.0000	0.0000	0.0000	251.9762	493.4976	710.8856	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7493	87.5017	86.9668	85.7189	83.4364	80.3000	80.3000	80.3000	80.3000	85.7972	87.2360	87.8402	(217)
Fuel for water heating, kWh/month													
	233.7258	206.6632	216.4283	194.7557	193.7160	177.2782	169.8460	189.3385	191.4296	204.0142	214.1010	227.9474	(219)
Water heating fuel used												2419.2438	(219)
Annual totals kWh/year													
Space heating fuel - main system												3453.9389	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.2992	(232)
Total delivered energy for all uses												6320.4819	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3453.9389	0.2160	746.0508	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2419.2438	0.2160	522.5567	(264)
Space and water heating			1268.6075	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	372.2992	0.5190	193.2233	(268)
Total CO2, kg/m2/year			1500.7557	(272)
Emissions per m2 for space and water heating			15.0594	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2937	(272b)
Emissions per m2 for pumps and fans			0.4621	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0594 * 1.00) + 2.2937 + 0.4621, rounded to 2 d.p.			17.8200	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 453 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 453	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 453, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.25	**TER**	17.82
Environmental	94 A	**% DER<TER**	53.69		
CO_2 Emissions (t/year)	0.35	**DFEE**	37.99	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.36 m	42.12 m²	2.31 m
1st Storey:	18.36 m	42.12 m²	2.63 m

7.0 Living Area	15.32	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	196.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	90.60	74.54

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	45.89

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	42.12	42.12

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	42.12

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
D2 W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8*	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.22	0.065	No
Independently assessed	E3 Sill	7.38	0.004	No
Independently assessed	E4 Jamb	25.35	0.005	No
Independently assessed	E5 Ground floor (normal)	18.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	18.36	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.06	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.30	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.30	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.30	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.30	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£45	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 453 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 453	**Prop Type Ref**	Opp
Property	L356-R - Semi SG, Plot 453, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.25	**TER**	17.82
Environmental	94 A	**% DER<TER**	53.69		
CO_2 Emissions (t/year)	0.35	**DFEE**	37.99	**TFEE**	50.45
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.70		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	84.24	m^2	
DER	8.25	$kgCO_2/yr/m^2$	
TER	17.82	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.25	$kgCO_2/yr/m^2$	
Reduction DER/TER	53.69	%	
CfSH ENE1 credits achieved	5.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.99	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	84.24	m^2	
DER	17.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.13	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.13	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.70	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	28.88	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	28.88	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 454 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 454	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 454, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.50	**TER**	18.05
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.02	**TFEE**	51.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 84 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.05 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 8.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.44 m², No overhang
Windows facing East: 7.10 m², No overhang
Windows facing West: 5.38 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3692	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3138	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4001	0.3923	0.3844	0.3452	0.3373	0.2981	0.2981	0.2903	0.3138	0.3373	0.3530	0.3687	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6501	0.6423	0.6344	0.5952	0.5873	0.5481	0.5481	0.5403	0.5638	0.5873	0.6030	0.6187	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.9200	1.2357	17.2015			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			42.1200	0.1200	5.0544			(28a)
External Wall	90.6000	16.0600	74.5400	0.2100	15.6534			(29a)
Main Roof	42.1200		42.1200	0.0700	2.9484			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0677			(33)
Party Wall			45.8900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	196.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.3425	(36)
Total fabric heat loss (33) + (36) =	48.4102	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.6384	44.0997	43.5611	40.8677	40.3290	37.6357	37.6357	37.0970	38.7130	40.3290	41.4064	42.4837	(38)
Heat transfer coeff	93.0486	92.5100	91.9713	89.2779	88.7392	86.0459	86.0459	85.5072	87.1232	88.7392	89.8166	90.8939	(39)
Average = Sum(39)m / 12 =												89.1432	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1046	1.0982	1.0918	1.0598	1.0534	1.0214	1.0214	1.0150	1.0342	1.0534	1.0662	1.0790	(40)
HLP (average)												1.0582	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8011	10.6498	11.7590	11.3430	11.6945	11.2865	11.6436	11.6766	11.3173	11.7323	11.3959	11.7909 (61)

Total heat required for water heating calculated for each month

	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614 (64)
								Total per year (kWh/year) = Sum(64)m =				1624.7415 (64)

Heat gains from water heating, kWh/month

	54.1998	47.4856	49.1932	43.1607	41.6163	36.2105	33.8506	38.4229	38.7571	44.8034	48.5537	52.5802 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	21.0811	18.7241	15.2274	11.5281	8.6174	7.2752	7.8611	10.2182	13.7148	17.4141	20.3248	21.6670	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)

Water heating gains (Table 5)

	72.8492	70.6631	66.1199	59.9454	55.9359	50.2924	45.4981	51.6437	53.8293	60.2197	67.4357	70.6722	(72)

Total internal gains

	386.0800	383.9035	369.8997	347.3293	324.3819	302.3328	288.0613	294.1972	305.8435	328.6297	354.7837	374.4257	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	10.6334	0.7200	0.7000	0.7700	5.3481	(74)
East	7.1000	19.6403	0.7200	0.7000	0.7700	48.7045	(76)
West	5.3800	19.6403	0.7200	0.7000	0.7700	36.9057	(80)

Solar gains	90.9583	177.6922	293.1692	430.1370	530.5398	544.8626	517.9906	442.4820	341.6502	210.8855	113.3434	74.8601	(83)
Total gains	477.0383	561.5958	663.0690	777.4662	854.9218	847.1954	806.0519	736.6792	647.4936	539.5152	468.1272	449.2859	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.2904	49.5774	49.8677	51.3722	51.6840	53.3018	53.3018	53.6376	52.6427	51.6840	51.0641	50.4588	
alpha	4.2860	4.3052	4.3245	4.4248	4.4456	4.5535	4.5535	4.5758	4.5095	4.4456	4.4043	4.3639	
util living area													
	0.9956	0.9906	0.9749	0.9214	0.8017	0.6148	0.4616	0.5194	0.7869	0.9596	0.9916	0.9966	(86)
MIT	19.5348	19.7311	20.0642	20.5009	20.8078	20.9587	20.9910	20.9852	20.8735	20.4435	19.9259	19.5260	(87)
Th 2	19.9971	20.0023	20.0076	20.0338	20.0391	20.0655	20.0655	20.0708	20.0549	20.0391	20.0285	20.0180	(88)
util rest of house													
	0.9944	0.9881	0.9680	0.9002	0.7531	0.5375	0.3674	0.4211	0.7181	0.9446	0.9890	0.9957	(89)
MIT 2	18.0356	18.3248	18.8099	19.4430	19.8456	20.0353	20.0614	20.0634	19.9461	19.3792	18.6279	18.0369	(90)
Living area fraction									fLA = Living area / (4) =			0.1819	(91)
MIT	18.3082	18.5806	19.0380	19.6354	20.0206	20.2032	20.2304	20.2310	20.1148	19.5728	18.8639	18.3077	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3082	18.5806	19.0380	19.6354	20.0206	20.2032	20.2304	20.2310	20.1148	19.5728	18.8639	18.3077	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9829	0.9590	0.8898	0.7520	0.5494	0.3844	0.4385	0.7230	0.9351	0.9844	0.9933	(94)
Useful gains	472.9478	552.0147	635.8987	691.7717	642.9396	465.4545	309.8165	323.0703	468.1067	504.4799	460.8084	446.2720	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1303.4440	1265.5877	1153.1346	958.4316	738.3606	482.1346	312.3838	327.5796	524.0262	796.2362	1056.5961	1282.3051	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	617.8892	479.5211	384.8235	191.9951	70.9932	0.0000	0.0000	0.0000	0.0000	217.0666	428.9671	622.0086	(98)
Space heating												3013.2646	(98)
Space heating per m2											(98) / (4) =	35.7700	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3229.6512	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	617.8892	479.5211	384.8235	191.9951	70.9932	0.0000	0.0000	0.0000	0.0000	217.0666	428.9671	622.0086	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	662.2606	513.9561	412.4582	205.7826	76.0914	0.0000	0.0000	0.0000	0.0000	232.6545	459.7719	666.6759	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.9350	145.4563	150.8672	132.6209	128.0635	111.7042	104.6953	118.4548	119.3708	137.6582	148.8538	161.0614	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5132	89.4357	89.2562	88.7937	87.9505	86.7000	86.7000	86.7000	86.7000	88.8680	89.3443	89.5353	(217)
Fuel for water heating, kWh/month													
	185.3750	162.6378	169.0271	149.3585	145.6086	128.8399	120.7558	136.6261	137.6826	154.9019	166.6069	179.8858	(219)
Water heating fuel used												1837.3060	(219)
Annual totals kWh/year													
Space heating fuel - main system												3229.6512	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.2992	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4337.6773	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3229.6512	0.2160	697.6047	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1837.3060	0.2160	396.8581	(264)
Space and water heating			1094.4627	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	372.2992	0.5190	193.2233	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			715.9665	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		8.5000	ZC1
Total Floor Area	TFA	84.2400	
Assumed number of occupants	N	2.5384	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0436	ZC2
CO2 emissions from cooking, equation (L16)		2.1358	ZC3
Total CO2 emissions		26.6795	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.6795	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.1200 (1b)	x	2.3100 (2b)	=	97.2972	(1b) - (3b)
First floor	42.1200 (1c)	x	2.6300 (2c)	=	110.7756	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.2400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	208.0728	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1442	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3942	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3351	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4272	0.4188	0.4104	0.3686	0.3602	0.3183	0.3183	0.3099	0.3351	0.3602	0.3769	0.3937	(22b)
Effective ac	0.5912	0.5877	0.5842	0.5679	0.5649	0.5507	0.5507	0.5480	0.5561	0.5649	0.5710	0.5775	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.9200	1.3258	18.4545			(27)
Ground floor			42.1200	0.1300	5.4756			(28a)
External Wall	90.6000	16.0600	74.5400	0.1800	13.4172			(29a)
Main Roof	42.1200		42.1200	0.1300	5.4756			(30)
Total net area of external elements Aum(A, m2)			174.8400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3909			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.5272	(36)
Total fabric heat loss (33) + (36) =	54.9181	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5974	40.3541	40.1156	38.9955	38.7859	37.8104	37.8104	37.6297	38.1861	38.7859	39.2099	39.6531	(38)
Heat transfer coeff	95.5155	95.2722	95.0338	93.9137	93.7041	92.7285	92.7285	92.5479	93.1043	93.7041	94.1280	94.5713	(39)
Average = Sum(39)m / 12 =												93.9127	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1339	1.1310	1.1281	1.1148	1.1123	1.1008	1.1008	1.0986	1.1052	1.1123	1.1174	1.1226	(40)
HLP (average)												1.1148	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5384 (42)
Average daily hot water use (litres/day)	94.4872 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.9359	100.1564	96.3769	92.5974	88.8179	85.0384	85.0384	88.8179	92.5974	96.3769	100.1564	103.9359	(44)
Energy conte	154.1339	134.8065	139.1082	121.2779	116.3691	100.4176	93.0517	106.7782	108.0535	125.9259	137.4580	149.2704	(45)
Energy content (annual)										Total = Sum(45)m =		1486.6509	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1201	20.2210	20.8662	18.1917	17.4554	15.0626	13.9578	16.0167	16.2080	18.8889	20.6187	22.3906	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.1126	45.6645	45.2606	41.9368	43.3347	45.2606	45.6645	49.1126	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
								Total per year (kWh/year) = Sum(64)m =				2049.2581	(64)
Heat gains from water heating, kWh/month													
	63.9892	56.3300	58.5316	51.7410	50.0079	43.8731	41.7734	46.8189	47.3439	54.1485	58.0335	62.3721	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	126.9203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.0811	18.7241	15.2274	11.5281	8.6174	7.2752	7.8611	10.2182	13.7148	17.4141	20.3248	21.6670	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.0736	230.4403	224.4763	211.7797	195.7525	180.6892	170.6260	168.2593	174.2233	186.9199	202.9471	218.0104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	35.6920	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	-101.5363	(71)
Water heating gains (Table 5)													
	86.0071	83.8244	78.6716	71.8625	67.2149	60.9348	56.1470	62.9286	65.7554	72.7803	80.6021	83.8335	(72)
Total internal gains													
	399.2378	397.0648	382.4514	359.2465	335.6609	312.9753	298.7102	305.4822	317.7696	341.1903	367.9501	387.5870	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	10.6334	0.6300	0.7000	0.7700	4.6796	(74)
East	7.1000	19.6403	0.6300	0.7000	0.7700	42.6165	(76)
West	5.3800	19.6403	0.6300	0.7000	0.7700	32.2925	(80)

Solar gains	79.5885	155.4807	256.5231	376.3698	464.2224	476.7547	453.2418	387.1717	298.9439	184.5248	99.1755	65.5026	(83)
Total gains	478.8264	552.5455	638.9744	735.6163	799.8832	789.7300	751.9520	692.6539	616.7134	525.7151	467.1256	453.0896	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.2466	61.4030	61.5571	62.2913	62.4306	63.0874	63.0874	63.2105	62.8328	62.4306	62.1494	61.8581	
alpha	5.0831	5.0935	5.1038	5.1528	5.1620	5.2058	5.2058	5.2140	5.1889	5.1620	5.1433	5.1239	
util living area													
	0.9985	0.9965	0.9893	0.9597	0.8714	0.7006	0.5321	0.5949	0.8550	0.9805	0.9968	0.9988	(86)
MIT	19.7510	19.9000	20.1651	20.5171	20.8042	20.9548	20.9911	20.9847	20.8706	20.4847	20.0548	19.7269	(87)
Th 2	19.9733	19.9756	19.9779	19.9887	19.9908	20.0002	20.0002	20.0020	19.9966	19.9908	19.9867	19.9824	(88)
util rest of house													
	0.9979	0.9952	0.9854	0.9445	0.8253	0.6111	0.4167	0.4757	0.7860	0.9706	0.9954	0.9985	(89)
MIT 2	18.3041	18.5233	18.9103	19.4191	19.7988	19.9703	19.9969	19.9956	19.8908	19.3829	18.7580	18.2754	(90)
Living area fraction										fLA = Living area / (4) =		0.1819	(91)
MIT	18.5673	18.7736	19.1385	19.6188	19.9816	20.1493	20.1777	20.1755	20.0690	19.5833	18.9938	18.5394	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5673	18.7736	19.1385	19.6188	19.9816	20.1493	20.1777	20.1755	20.0690	19.5833	18.9938	18.5394	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9931	0.9809	0.9374	0.8248	0.6253	0.4377	0.4973	0.7918	0.9650	0.9935	0.9976	(94)
Useful gains	477.2988	548.7433	626.7804	689.5933	659.7189	493.8462	329.1220	344.4556	488.3375	507.3271	464.0741	451.9916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1362.7450	1321.7711	1201.0854	1006.6426	776.0209	514.5799	331.7571	349.4118	555.7392	841.7706	1119.5420	1356.0931	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	658.7719	519.4747	427.2830	228.2755	86.5286	0.0000	0.0000	0.0000	0.0000	248.8260	471.9369	672.6515	(98)
Space heating												3313.7481	(98)
Space heating per m2											(98) / (4) =	39.3370	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3547.9102	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	658.7719	519.4747	427.2830	228.2755	86.5286	0.0000	0.0000	0.0000	0.0000	248.8260	471.9369	672.6515	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	705.3233	556.1828	457.4764	244.4063	92.6431	0.0000	0.0000	0.0000	0.0000	266.4090	505.2858	720.1836	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	205.0928	180.8339	188.2208	166.9424	161.6297	142.3544	136.3864	152.0388	153.7179	175.0385	186.7730	200.2294	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7788	87.5563	87.0517	85.8394	83.5550	80.3000	80.3000	80.3000	80.3000	85.9364	87.2870	87.8649	(217)
Fuel for water heating, kWh/month													
	233.6473	206.5344	216.2172	194.4823	193.4410	177.2782	169.8460	189.3385	191.4296	203.6839	213.9757	227.8832	(219)
Water heating fuel used												2417.7573	(219)
Annual totals kWh/year													
Space heating fuel - main system												3547.9102	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												372.2992	(232)
Total delivered energy for all uses												6412.9667	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3547.9102	0.2160	766.3486	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2417.7573	0.2160	522.2356	(264)
Space and water heating			1288.5842	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	372.2992	0.5190	193.2233	(268)
Total CO2, kg/m2/year			1520.7325	(272)
Emissions per m2 for space and water heating			15.2966	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2937	(272b)
Emissions per m2 for pumps and fans			0.4621	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2966 * 1.00) + 2.2937 + 0.4621, rounded to 2 d.p.			18.0500	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 454 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 454	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 454, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.50	**TER**	18.05
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.02	**TFEE**	51.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	18.36 m	42.12 m²	2.31 m
1st Storey:	18.36 m	42.12 m²	2.63 m

7.0 Living Area	15.32	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	196.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	90.60	74.54

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	45.89

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	42.12	42.12

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	42.12

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.48	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.78	100
W5	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
D2 W9	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W8*	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.22	0.065	No
Independently assessed	E3 Sill	7.38	0.004	No
Independently assessed	E4 Jamb	25.35	0.005	No
Independently assessed	E5 Ground floor (normal)	18.36	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	18.36	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	9.06	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.30	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.30	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.30	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.30	0.037	No

Y-value	0.025	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£45	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 454 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 454	**Prop Type Ref**	As
Property	L356-R - Semi SG, Plot 454, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	8.50	**TER**	18.05
Environmental	94 A	**% DER<TER**	52.91		
CO_2 Emissions (t/year)	0.37	**DFEE**	39.02	**TFEE**	51.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	84.24	m^2	
DER	8.50	$kgCO_2/yr/m^2$	
TER	18.05	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	8.50	$kgCO_2/yr/m^2$	
Reduction DER/TER	52.91	%	
CfSH ENE1 credits achieved	5.7		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	39.02	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	84.24	m^2	
DER	18.20	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	36.38	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	36.38	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	10.95	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.04	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.14	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	29.13	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	29.13	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 455 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 455	**Prop Type Ref**	Opp
Property	LOC-S Lockton - Semi SG, Plot 455, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.83	**TER**	16.50
Environmental	96 A	**% DER<TER**	64.67		
CO_2 Emissions (t/year)	0.19	**DFEE**	37.34	**TFEE**	49.02
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 109 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.50 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.83 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 7.93 m², No overhang
Windows facing South: 1.04 m², No overhang
Windows facing West: 4.13 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.3300 (1b)	x	2.3100 (2b)	=	125.5023	(1b) - (3b)
First floor	54.3300 (1c)	x	2.6300 (2c)	=	142.8879	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.3902	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1118	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3368	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2863	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3650	0.3578	0.3507	0.3149	0.3077	0.2719	0.2719	0.2648	0.2863	0.3077	0.3220	0.3364	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6150	0.6078	0.6007	0.5649	0.5577	0.5219	0.5219	0.5148	0.5363	0.5577	0.5720	0.5864	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.1000	1.2357	16.1882			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			54.3300	0.1300	7.0629			(28a)
External Wall	103.4200	15.2400	88.1800	0.2100	18.5178			(29a)
Main Roof	54.3300		54.3300	0.0700	3.8031			(30)
Total net area of external elements Aum(A, m2)			212.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7820			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	179.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7113	(36)
Total fabric heat loss (33) + (36) =	53.4933	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.4683	53.8344	53.2006	50.0313	49.3975	46.2283	46.2283	45.5944	47.4960	49.3975	50.6652	51.9329	(38)
Heat transfer coeff	107.9616	107.3277	106.6939	103.5247	102.8908	99.7216	99.7216	99.0878	100.9893	102.8908	104.1585	105.4262	(39)
Average = Sum(39)m / 12 =												103.3662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9936	0.9877	0.9819	0.9527	0.9469	0.9177	0.9177	0.9119	0.9294	0.9469	0.9586	0.9702	(40)
HLP (average)												0.9513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8065 (42)
Average daily hot water use (litres/day)	100.8553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9408	106.9066	102.8724	98.8382	94.8040	90.7698	90.7698	94.8040	98.8382	102.8724	106.9066	110.9408	(44)
Energy conte	164.5220	143.8920	148.4837	129.4517	124.2120	107.1855	99.3231	113.9747	115.3359	134.4129	146.7222	159.3308	(45)
Energy content (annual)										Total = Sum(45)m =		1586.8466	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6783	21.5838	22.2726	19.4178	18.6318	16.0778	14.8985	17.0962	17.3004	20.1619	22.0083	23.8996	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8229	10.6689	11.7893	11.3759	11.7247	11.3115	11.6668	11.7044	11.3466	11.7597	11.4153	11.8120 (61)

Total heat required for water heating calculated for each month

	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428 (64)

Total per year (kWh/year) = Sum(64)m = 1725.2445 (64)

Heat gains from water heating, kWh/month

	57.6593	50.5113	52.3181	45.8867	44.2317	38.4671	35.9416	40.8227	41.1858	47.6322	51.6390	55.9305 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.6522	23.6722	19.2516	14.5747	10.8947	9.1978	9.9385	12.9185	17.3392	22.0161	25.6960	27.3929	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)

Water heating gains (Table 5)

	77.4991	75.1657	70.3201	63.7315	59.4512	53.4265	48.3086	54.8692	57.2026	64.0218	71.7208	75.1754	(72)

Total internal gains

	441.8659	439.3503	423.0338	396.7590	369.8522	344.3236	328.0503	334.7930	348.5974	375.1028	405.4282	428.3868	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9300	19.6403	0.7200	0.7000	0.7700	54.3982	(76)
South	1.0400	46.7521	0.7200	0.7000	0.7700	16.9824	(78)
West	4.1300	19.6403	0.7200	0.7000	0.7700	28.3309	(80)

Solar gains	99.7115	189.6484	301.9488	428.7459	518.0975	527.8066	503.4981	436.8977	346.9834	222.0303	123.2834	82.7067	(83)
Total gains	541.5774	628.9988	724.9826	825.5049	887.9497	872.1302	831.5484	771.6907	695.5808	597.1331	528.7116	511.0935	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0439	50.3394	50.6385	52.1887	52.5102	54.1790	54.1790	54.5256	53.4989	52.5102	51.8711	51.2474	
alpha	4.3363	4.3560	4.3759	4.4792	4.5007	4.6119	4.6119	4.6350	4.5666	4.5007	4.4581	4.4165	
util living area	0.9962	0.9922	0.9804	0.9414	0.8474	0.6755	0.5142	0.5684	0.8211	0.9666	0.9929	0.9971	(86)
MIT	19.5381	19.7209	20.0296	20.4442	20.7607	20.9422	20.9868	20.9798	20.8523	20.4232	19.9230	19.5319	(87)
Th 2	20.0887	20.0936	20.0984	20.1229	20.1278	20.1524	20.1524	20.1574	20.1426	20.1278	20.1180	20.1082	(88)
util rest of house	0.9953	0.9903	0.9754	0.9260	0.8084	0.6039	0.4212	0.4738	0.7629	0.9551	0.9908	0.9963	(89)
MIT 2	18.1135	18.3832	18.8345	19.4426	19.8718	20.1059	20.1455	20.1458	20.0056	19.4250	18.6957	18.1176	(90)
Living area fraction									fLA = Living area / (4) =			0.1775	(91)
MIT	18.3664	18.6207	19.0466	19.6204	20.0296	20.2543	20.2949	20.2939	20.1559	19.6022	18.9136	18.3687	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3664	18.6207	19.0466	19.6204	20.0296	20.2543	20.2949	20.2939	20.1559	19.6022	18.9136	18.3687	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9858	0.9675	0.9152	0.8034	0.6131	0.4373	0.4897	0.7639	0.9459	0.9867	0.9942	(94)
Useful gains	537.5764	620.0444	701.4053	755.5008	713.3941	534.6666	363.6023	377.9133	531.3573	564.8271	521.6614	508.1367	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1518.6276	1472.6098	1338.6481	1109.8285	857.0404	563.8587	368.4595	385.8361	611.5779	926.2423	1230.4877	1493.7544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	729.9021	572.9239	474.1087	255.1160	106.8728	0.0000	0.0000	0.0000	0.0000	268.8929	510.3549	733.2996	(98)
Space heating												3651.4708	(98)
Space heating per m2											(98) / (4) =	33.6046	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3913.6879	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	729.9021	572.9239	474.1087	255.1160	106.8728	0.0000	0.0000	0.0000	0.0000	268.8929	510.3549	733.2996	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	782.3173	614.0664	508.1551	273.4362	114.5475	0.0000	0.0000	0.0000	0.0000	288.2024	547.0042	785.9588	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5762	89.5104	89.3625	88.9858	88.2485	86.7000	86.7000	86.7000	86.7000	88.9986	89.4217	89.5960	(217)
Fuel for water heating, kWh/month													
	196.8658	172.6738	179.3514	158.2585	154.0385	136.6747	128.0160	144.9586	146.1159	164.2415	176.8448	191.0161	(219)
Water heating fuel used												1949.0554	(219)
Annual totals kWh/year													
Space heating fuel - main system												3913.6879	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.6862	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												4643.5609	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3913.6879	0.2160	845.3566	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1949.0554	0.2160	420.9960	(264)
Space and water heating			1266.3526	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.6862	0.5190	244.2861	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			633.5969	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.8300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.8300	ZC1
Total Floor Area	TFA	108.6600	
Assumed number of occupants	N	2.8065	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7036	ZC2
CO2 emissions from cooking, equation (L16)		1.7150	ZC3
Total CO2 emissions		22.2486	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.2486	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.3300 (1b)	x	2.3100 (2b)	=	125.5023	(1b) - (3b)
First floor	54.3300 (1c)	x	2.6300 (2c)	=	142.8879	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.3902	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1490 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3990 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3392 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4325	0.4240	0.4155	0.3731	0.3646	0.3222	0.3222	0.3137	0.3392	0.3646	0.3816	0.3985	(22b)
Effective ac	0.5935	0.5899	0.5863	0.5696	0.5665	0.5519	0.5519	0.5492	0.5575	0.5665	0.5728	0.5794	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.1000	1.3258	17.3674			(27)
Ground floor			54.3300	0.1300	7.0629			(28a)
External Wall	103.4200	15.2400	88.1800	0.1800	15.8724			(29a)
Main Roof	54.3300		54.3300	0.1300	7.0629			(30)
Total net area of external elements Aum(A, m2)			212.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9336			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1252	(36)
Total fabric heat loss (33) + (36) =	60.0588	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.5664	52.2448	51.9295	50.4489	50.1719	48.8823	48.8823	48.6435	49.3790	50.1719	50.7323	51.3182	(38)
Heat transfer coeff	112.6252	112.3036	111.9884	110.5077	110.2307	108.9411	108.9411	108.7023	109.4379	110.2307	110.7911	111.3770	(39)
Average = Sum(39)m / 12 =												110.5064	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0365	1.0335	1.0306	1.0170	1.0145	1.0026	1.0026	1.0004	1.0072	1.0145	1.0196	1.0250	(40)
HLP (average)												1.0170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8065 (42)
Average daily hot water use (litres/day)	100.8553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9408	106.9066	102.8724	98.8382	94.8040	90.7698	90.7698	94.8040	98.8382	102.8724	106.9066	110.9408	(44)
Energy conte	164.5220	143.8920	148.4837	129.4517	124.2120	107.1855	99.3231	113.9747	115.3359	134.4129	146.7222	159.3308	(45)
Energy content (annual)										Total = Sum(45)m =		1586.8466	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6783	21.5838	22.2726	19.4178	18.6318	16.0778	14.8985	17.0962	17.3004	20.1619	22.0083	23.8996	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.7421	48.3111	44.7632	46.2553	48.3111	48.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(64)
								Total per year (kWh/year) = Sum(64)m =				2171.1495	(64)
Heat gains from water heating, kWh/month													
	67.4433	59.3509	62.1106	55.2282	53.3782	46.8300	44.5888	49.9744	50.5347	57.4320	61.1139	65.7172	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.6522	23.6722	19.2516	14.5747	10.8947	9.1978	9.9385	12.9185	17.3392	22.0161	25.6960	27.3929	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)													
	90.6496	88.3199	83.4819	76.7059	71.7450	65.0416	59.9311	67.1698	70.1871	77.1936	84.8804	88.3296	(72)
Total internal gains													
	455.0164	452.5045	436.1956	409.7334	382.1460	355.9387	339.6728	347.0937	361.5819	388.2745	418.5878	441.5410	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.9300	19.6403	0.6300	0.7000	0.7700	47.5984	(76)
South	1.0400	46.7521	0.6300	0.7000	0.7700	14.8596	(78)
West	4.1300	19.6403	0.6300	0.7000	0.7700	24.7896	(80)

Solar gains	87.2475	165.9424	264.2052	375.1527	453.3353	461.8308	440.5608	382.2855	303.6105	194.2765	107.8729	72.3684	(83)
Total gains	542.2640	618.4469	700.4008	784.8860	835.4814	817.7695	780.2336	729.3792	665.1924	582.5511	526.4608	513.9094	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9995	67.1914	67.3805	68.2833	68.4549	69.2652	69.2652	69.4174	68.9509	68.4549	68.1086	67.7504	
alpha	5.4666	5.4794	5.4920	5.5522	5.5637	5.6177	5.6177	5.6278	5.5967	5.5637	5.5406	5.5167	
util living area													
	0.9992	0.9982	0.9944	0.9779	0.9198	0.7739	0.5984	0.6575	0.8967	0.9885	0.9983	0.9994	(86)
MIT	19.8182	19.9485	20.1806	20.4954	20.7725	20.9428	20.9889	20.9818	20.8592	20.4944	20.1019	19.7993	(87)
Th 2	20.0530	20.0555	20.0579	20.0692	20.0713	20.0812	20.0812	20.0830	20.0774	20.0713	20.0670	20.0625	(88)
util rest of house													
	0.9989	0.9975	0.9923	0.9689	0.8864	0.6917	0.4817	0.5403	0.8412	0.9824	0.9976	0.9992	(89)
MIT 2	18.4599	18.6521	18.9924	19.4545	19.8348	20.0402	20.0767	20.0748	19.9544	19.4590	18.8851	18.4391	(90)
Living area fraction										fLA = Living area / (4) =		0.1775	(91)
MIT	18.7010	18.8822	19.2034	19.6393	20.0013	20.2005	20.2387	20.2358	20.1151	19.6428	19.1011	18.6806	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7010	18.8822	19.2034	19.6393	20.0013	20.2005	20.2387	20.2358	20.1151	19.6428	19.1011	18.6806	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9963	0.9895	0.9635	0.8834	0.7034	0.5024	0.5609	0.8439	0.9784	0.9964	0.9988	(94)
Useful gains	541.3589	616.1688	693.0698	756.2108	738.0741	575.2122	392.0067	409.0949	561.3827	569.9876	524.5808	513.2720	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1621.9165	1570.2531	1422.6303	1186.7767	915.0581	610.1225	396.4011	416.9643	658.2756	996.7976	1329.6197	1612.8064	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	803.9349	641.1446	542.7930	310.0074	131.6761	0.0000	0.0000	0.0000	0.0000	317.5466	579.6280	818.0536	(98)
Space heating												4144.7843	(98)
Space heating per m2											(98) / (4) =	38.1445	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4437.6705	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	803.9349	641.1446	542.7930	310.0074	131.6761	0.0000	0.0000	0.0000	0.0000	317.5466	579.6280	818.0536	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	860.7440	686.4504	581.1489	331.9138	140.9808	0.0000	0.0000	0.0000	0.0000	339.9857	620.5867	875.8604	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0588	87.8742	87.4446	86.4320	84.3808	80.3000	80.3000	80.3000	80.3000	86.3947	87.6149	88.1331	(217)
Fuel for water heating, kWh/month													
	244.7012	216.1265	228.0788	206.1665	204.4577	189.2262	181.2931	202.0994	204.3313	214.5640	223.7489	238.6046	(219)
Water heating fuel used												2553.3982	(219)
Annual totals kWh/year													
Space heating fuel - main system												4437.6705	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.6862	(232)
Total delivered energy for all uses												7536.7548	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4437.6705	0.2160	958.5368	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2553.3982	0.2160	551.5340	(264)
Space and water heating			1510.0708	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.6862	0.5190	244.2861	(268)
Total CO2, kg/m2/year			1793.2820	(272)
Emissions per m2 for space and water heating			13.8972	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2482	(272b)
Emissions per m2 for pumps and fans			0.3582	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8972 * 1.00) + 2.2482 + 0.3582, rounded to 2 d.p.			16.5000	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 455 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 455	**Prop Type Ref**	Opp
Property	LOC-S Lockton - Semi SG, Plot 455, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.83	**TER**	16.50
Environmental	96 A	**% DER<TER**	64.67		
CO_2 Emissions (t/year)	0.19	**DFEE**	37.34	**TFEE**	49.02
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.96 m	54.33 m²	2.31 m
1st Storey:	20.96 m	54.33 m²	2.63 m

7.0 Living Area	19.29	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	179.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	103.42	88.18

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	54.33	54.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	54.33

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.52	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.52	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.56	0.065	No
Independently assessed	E3 Sill	7.72	0.004	No
Independently assessed	E4 Jamb	24.75	0.005	No
Independently assessed	E5 Ground floor (normal)	20.96	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.96	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	11.55	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value	0.022	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 455 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 455	**Prop Type Ref**	Opp
Property	LOC-S Lockton - Semi SG, Plot 455, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.83	**TER**	16.50
Environmental	96 A	**% DER<TER**	64.67		
CO_2 Emissions (t/year)	0.19	**DFEE**	37.34	**TFEE**	49.02
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	108.66	m^2	
DER	5.83	$kgCO_2/yr/m^2$	
TER	16.50	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.83	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.67	%	
CfSH ENE1 credits achieved	6.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	37.34	$kWh/m^2/yr$
CfSH ENE2 credits achieved	9.0	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	108.66	m^2	
DER	16.27	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.70	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.72	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.69	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.69	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.84	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.70	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.72	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.26	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.26	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 456 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 456	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 456, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.41 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.20 m², No overhang
Windows facing East: 3.01 m², No overhang
Windows facing West: 3.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1537	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3787	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3219	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4105	0.4024	0.3944	0.3541	0.3461	0.3058	0.3058	0.2978	0.3219	0.3461	0.3622	0.3783	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6605	0.6524	0.6444	0.6041	0.5961	0.5558	0.5558	0.5478	0.5719	0.5961	0.6122	0.6283	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.3100	1.2357	9.0333			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.2100	16.0188			(29a)
Main Roof	39.5000		39.5000	0.0700	2.7650			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3721			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1361	(36)
Total fabric heat loss (33) + (36) =	43.5081	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5292	42.0109	41.4926	38.9014	38.3831	35.7919	35.7919	35.2736	36.8284	38.3831	39.4196	40.4561	(38)
Heat transfer coeff	86.0373	85.5190	85.0008	82.4095	81.8913	79.3000	79.3000	78.7817	80.3365	81.8913	82.9278	83.9643	(39)
Average = Sum(39)m / 12 =												82.2800	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0891	1.0825	1.0760	1.0432	1.0366	1.0038	1.0038	0.9972	1.0169	1.0366	1.0497	1.0628	(40)
HLP (average)												1.0415	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7934   10.6369   11.7457   11.3319   11.6843   11.2781   11.6358   11.6672   11.3074   11.7203   11.3827   11.7834 (61)
Total heat required for water heating calculated for each month
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1589.1957 (64)
Heat gains from water heating, kWh/month
               52.9768   46.4144   48.0878   42.1971   40.6918   35.4128   33.1114   37.5746   37.8986   43.8028   47.4614   51.3957 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.7354   20.1934   16.4224   12.4328    9.2937    7.8461    8.4780   11.0200   14.7910   18.7806   21.9197   23.3673 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.3379  219.5931  213.9099  201.8109  186.5382  172.1839  162.5944  160.3391  166.0223  178.1213  193.3941  207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445 (71)
Water heating gains (Table 5)
               71.2053   69.0690   64.6342   58.6070   54.6933   49.1845   44.5046   50.5035   52.6369   58.8747   65.9187   69.0802 (72)
Total internal gains
              373.9328  371.5098  357.6206  335.5050  313.1793  291.8687  278.2312  284.5168  296.1045  318.4308  343.8867  362.8501 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data       factor                W
                                                      W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                1.2000          10.6334            0.7200           0.7000           0.7700            4.4567 (74)
East                                 3.0100          19.6403            0.7200           0.7000           0.7700           20.6480 (76)
West                                 3.1000          19.6403            0.7200           0.7000           0.7700           21.2654 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    46.3701   90.5084  149.5007  220.1771  272.6610  280.5843  266.5104  226.8749  174.4440  107.4281   57.7590   38.1828 (83)
Total gains   420.3029  462.0182  507.1213  555.6821  585.8404  572.4530  544.7416  511.3917  470.5485  425.8590  401.6457  401.0329 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           57.6430   57.9923   58.3459   60.1805   60.5613   62.5403   62.5403   62.9517   61.7334   60.5613   59.8044   59.0661
alpha          4.8429    4.8662    4.8897    5.0120    5.0374    5.1694    5.1694    5.1968    5.1156    5.0374    4.9870    4.9377
util living area
               0.9982    0.9967    0.9923    0.9756    0.9226    0.7836    0.6159    0.6695    0.8967    0.9845    0.9966    0.9986 (86)

MIT           19.6754   19.8053   20.0479   20.4021   20.7091   20.9219   20.9823   20.9735   20.8251   20.4310   20.0125   19.6778 (87)
Th 2          20.0098   20.0151   20.0205   20.0475   20.0529   20.0802   20.0802   20.0856   20.0693   20.0529   20.0421   20.0313 (88)
util rest of house
               0.9976    0.9957    0.9897    0.9666    0.8918    0.7053    0.4991    0.5544    0.8443    0.9772    0.9953    0.9981 (89)
MIT 2         18.2317   18.4252   18.7827   19.3131   19.7415   20.0204   20.0722   20.0724   19.9101   19.3631   18.7475   18.2503 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1629 (91)
MIT           18.4669   18.6500   18.9888   19.4905   19.8991   20.1673   20.2205   20.2192   20.0592   19.5371   18.9536   18.4829 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.4669   18.6500   18.9888   19.4905   19.8991   20.1673   20.2205   20.2192   20.0592   19.5371   18.9536   18.4829 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9962    0.9935    0.9857    0.9595    0.8857    0.7135    0.5178    0.5724    0.8436    0.9716    0.9932    0.9970 (94)
Useful gains 418.7127  459.0294  499.8791  533.1829  518.8684  408.4653  282.0504  292.7087  396.9606  413.7592  398.8958  399.8361 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1218.8832 1175.8900 1061.5595  872.7611  671.4369  441.4833  287.1018  300.8808  478.7376  731.8666  982.9951 1199.2514 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             595.3269  481.7303  417.8902  244.4963  113.5110    0.0000    0.0000    0.0000    0.0000  236.6719  420.5515  594.7650 (98)
Space heating                                                                                                          3104.9431 (98)
Space heating per m2                                                                                    (98) / (4) =     39.3031 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3327.9133	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.3269	481.7303	417.8902	244.4963	113.5110	0.0000	0.0000	0.0000	0.0000	236.6719	420.5515	594.7650	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.0781	516.3240	447.8995	262.0539	121.6623	0.0000	0.0000	0.0000	0.0000	253.6677	450.7518	637.4758	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2548	142.2314	147.5394	129.7202	125.2806	109.3031	102.4704	115.9012	116.7863	134.6458	145.5655	157.4972	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5040	89.4533	89.3321	89.0187	88.3748	86.7000	86.7000	86.7000	86.7000	88.9605	89.3461	89.5218	(217)
Fuel for water heating, kWh/month													
	181.2821	159.0006	165.1583	145.7224	141.7605	126.0704	118.1896	133.6808	134.7016	151.3545	162.9232	175.9318	(219)
Water heating fuel used												1795.7757	(219)
Annual totals kWh/year													
Space heating fuel - main system												3327.9133	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4423.6244	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3327.9133	0.2160	718.8293	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1795.7757	0.2160	387.8875	(264)
Space and water heating			1106.7168	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			743.3833	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.4100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.4100	ZC1
Total Floor Area	TFA	79.0000	
Assumed number of occupants	N	2.4436	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3025	ZC2
CO2 emissions from cooking, equation (L16)		2.2487	ZC3
Total CO2 emissions		27.9612	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9612	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1537	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4037	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3432	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032	(22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			7.3100	1.3258	9.6913			(27)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.1800	13.7304			(29a)
Main Roof	39.5000		39.5000	0.1300	5.1350			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.8277			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1142	(36)
Total fabric heat loss (33) + (36) =	47.9419	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3607	38.1213	37.8867	36.7847	36.5785	35.6186	35.6186	35.4409	35.9884	36.5785	36.9956	37.4316	(38)
Heat transfer coeff	86.3026	86.0632	85.8286	84.7265	84.5204	83.5605	83.5605	83.3828	83.9302	84.5204	84.9375	85.3735	(39)
Average = Sum(39)m / 12 =												84.7256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0924	1.0894	1.0864	1.0725	1.0699	1.0577	1.0577	1.0555	1.0624	1.0699	1.0752	1.0807	(40)
HLP (average)												1.0725	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)
Average daily hot water use (litres/day)	92.2358	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0010	47.9424	44.5764	44.1822	40.9375	42.3021	44.1822	44.5764	47.9424	48.2153	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.0043	(64)
Heat gains from water heating, kWh/month													
	62.7681	55.0054	57.1370	50.5082	48.8163	42.8277	40.7780	45.7034	46.2158	52.8583	56.6696	61.1896	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.7354	20.1934	16.4224	12.4328	9.2937	7.8461	8.4780	11.0200	14.7910	18.7806	21.9197	23.3673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	84.3658	81.8533	76.7970	70.1503	65.6133	59.4829	54.8092	61.4292	64.1887	71.0461	78.7078	82.2440	(72)
Total internal gains													
	387.0932	384.2940	369.7835	347.0482	324.0994	302.1671	288.5357	295.4425	307.6562	330.6022	356.6758	376.0139	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.2000	10.6334	0.6300	0.7000	0.7700	3.8996	(74)
East	3.0100	19.6403	0.6300	0.7000	0.7700	18.0670	(76)
West	3.1000	19.6403	0.6300	0.7000	0.7700	18.6072	(80)

Solar gains	40.5738	79.1949	130.8131	192.6550	238.5784	245.5112	233.1966	198.5155	152.6385	93.9996	50.5391	33.4100	(83)
Total gains	427.6670	463.4889	500.5966	539.7032	562.6778	547.6783	521.7323	493.9581	460.2947	424.6019	407.2149	409.4239	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5684	63.7452	63.9194	64.7508	64.9088	65.6543	65.6543	65.7943	65.3651	64.9088	64.5900	64.2601	
alpha	5.2379	5.2497	5.2613	5.3167	5.3273	5.3770	5.3770	5.3863	5.3577	5.3273	5.3060	5.2840	
util living area													
	0.9988	0.9979	0.9950	0.9841	0.9456	0.8330	0.6692	0.7210	0.9219	0.9892	0.9977	0.9991	(86)
MIT	19.7816	19.8903	20.1023	20.4042	20.6936	20.9050	20.9776	20.9669	20.8130	20.4462	20.0667	19.7656	(87)
Th 2	20.0070	20.0095	20.0119	20.0234	20.0255	20.0355	20.0355	20.0374	20.0317	20.0255	20.0212	20.0166	(88)
util rest of house													
	0.9984	0.9971	0.9931	0.9773	0.9196	0.7551	0.5400	0.5961	0.8738	0.9833	0.9967	0.9987	(89)
MIT 2	18.3730	18.5337	18.8448	19.2904	19.6964	19.9635	20.0261	20.0217	19.8624	19.3556	18.8003	18.3565	(90)
Living area fraction										fLA = Living area / (4) =		0.1629	(91)
MIT	18.6025	18.7547	19.0496	19.4719	19.8589	20.1169	20.1811	20.1757	20.0173	19.5333	19.0066	18.5861	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6025	18.7547	19.0496	19.4719	19.8589	20.1169	20.1811	20.1757	20.0173	19.5333	19.0066	18.5861	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9957	0.9904	0.9720	0.9140	0.7626	0.5609	0.6157	0.8729	0.9791	0.9952	0.9980	(94)
Useful gains	426.5811	461.4976	495.8014	524.5759	514.2664	417.6609	292.6249	304.1324	401.7873	415.7125	405.2595	408.6006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1234.3441	1192.3826	1077.1177	895.7174	689.5898	460.9921	299.2387	314.8244	496.6390	755.0450	1011.3182	1228.1882	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.9757	491.1547	432.4993	267.2219	130.4406	0.0000	0.0000	0.0000	0.0000	252.4634	436.3623	609.7732	(98)
Space heating												3220.8910	(98)
Space heating per m2											(98) / (4) =	40.7708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3448.4914	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.9757	491.1547	432.4993	267.2219	130.4406	0.0000	0.0000	0.0000	0.0000	252.4634	436.3623	609.7732	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	643.4429	525.8616	463.0614	286.1048	139.6580	0.0000	0.0000	0.0000	0.0000	270.3034	467.1973	652.8621	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6331	87.4898	87.1324	86.2885	84.5765	80.3000	80.3000	80.3000	80.3000	86.0324	87.1681	87.7096	(217)
Fuel for water heating, kWh/month													
	229.8449	201.8470	210.8701	188.8601	186.5512	173.0542	165.7991	184.8272	186.8684	198.6089	209.2487	224.2317	(219)
Water heating fuel used												2360.6114	(219)
Annual totals kWh/year													
Space heating fuel - main system												3448.4914	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Total delivered energy for all uses												6285.6174	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3448.4914	0.2160	744.8741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2360.6114	0.2160	509.8921	(264)
Space and water heating			1254.7662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Total CO2, kg/m2/year			1502.0773	(272)
Emissions per m2 for space and water heating			15.8831	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6378	(272b)
Emissions per m2 for pumps and fans			0.4927	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8831 * 1.00) + 2.6378 + 0.4927, rounded to 2 d.p.			19.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 456 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 456	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 456, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.81 m	39.50 m²	2.31 m
1st Storey:	17.81 m	39.50 m²	2.63 m

7.0 Living Area	12.87	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	226.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	87.87	76.28

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.50	39.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	39.50

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.96	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2	Half Glazed Door	[1] External Wall	East							2.14	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.41	0.065	No
Independently assessed	E3 Sill	6.36	0.004	No
Independently assessed	E4 Jamb	21.90	0.005	No
Independently assessed	E5 Ground floor (normal)	17.81	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.81	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.40	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value 0.025 W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 456 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 456	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 456, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79	m^2	
DER	9.41	$kgCO_2/yr/m^2$	
TER	19.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.41	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.51	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.17	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79	m^2	
DER	19.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.87	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 457 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 457	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 457, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.16 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.01 m², No overhang
Windows facing South: 1.20 m², No overhang
Windows facing West: 3.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1537	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3787	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3219	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4105	0.4024	0.3944	0.3541	0.3461	0.3058	0.3058	0.2978	0.3219	0.3461	0.3622	0.3783	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6605	0.6524	0.6444	0.6041	0.5961	0.5558	0.5558	0.5478	0.5719	0.5961	0.6122	0.6283	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.3100	1.2357	9.0333			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.2100	16.0188			(29a)
Main Roof	39.5000		39.5000	0.0700	2.7650			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3721			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1361	(36)
Total fabric heat loss (33) + (36) =	43.5081	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5292	42.0109	41.4926	38.9014	38.3831	35.7919	35.7919	35.2736	36.8284	38.3831	39.4196	40.4561	(38)
Heat transfer coeff	86.0373	85.5190	85.0008	82.4095	81.8913	79.3000	79.3000	78.7817	80.3365	81.8913	82.9278	83.9643	(39)
Average = Sum(39)m / 12 =												82.2800	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0891	1.0825	1.0760	1.0432	1.0366	1.0038	1.0038	0.9972	1.0169	1.0366	1.0497	1.0628	(40)
HLP (average)												1.0415	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7934   10.6369   11.7457   11.3319   11.6843   11.2781   11.6358   11.6672   11.3074   11.7203   11.3827   11.7834 (61)
Total heat required for water heating calculated for each month
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1589.1957 (64)
Heat gains from water heating, kWh/month
               52.9768   46.4144   48.0878   42.1971   40.6918   35.4128   33.1114   37.5746   37.8986   43.8028   47.4614   51.3957 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.7354   20.1934   16.4224   12.4328    9.2937    7.8461    8.4780   11.0200   14.7910   18.7806   21.9197   23.3673 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.3379  219.5931  213.9099  201.8109  186.5382  172.1839  162.5944  160.3391  166.0223  178.1213  193.3941  207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445 (71)
Water heating gains (Table 5)
               71.2053   69.0690   64.6342   58.6070   54.6933   49.1845   44.5046   50.5035   52.6369   58.8747   65.9187   69.0802 (72)
Total internal gains
              373.9328  371.5098  357.6206  335.5050  313.1793  291.8687  278.2312  284.5168  296.1045  318.4308  343.8867  362.8501 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
East                                  3.0100            19.6403            0.7200           0.7000           0.7700           20.6480 (76)
South                                 1.2000            46.7521            0.7200           0.7000           0.7700           19.5950 (78)
West                                  3.1000            19.6403            0.7200           0.7000           0.7700           21.2654 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    61.5084  114.0830  175.9071  243.1326  289.4912  293.3938  280.4821  246.0072  199.7463  131.9035   75.4878   51.3994 (83)
Total gains   435.4411  485.5927  533.5278  578.6376  602.6706  585.2625  558.7133  530.5240  495.8507  450.3343  419.3745  414.2495 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            57.6430   57.9923   58.3459   60.1805   60.5613   62.5403   62.5403   62.9517   61.7334   60.5613   59.8044   59.0661
alpha           4.8429    4.8662    4.8897    5.0120    5.0374    5.1694    5.1694    5.1968    5.1156    5.0374    4.9870    4.9377
util living area
                0.9978    0.9959    0.9905    0.9715    0.9152    0.7729    0.6027    0.6501    0.8793    0.9806    0.9959    0.9983 (86)

MIT            19.6949   19.8354   20.0808   20.4283   20.7236   20.9269   20.9839   20.9768   20.8437   20.4604   20.0353   19.6949 (87)
Th 2           20.0098   20.0151   20.0205   20.0475   20.0529   20.0802   20.0802   20.0856   20.0693   20.0529   20.0421   20.0313 (88)
util rest of house
                0.9972    0.9947    0.9873    0.9611    0.8824    0.6937    0.4873    0.5362    0.8222    0.9716    0.9944    0.9978 (89)
MIT 2          18.2602   18.4691   18.8302   19.3497   19.7596   20.0247   20.0730   20.0742   19.9302   19.4043   18.7807   18.2754 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.1629 (91)
MIT            18.4939   18.6917   19.0340   19.5255   19.9166   20.1717   20.2214   20.2213   20.0790   19.5764   18.9851   18.5066 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.4939   18.6917   19.0340   19.5255   19.9166   20.1717   20.2214   20.2213   20.0790   19.5764   18.9851   18.5066 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9956    0.9921    0.9827    0.9536    0.8767    0.7024    0.5059    0.5541    0.8229    0.9654    0.9918    0.9966 (94)
Useful gains  433.5376  481.7663  524.3179  551.8060  528.3773  411.0930  282.6287  293.9819  408.0362  434.7447  415.9559  412.8326 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1221.2065 1179.4502 1065.3971  875.6388  672.8685  441.8375  287.1771  301.0459  480.3338  735.0848  985.6031 1201.2470 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              586.0257  468.8436  402.5629  233.1596  107.5014    0.0000    0.0000    0.0000    0.0000  223.4530  410.1460  586.5803 (98)
Space heating                                                                                                         3018.2726 (98)
Space heating per m2                                                                                    (98) / (4) =     38.2060 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3235.0189	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	586.0257	468.8436	402.5629	233.1596	107.5014	0.0000	0.0000	0.0000	0.0000	223.4530	410.1460	586.5803	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	628.1090	502.5119	431.4715	249.9031	115.2213	0.0000	0.0000	0.0000	0.0000	239.4995	439.5991	628.7035	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2548	142.2314	147.5394	129.7202	125.2806	109.3031	102.4704	115.9012	116.7863	134.6458	145.5655	157.4972	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4942	89.4356	89.3055	88.9793	88.3262	86.7000	86.7000	86.7000	86.7000	88.9119	89.3284	89.5133	(217)
Fuel for water heating, kWh/month													
	181.3019	159.0321	165.2076	145.7870	141.8386	126.0704	118.1896	133.6808	134.7016	151.4373	162.9554	175.9485	(219)
Water heating fuel used												1796.1507	(219)
Annual totals kWh/year													
Space heating fuel - main system												3235.0189	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4331.1051	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3235.0189	0.2160	698.7641	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1796.1507	0.2160	387.9686	(264)
Space and water heating			1086.7326	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			723.3992	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.1600	ZC1
Total Floor Area	TFA	79.0000	
Assumed number of occupants	N	2.4436	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3025	ZC2
CO2 emissions from cooking, equation (L16)		2.2487	ZC3
Total CO2 emissions		27.7112	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7112	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1537	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4037	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3432	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032	(22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			7.3100	1.3258	9.6913			(27)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.1800	13.7304			(29a)
Main Roof	39.5000		39.5000	0.1300	5.1350			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.8277			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1142	(36)
Total fabric heat loss (33) + (36) =	47.9419	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3607	38.1213	37.8867	36.7847	36.5785	35.6186	35.6186	35.4409	35.9884	36.5785	36.9956	37.4316	(38)
Heat transfer coeff	86.3026	86.0632	85.8286	84.7265	84.5204	83.5605	83.5605	83.3828	83.9302	84.5204	84.9375	85.3735	(39)
Average = Sum(39)m / 12 =												84.7256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0924	1.0894	1.0864	1.0725	1.0699	1.0577	1.0577	1.0555	1.0624	1.0699	1.0752	1.0807	(40)
HLP (average)												1.0725	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)
Average daily hot water use (litres/day)	92.2358	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0010	47.9424	44.5764	44.1822	40.9375	42.3021	44.1822	44.5764	47.9424	48.2153	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.0043	(64)
Heat gains from water heating, kWh/month													
	62.7681	55.0054	57.1370	50.5082	48.8163	42.8277	40.7780	45.7034	46.2158	52.8583	56.6696	61.1896	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.7354	20.1934	16.4224	12.4328	9.2937	7.8461	8.4780	11.0200	14.7910	18.7806	21.9197	23.3673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	84.3658	81.8533	76.7970	70.1503	65.6133	59.4829	54.8092	61.4292	64.1887	71.0461	78.7078	82.2440	(72)
Total internal gains													
	387.0932	384.2940	369.7835	347.0482	324.0994	302.1671	288.5357	295.4425	307.6562	330.6022	356.6758	376.0139	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0100	19.6403	0.6300	0.7000	0.7700	18.0670	(76)
South	1.2000	46.7521	0.6300	0.7000	0.7700	17.1456	(78)
West	3.1000	19.6403	0.6300	0.7000	0.7700	18.6072	(80)

Solar gains	53.8198	99.8226	153.9188	212.7411	253.3048	256.7196	245.4218	215.2563	174.7780	115.4156	66.0518	44.9745	(83)
Total gains	440.9130	484.1166	523.7023	559.7892	577.4042	558.8867	533.9576	510.6989	482.4342	446.0178	422.7276	420.9883	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5684	63.7452	63.9194	64.7508	64.9088	65.6543	65.6543	65.7943	65.3651	64.9088	64.5900	64.2601	
alpha	5.2379	5.2497	5.2613	5.3167	5.3273	5.3770	5.3770	5.3863	5.3577	5.3273	5.3060	5.2840	
util living area													
	0.9986	0.9974	0.9939	0.9814	0.9402	0.8240	0.6568	0.7034	0.9087	0.9865	0.9972	0.9989	(86)
MIT	19.7974	19.9148	20.1292	20.4262	20.7066	20.9102	20.9795	20.9706	20.8300	20.4704	20.0851	19.7794	(87)
Th 2	20.0070	20.0095	20.0119	20.0234	20.0255	20.0355	20.0355	20.0374	20.0317	20.0255	20.0212	20.0166	(88)
util rest of house													
	0.9981	0.9965	0.9916	0.9736	0.9124	0.7446	0.5286	0.5788	0.8557	0.9795	0.9961	0.9985	(89)
MIT 2	18.3961	18.5694	18.8838	19.3214	19.7130	19.9682	20.0270	20.0237	19.8812	19.3898	18.8271	18.3767	(90)
Living area fraction									fLA = Living area / (4) =			0.1629	(91)
MIT	18.6244	18.7886	19.0867	19.5014	19.8748	20.1216	20.1822	20.1779	20.0357	19.5658	19.0321	18.6052	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6244	18.7886	19.0867	19.5014	19.8748	20.1216	20.1822	20.1779	20.0357	19.5658	19.0321	18.6052	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9948	0.9885	0.9679	0.9070	0.7527	0.5493	0.5985	0.8559	0.9747	0.9943	0.9977	(94)
Useful gains	439.6300	481.6027	517.6584	541.8105	523.6899	420.6927	293.3230	305.6436	412.9284	434.7258	420.3375	420.0274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1236.2330	1195.2946	1080.2956	898.2201	690.9411	461.3914	299.3270	315.0153	498.1875	757.7933	1013.4803	1229.8265	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	592.6726	479.6010	418.6021	256.6149	124.4349	0.0000	0.0000	0.0000	0.0000	240.3622	427.0629	602.4906	(98)
Space heating												3141.8412	(98)
Space heating per m2											(98) / (4) =	39.7701	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3363.8557	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	592.6726	479.6010	418.6021	256.6149	124.4349	0.0000	0.0000	0.0000	0.0000	240.3622	427.0629	602.4906	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	634.5531	513.4914	448.1821	274.7483	133.2280	0.0000	0.0000	0.0000	0.0000	257.3471	457.2408	645.0649	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6051	87.4402	87.0598	86.1894	84.4608	80.3000	80.3000	80.3000	80.3000	85.9102	87.1206	87.6858	(217)
Fuel for water heating, kWh/month													
	229.9184	201.9614	211.0459	189.0773	186.8069	173.0542	165.7991	184.8272	186.8684	198.8912	209.3629	224.2925	(219)
Water heating fuel used												2361.9054	(219)
Annual totals kWh/year													
Space heating fuel - main system												3363.8557	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Total delivered energy for all uses												6202.2757	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3363.8557	0.2160	726.5928	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2361.9054	0.2160	510.1716	(264)
Space and water heating			1236.7644	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Total CO2, kg/m2/year			1484.0755	(272)
Emissions per m2 for space and water heating			15.6552	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6378	(272b)
Emissions per m2 for pumps and fans			0.4927	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6552 * 1.00) + 2.6378 + 0.4927, rounded to 2 d.p.			18.7900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 457 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 457	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 457, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.81 m	39.50 m²	2.31 m
1st Storey:	17.81 m	39.50 m²	2.63 m

7.0 Living Area	12.87	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	226.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	87.87	76.28

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.50	39.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	39.50

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.96	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2	Half Glazed Door	[1] External Wall	East							2.14	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.41	0.065	No
Independently assessed	E3 Sill	6.36	0.004	No
Independently assessed	E4 Jamb	21.90	0.005	No
Independently assessed	E5 Ground floor (normal)	17.81	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.81	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.40	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value 0.025 W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 457 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 457	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 457, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79	m^2	
DER	9.16	$kgCO_2/yr/m^2$	
TER	18.79	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.16	$kgCO_2/yr/m^2$	
Reduction DER/TER	51.24	%	
CfSH ENE1 credits achieved	5.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.07	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79	m^2	
DER	19.34	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.16	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.16	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 458 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 458	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 458, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.41 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.20 m², No overhang
Windows facing East: 3.01 m², No overhang
Windows facing West: 3.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1537	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3787	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3219	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4105	0.4024	0.3944	0.3541	0.3461	0.3058	0.3058	0.2978	0.3219	0.3461	0.3622	0.3783	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6605	0.6524	0.6444	0.6041	0.5961	0.5558	0.5558	0.5478	0.5719	0.5961	0.6122	0.6283	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.3100	1.2357	9.0333			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.2100	16.0188			(29a)
Main Roof	39.5000		39.5000	0.0700	2.7650			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3721			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1361	(36)
Total fabric heat loss (33) + (36) =	43.5081	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5292	42.0109	41.4926	38.9014	38.3831	35.7919	35.7919	35.2736	36.8284	38.3831	39.4196	40.4561	(38)
Heat transfer coeff	86.0373	85.5190	85.0008	82.4095	81.8913	79.3000	79.3000	78.7817	80.3365	81.8913	82.9278	83.9643	(39)
Average = Sum(39)m / 12 =												82.2800	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0891	1.0825	1.0760	1.0432	1.0366	1.0038	1.0038	0.9972	1.0169	1.0366	1.0497	1.0628	(40)
HLP (average)												1.0415	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7934   10.6369   11.7457   11.3319   11.6843   11.2781   11.6358   11.6672   11.3074   11.7203   11.3827   11.7834 (61)
Total heat required for water heating calculated for each month
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1589.1957 (64)
Heat gains from water heating, kWh/month
               52.9768   46.4144   48.0878   42.1971   40.6918   35.4128   33.1114   37.5746   37.8986   43.8028   47.4614   51.3957 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.7354   20.1934   16.4224   12.4328    9.2937    7.8461    8.4780   11.0200   14.7910   18.7806   21.9197   23.3673 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.3379  219.5931  213.9099  201.8109  186.5382  172.1839  162.5944  160.3391  166.0223  178.1213  193.3941  207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445 (71)
Water heating gains (Table 5)
               71.2053   69.0690   64.6342   58.6070   54.6933   49.1845   44.5046   50.5035   52.6369   58.8747   65.9187   69.0802 (72)
Total internal gains
              373.9328  371.5098  357.6206  335.5050  313.1793  291.8687  278.2312  284.5168  296.1045  318.4308  343.8867  362.8501 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                Area          Solar flux              g                FF            Access            Gains
                                     m2            Table 6a       Specific data    Specific data       factor                W
                                                      W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                1.2000          10.6334            0.7200           0.7000           0.7700            4.4567 (74)
East                                 3.0100          19.6403            0.7200           0.7000           0.7700           20.6480 (76)
West                                 3.1000          19.6403            0.7200           0.7000           0.7700           21.2654 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains    46.3701   90.5084  149.5007  220.1771  272.6610  280.5843  266.5104  226.8749  174.4440  107.4281   57.7590   38.1828 (83)
Total gains   420.3029  462.0182  507.1213  555.6821  585.8404  572.4530  544.7416  511.3917  470.5485  425.8590  401.6457  401.0329 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           57.6430   57.9923   58.3459   60.1805   60.5613   62.5403   62.5403   62.9517   61.7334   60.5613   59.8044   59.0661
alpha          4.8429    4.8662    4.8897    5.0120    5.0374    5.1694    5.1694    5.1968    5.1156    5.0374    4.9870    4.9377
util living area
               0.9982    0.9967    0.9923    0.9756    0.9226    0.7836    0.6159    0.6695    0.8967    0.9845    0.9966    0.9986 (86)

MIT           19.6754   19.8053   20.0479   20.4021   20.7091   20.9219   20.9823   20.9735   20.8251   20.4310   20.0125   19.6778 (87)
Th 2          20.0098   20.0151   20.0205   20.0475   20.0529   20.0802   20.0802   20.0856   20.0693   20.0529   20.0421   20.0313 (88)
util rest of house
               0.9976    0.9957    0.9897    0.9666    0.8918    0.7053    0.4991    0.5544    0.8443    0.9772    0.9953    0.9981 (89)
MIT 2         18.2317   18.4252   18.7827   19.3131   19.7415   20.0204   20.0722   20.0724   19.9101   19.3631   18.7475   18.2503 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1629 (91)
MIT           18.4669   18.6500   18.9888   19.4905   19.8991   20.1673   20.2205   20.2192   20.0592   19.5371   18.9536   18.4829 (92)
Temperature adjustment                                                                                                    0.0000
adjusted MIT  18.4669   18.6500   18.9888   19.4905   19.8991   20.1673   20.2205   20.2192   20.0592   19.5371   18.9536   18.4829 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9962    0.9935    0.9857    0.9595    0.8857    0.7135    0.5178    0.5724    0.8436    0.9716    0.9932    0.9970 (94)
Useful gains 418.7127  459.0294  499.8791  533.1829  518.8684  408.4653  282.0504  292.7087  396.9606  413.7592  398.8958  399.8361 (95)
Ext temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1218.8832 1175.8900 1061.5595  872.7611  671.4369  441.4833  287.1018  300.8808  478.7376  731.8666  982.9951 1199.2514 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             595.3269  481.7303  417.8902  244.4963  113.5110    0.0000    0.0000    0.0000    0.0000  236.6719  420.5515  594.7650 (98)
Space heating                                                                                                          3104.9431 (98)
Space heating per m2                                                                                    (98) / (4) =     39.3031 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3327.9133	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	595.3269	481.7303	417.8902	244.4963	113.5110	0.0000	0.0000	0.0000	0.0000	236.6719	420.5515	594.7650	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	638.0781	516.3240	447.8995	262.0539	121.6623	0.0000	0.0000	0.0000	0.0000	253.6677	450.7518	637.4758	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2548	142.2314	147.5394	129.7202	125.2806	109.3031	102.4704	115.9012	116.7863	134.6458	145.5655	157.4972	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5040	89.4533	89.3321	89.0187	88.3748	86.7000	86.7000	86.7000	86.7000	88.9605	89.3461	89.5218	(217)
Fuel for water heating, kWh/month													
	181.2821	159.0006	165.1583	145.7224	141.7605	126.0704	118.1896	133.6808	134.7016	151.3545	162.9232	175.9318	(219)
Water heating fuel used												1795.7757	(219)
Annual totals kWh/year													
Space heating fuel - main system												3327.9133	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =											-1176.5791	-1176.5791	(233)
Total delivered energy for all uses												4423.6244	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3327.9133	0.2160	718.8293	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1795.7757	0.2160	387.8875	(264)
Space and water heating			1106.7168	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			743.3833	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.4100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.4100	ZC1
Total Floor Area	TFA	79.0000	
Assumed number of occupants	N	2.4436	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3025	ZC2
CO2 emissions from cooking, equation (L16)		2.2487	ZC3
Total CO2 emissions		27.9612	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.9612	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1537	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4037	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3432	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032	(22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			7.3100	1.3258	9.6913			(27)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.1800	13.7304			(29a)
Main Roof	39.5000		39.5000	0.1300	5.1350			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.8277			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1142	(36)
Total fabric heat loss (33) + (36) =	47.9419	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3607	38.1213	37.8867	36.7847	36.5785	35.6186	35.6186	35.4409	35.9884	36.5785	36.9956	37.4316	(38)
Heat transfer coeff	86.3026	86.0632	85.8286	84.7265	84.5204	83.5605	83.5605	83.3828	83.9302	84.5204	84.9375	85.3735	(39)
Average = Sum(39)m / 12 =												84.7256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0924	1.0894	1.0864	1.0725	1.0699	1.0577	1.0577	1.0555	1.0624	1.0699	1.0752	1.0807	(40)
HLP (average)												1.0725	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)
Average daily hot water use (litres/day)	92.2358	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0010	47.9424	44.5764	44.1822	40.9375	42.3021	44.1822	44.5764	47.9424	48.2153	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.0043	(64)
Heat gains from water heating, kWh/month													
	62.7681	55.0054	57.1370	50.5082	48.8163	42.8277	40.7780	45.7034	46.2158	52.8583	56.6696	61.1896	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.7354	20.1934	16.4224	12.4328	9.2937	7.8461	8.4780	11.0200	14.7910	18.7806	21.9197	23.3673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	84.3658	81.8533	76.7970	70.1503	65.6133	59.4829	54.8092	61.4292	64.1887	71.0461	78.7078	82.2440	(72)
Total internal gains													
	387.0932	384.2940	369.7835	347.0482	324.0994	302.1671	288.5357	295.4425	307.6562	330.6022	356.6758	376.0139	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.2000	10.6334	0.6300	0.7000	0.7700	3.8996	(74)
East	3.0100	19.6403	0.6300	0.7000	0.7700	18.0670	(76)
West	3.1000	19.6403	0.6300	0.7000	0.7700	18.6072	(80)

Solar gains	40.5738	79.1949	130.8131	192.6550	238.5784	245.5112	233.1966	198.5155	152.6385	93.9996	50.5391	33.4100	(83)
Total gains	427.6670	463.4889	500.5966	539.7032	562.6778	547.6783	521.7323	493.9581	460.2947	424.6019	407.2149	409.4239	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5684	63.7452	63.9194	64.7508	64.9088	65.6543	65.6543	65.7943	65.3651	64.9088	64.5900	64.2601	
alpha	5.2379	5.2497	5.2613	5.3167	5.3273	5.3770	5.3770	5.3863	5.3577	5.3273	5.3060	5.2840	
util living area													
	0.9988	0.9979	0.9950	0.9841	0.9456	0.8330	0.6692	0.7210	0.9219	0.9892	0.9977	0.9991	(86)
MIT	19.7816	19.8903	20.1023	20.4042	20.6936	20.9050	20.9776	20.9669	20.8130	20.4462	20.0667	19.7656	(87)
Th 2	20.0070	20.0095	20.0119	20.0234	20.0255	20.0355	20.0355	20.0374	20.0317	20.0255	20.0212	20.0166	(88)
util rest of house													
	0.9984	0.9971	0.9931	0.9773	0.9196	0.7551	0.5400	0.5961	0.8738	0.9833	0.9967	0.9987	(89)
MIT 2	18.3730	18.5337	18.8448	19.2904	19.6964	19.9635	20.0261	20.0217	19.8624	19.3556	18.8003	18.3565	(90)
Living area fraction										fLA = Living area / (4) =		0.1629	(91)
MIT	18.6025	18.7547	19.0496	19.4719	19.8589	20.1169	20.1811	20.1757	20.0173	19.5333	19.0066	18.5861	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6025	18.7547	19.0496	19.4719	19.8589	20.1169	20.1811	20.1757	20.0173	19.5333	19.0066	18.5861	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9957	0.9904	0.9720	0.9140	0.7626	0.5609	0.6157	0.8729	0.9791	0.9952	0.9980	(94)
Useful gains	426.5811	461.4976	495.8014	524.5759	514.2664	417.6609	292.6249	304.1324	401.7873	415.7125	405.2595	408.6006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1234.3441	1192.3826	1077.1177	895.7174	689.5898	460.9921	299.2387	314.8244	496.6390	755.0450	1011.3182	1228.1882	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	600.9757	491.1547	432.4993	267.2219	130.4406	0.0000	0.0000	0.0000	0.0000	252.4634	436.3623	609.7732	(98)
Space heating												3220.8910	(98)
Space heating per m2											(98) / (4) =	40.7708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3448.4914	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	600.9757	491.1547	432.4993	267.2219	130.4406	0.0000	0.0000	0.0000	0.0000	252.4634	436.3623	609.7732	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	643.4429	525.8616	463.0614	286.1048	139.6580	0.0000	0.0000	0.0000	0.0000	270.3034	467.1973	652.8621	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6331	87.4898	87.1324	86.2885	84.5765	80.3000	80.3000	80.3000	80.3000	86.0324	87.1681	87.7096	(217)
Fuel for water heating, kWh/month													
	229.8449	201.8470	210.8701	188.8601	186.5512	173.0542	165.7991	184.8272	186.8684	198.6089	209.2487	224.2317	(219)
Water heating fuel used												2360.6114	(219)
Annual totals kWh/year													
Space heating fuel - main system												3448.4914	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Total delivered energy for all uses												6285.6174	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3448.4914	0.2160	744.8741	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2360.6114	0.2160	509.8921	(264)
Space and water heating			1254.7662	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Total CO2, kg/m2/year			1502.0773	(272)
Emissions per m2 for space and water heating			15.8831	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6378	(272b)
Emissions per m2 for pumps and fans			0.4927	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8831 * 1.00) + 2.6378 + 0.4927, rounded to 2 d.p.			19.0100	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 458 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 458	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 458, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.81 m	39.50 m²	2.31 m
1st Storey:	17.81 m	39.50 m²	2.63 m

7.0 Living Area	12.87	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	226.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	87.87	76.28

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.50	39.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	39.50

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.96	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2	Half Glazed Door	[1] External Wall	East							2.14	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.41	0.065	No
Independently assessed	E3 Sill	6.36	0.004	No
Independently assessed	E4 Jamb	21.90	0.005	No
Independently assessed	E5 Ground floor (normal)	17.81	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.81	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.40	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value 0.025 W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 458 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 458	**Prop Type Ref**	As
Property	AL24 - Semi SG, Plot 458, Boorley Gardens, Southampton, SO32		

SAP Rating	91 B	**DER**	9.41	**TER**	19.01
Environmental	94 A	**% DER<TER**	50.51		
CO_2 Emissions (t/year)	0.38	**DFEE**	41.17	**TFEE**	52.67
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79	m^2	
DER	9.41	$kgCO_2/yr/m^2$	
TER	19.01	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.41	$kgCO_2/yr/m^2$	
Reduction DER/TER	50.51	%	
CfSH ENE1 credits achieved	5.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	41.17	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.2		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79	m^2	
DER	19.60	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	38.15	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.87	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 459 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 459	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 459, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.16 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.1 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 3.01 m², No overhang
Windows facing South: 1.20 m², No overhang
Windows facing West: 3.10 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.025 W/m²K
Photovoltaic array 1.62 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1537	(8)
Pressure test				Yes	
Measured/design AP50				4.5000	
Infiltration rate				0.3787	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3219	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4105	0.4024	0.3944	0.3541	0.3461	0.3058	0.3058	0.2978	0.3219	0.3461	0.3622	0.3783	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6605	0.6524	0.6444	0.6041	0.5961	0.5558	0.5558	0.5478	0.5719	0.5961	0.6122	0.6283	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.3100	1.2357	9.0333			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.2100	16.0188			(29a)
Main Roof	39.5000		39.5000	0.0700	2.7650			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3721			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	226.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.1361	(36)
Total fabric heat loss (33) + (36) =	43.5081	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.5292	42.0109	41.4926	38.9014	38.3831	35.7919	35.7919	35.2736	36.8284	38.3831	39.4196	40.4561	(38)
Heat transfer coeff	86.0373	85.5190	85.0008	82.4095	81.8913	79.3000	79.3000	78.7817	80.3365	81.8913	82.9278	83.9643	(39)
Average = Sum(39)m / 12 =												82.2800	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0891	1.0825	1.0760	1.0432	1.0366	1.0038	1.0038	0.9972	1.0169	1.0366	1.0497	1.0628	(40)
HLP (average)												1.0415	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7934   10.6369   11.7457   11.3319   11.6843   11.2781   11.6358   11.6672   11.3074   11.7203   11.3827   11.7834 (61)
Total heat required for water heating calculated for each month
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              162.2548  142.2314  147.5394  129.7202  125.2806  109.3031  102.4704  115.9012  116.7863  134.6458  145.5655  157.4972 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1589.1957 (64)
Heat gains from water heating, kWh/month
               52.9768   46.4144   48.0878   42.1971   40.6918   35.4128   33.1114   37.5746   37.8986   43.8028   47.4614   51.3957 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807  122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               22.7354   20.1934   16.4224   12.4328    9.2937    7.8461    8.4780   11.0200   14.7910   18.7806   21.9197   23.3673 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              217.3379  219.5931  213.9099  201.8109  186.5382  172.1839  162.5944  160.3391  166.0223  178.1213  193.3941  207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181   35.2181 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445  -97.7445 (71)
Water heating gains (Table 5)
               71.2053   69.0690   64.6342   58.6070   54.6933   49.1845   44.5046   50.5035   52.6369   58.8747   65.9187   69.0802 (72)
Total internal gains
              373.9328  371.5098  357.6206  335.5050  313.1793  291.8687  278.2312  284.5168  296.1045  318.4308  343.8867  362.8501 (73)


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6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------
East                                  3.0100            19.6403            0.7200           0.7000           0.7700           20.6480 (76)
South                                 1.2000            46.7521            0.7200           0.7000           0.7700           19.5950 (78)
West                                  3.1000            19.6403            0.7200           0.7000           0.7700           21.2654 (80)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    61.5084  114.0830  175.9071  243.1326  289.4912  293.3938  280.4821  246.0072  199.7463  131.9035   75.4878   51.3994 (83)
Total gains   435.4411  485.5927  533.5278  578.6376  602.6706  585.2625  558.7133  530.5240  495.8507  450.3343  419.3745  414.2495 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            57.6430   57.9923   58.3459   60.1805   60.5613   62.5403   62.5403   62.9517   61.7334   60.5613   59.8044   59.0661
alpha           4.8429    4.8662    4.8897    5.0120    5.0374    5.1694    5.1694    5.1968    5.1156    5.0374    4.9870    4.9377
util living area
                0.9978    0.9959    0.9905    0.9715    0.9152    0.7729    0.6027    0.6501    0.8793    0.9806    0.9959    0.9983 (86)

MIT            19.6949   19.8354   20.0808   20.4283   20.7236   20.9269   20.9839   20.9768   20.8437   20.4604   20.0353   19.6949 (87)
Th 2           20.0098   20.0151   20.0205   20.0475   20.0529   20.0802   20.0802   20.0856   20.0693   20.0529   20.0421   20.0313 (88)
util rest of house
                0.9972    0.9947    0.9873    0.9611    0.8824    0.6937    0.4873    0.5362    0.8222    0.9716    0.9944    0.9978 (89)
MIT 2          18.2602   18.4691   18.8302   19.3497   19.7596   20.0247   20.0730   20.0742   19.9302   19.4043   18.7807   18.2754 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.1629 (91)
MIT            18.4939   18.6917   19.0340   19.5255   19.9166   20.1717   20.2214   20.2213   20.0790   19.5764   18.9851   18.5066 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   18.4939   18.6917   19.0340   19.5255   19.9166   20.1717   20.2214   20.2213   20.0790   19.5764   18.9851   18.5066 (93)


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8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9956    0.9921    0.9827    0.9536    0.8767    0.7024    0.5059    0.5541    0.8229    0.9654    0.9918    0.9966 (94)
Useful gains  433.5376  481.7663  524.3179  551.8060  528.3773  411.0930  282.6287  293.9819  408.0362  434.7447  415.9559  412.8326 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1221.2065 1179.4502 1065.3971  875.6388  672.8685  441.8375  287.1771  301.0459  480.3338  735.0848  985.6031 1201.2470 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              586.0257  468.8436  402.5629  233.1596  107.5014    0.0000    0.0000    0.0000    0.0000  223.4530  410.1460  586.5803 (98)
Space heating                                                                                                         3018.2726 (98)
Space heating per m2                                                                                    (98) / (4) =     38.2060 (99)


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8c. Space cooling requirement
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Not applicable
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3235.0189	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	586.0257	468.8436	402.5629	233.1596	107.5014	0.0000	0.0000	0.0000	0.0000	223.4530	410.1460	586.5803	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	628.1090	502.5119	431.4715	249.9031	115.2213	0.0000	0.0000	0.0000	0.0000	239.4995	439.5991	628.7035	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2548	142.2314	147.5394	129.7202	125.2806	109.3031	102.4704	115.9012	116.7863	134.6458	145.5655	157.4972	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4942	89.4356	89.3055	88.9793	88.3262	86.7000	86.7000	86.7000	86.7000	88.9119	89.3284	89.5133	(217)
Fuel for water heating, kWh/month													
	181.3019	159.0321	165.2076	145.7870	141.8386	126.0704	118.1896	133.6808	134.7016	151.4373	162.9554	175.9485	(219)
Water heating fuel used												1796.1507	(219)
Annual totals kWh/year													
Space heating fuel - main system												3235.0189	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.62 * 908 * 1.00) =										-1176.5791		-1176.5791	(233)
Total delivered energy for all uses												4331.1051	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3235.0189	0.2160	698.7641	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1796.1507	0.2160	387.9686	(264)
Space and water heating			1086.7326	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Energy saving/generation technologies				
PV Unit	-1176.5791	0.5190	-610.6445	(269)
Total CO2, kg/year			723.3992	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.1600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		9.1600	ZC1
Total Floor Area	TFA	79.0000	
Assumed number of occupants	N	2.4436	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3025	ZC2
CO2 emissions from cooking, equation (L16)		2.2487	ZC3
Total CO2 emissions		27.7112	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.7112	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3100 (2b)	=	91.2450	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6300 (2c)	=	103.8850	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.1300	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1537	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4037	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3432	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032	(22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			7.3100	1.3258	9.6913			(27)
Ground floor			39.5000	0.1300	5.1350			(28a)
External Wall	87.8700	11.5900	76.2800	0.1800	13.7304			(29a)
Main Roof	39.5000		39.5000	0.1300	5.1350			(30)
Total net area of external elements Aum(A, m2)			166.8700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.8277			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.1142	(36)
Total fabric heat loss (33) + (36) =	47.9419	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3607	38.1213	37.8867	36.7847	36.5785	35.6186	35.6186	35.4409	35.9884	36.5785	36.9956	37.4316	(38)
Heat transfer coeff	86.3026	86.0632	85.8286	84.7265	84.5204	83.5605	83.5605	83.3828	83.9302	84.5204	84.9375	85.3735	(39)
Average = Sum(39)m / 12 =												84.7256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0924	1.0894	1.0864	1.0725	1.0699	1.0577	1.0577	1.0555	1.0624	1.0699	1.0752	1.0807	(40)
HLP (average)												1.0725	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)
Average daily hot water use (litres/day)	92.2358	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0010	47.9424	44.5764	44.1822	40.9375	42.3021	44.1822	44.5764	47.9424	48.2153	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.0043	(64)
Heat gains from water heating, kWh/month													
	62.7681	55.0054	57.1370	50.5082	48.8163	42.8277	40.7780	45.7034	46.2158	52.8583	56.6696	61.1896	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.7354	20.1934	16.4224	12.4328	9.2937	7.8461	8.4780	11.0200	14.7910	18.7806	21.9197	23.3673	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	84.3658	81.8533	76.7970	70.1503	65.6133	59.4829	54.8092	61.4292	64.1887	71.0461	78.7078	82.2440	(72)
Total internal gains													
	387.0932	384.2940	369.7835	347.0482	324.0994	302.1671	288.5357	295.4425	307.6562	330.6022	356.6758	376.0139	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.0100	19.6403	0.6300	0.7000	0.7700	18.0670	(76)
South	1.2000	46.7521	0.6300	0.7000	0.7700	17.1456	(78)
West	3.1000	19.6403	0.6300	0.7000	0.7700	18.6072	(80)

Solar gains	53.8198	99.8226	153.9188	212.7411	253.3048	256.7196	245.4218	215.2563	174.7780	115.4156	66.0518	44.9745	(83)
Total gains	440.9130	484.1166	523.7023	559.7892	577.4042	558.8867	533.9576	510.6989	482.4342	446.0178	422.7276	420.9883	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5684	63.7452	63.9194	64.7508	64.9088	65.6543	65.6543	65.7943	65.3651	64.9088	64.5900	64.2601	
alpha	5.2379	5.2497	5.2613	5.3167	5.3273	5.3770	5.3770	5.3863	5.3577	5.3273	5.3060	5.2840	
util living area													
	0.9986	0.9974	0.9939	0.9814	0.9402	0.8240	0.6568	0.7034	0.9087	0.9865	0.9972	0.9989	(86)
MIT	19.7974	19.9148	20.1292	20.4262	20.7066	20.9102	20.9795	20.9706	20.8300	20.4704	20.0851	19.7794	(87)
Th 2	20.0070	20.0095	20.0119	20.0234	20.0255	20.0355	20.0355	20.0374	20.0317	20.0255	20.0212	20.0166	(88)
util rest of house													
	0.9981	0.9965	0.9916	0.9736	0.9124	0.7446	0.5286	0.5788	0.8557	0.9795	0.9961	0.9985	(89)
MIT 2	18.3961	18.5694	18.8838	19.3214	19.7130	19.9682	20.0270	20.0237	19.8812	19.3898	18.8271	18.3767	(90)
Living area fraction									fLA = Living area / (4) =			0.1629	(91)
MIT	18.6244	18.7886	19.0867	19.5014	19.8748	20.1216	20.1822	20.1779	20.0357	19.5658	19.0321	18.6052	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6244	18.7886	19.0867	19.5014	19.8748	20.1216	20.1822	20.1779	20.0357	19.5658	19.0321	18.6052	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9948	0.9885	0.9679	0.9070	0.7527	0.5493	0.5985	0.8559	0.9747	0.9943	0.9977	(94)
Useful gains	439.6300	481.6027	517.6584	541.8105	523.6899	420.6927	293.3230	305.6436	412.9284	434.7258	420.3375	420.0274	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1236.2330	1195.2946	1080.2956	898.2201	690.9411	461.3914	299.3270	315.0153	498.1875	757.7933	1013.4803	1229.8265	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	592.6726	479.6010	418.6021	256.6149	124.4349	0.0000	0.0000	0.0000	0.0000	240.3622	427.0629	602.4906	(98)
Space heating												3141.8412	(98)
Space heating per m2											(98) / (4) =	39.7701	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3363.8557	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	592.6726	479.6010	418.6021	256.6149	124.4349	0.0000	0.0000	0.0000	0.0000	240.3622	427.0629	602.4906	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	634.5531	513.4914	448.1821	274.7483	133.2280	0.0000	0.0000	0.0000	0.0000	257.3471	457.2408	645.0649	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6051	87.4402	87.0598	86.1894	84.4608	80.3000	80.3000	80.3000	80.3000	85.9102	87.1206	87.6858	(217)
Fuel for water heating, kWh/month													
	229.9184	201.9614	211.0459	189.0773	186.8069	173.0542	165.7991	184.8272	186.8684	198.8912	209.3629	224.2925	(219)
Water heating fuel used												2361.9054	(219)
Annual totals kWh/year													
Space heating fuel - main system												3363.8557	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												401.5146	(232)
Total delivered energy for all uses												6202.2757	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3363.8557	0.2160	726.5928	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2361.9054	0.2160	510.1716	(264)
Space and water heating			1236.7644	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	401.5146	0.5190	208.3861	(268)
Total CO2, kg/m2/year			1484.0755	(272)
Emissions per m2 for space and water heating			15.6552	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6378	(272b)
Emissions per m2 for pumps and fans			0.4927	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6552 * 1.00) + 2.6378 + 0.4927, rounded to 2 d.p.			18.7900	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 459 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 459	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 459, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	17.81 m	39.50 m²	2.31 m
1st Storey:	17.81 m	39.50 m²	2.63 m

7.0 Living Area	12.87	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	226.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	87.87	76.28

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	39.50	39.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	39.50

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.69	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.96	100
W4	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.48	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					2.05	100
W6	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2	Half Glazed Door	[1] External Wall	East							2.14	100

14.0 Conservatory None

15.0 Draught Proofing 100 %

16.0 Draught Lobby No

17.0 Thermal Bridging Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	8.41	0.065	No
Independently assessed	E3 Sill	6.36	0.004	No
Independently assessed	E4 Jamb	21.90	0.005	No
Independently assessed	E5 Ground floor (normal)	17.81	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	17.81	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.40	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value 0.025 W/m²K

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	$m^3/(h.m^2)$ @ 50 Pa
Property Tested ?		
As Built AP_{50}		$m^3/(h.m^2)$ @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	

PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.62	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£44	A 93	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 459 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 459	**Prop Type Ref**	Opp
Property	AL24 - Semi SG, Plot 459, Boorley Gardens, Southampton, SO32		

SAP Rating	92 A	**DER**	9.16	**TER**	18.79
Environmental	94 A	**% DER<TER**	51.24		
CO_2 Emissions (t/year)	0.37	**DFEE**	40.07	**TFEE**	51.50
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.19		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	79	m^2	
DER	9.16	$kgCO_2/yr/m^2$	
TER	18.79	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	9.16	$kgCO_2/yr/m^2$	
Reduction DER/TER	51.24	%	
CfSH ENE1 credits achieved	5.6		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	40.07	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	8.4		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	79	m^2	
DER	19.34	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	37.89	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	11.61	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	16.30	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	2.25	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	30.16	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	30.16	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	20	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 460 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 460	**Prop Type Ref**	As
Property	LOC-S Lockton - Semi SG, Plot 460, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.98	**TER**	16.65
Environmental	96 A	**% DER<TER**	64.08		
CO_2 Emissions (t/year)	0.20	**DFEE**	37.96	**TFEE**	49.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Semi-Detached House, total floor area 109 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.65 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.98 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.04 m², No overhang
Windows facing East: 7.93 m², No overhang
Windows facing West: 4.13 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.3300 (1b)	x	2.3100 (2b)	=	125.5023	(1b) - (3b)
First floor	54.3300 (1c)	x	2.6300 (2c)	=	142.8879	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.3902	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1118	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3368	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2863	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3650	0.3578	0.3507	0.3149	0.3077	0.2719	0.2719	0.2648	0.2863	0.3077	0.3220	0.3364	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6150	0.6078	0.6007	0.5649	0.5577	0.5219	0.5219	0.5148	0.5363	0.5577	0.5720	0.5864	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.1000	1.2357	16.1882			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			54.3300	0.1300	7.0629			(28a)
External Wall	103.4200	15.2400	88.1800	0.2100	18.5178			(29a)
Main Roof	54.3300		54.3300	0.0700	3.8031			(30)
Total net area of external elements Aum(A, m2)			212.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.7820			(33)
Party Wall			46.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	179.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7113	(36)
Total fabric heat loss (33) + (36) =	53.4933	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.4683	53.8344	53.2006	50.0313	49.3975	46.2283	46.2283	45.5944	47.4960	49.3975	50.6652	51.9329	(38)
Heat transfer coeff	107.9616	107.3277	106.6939	103.5247	102.8908	99.7216	99.7216	99.0878	100.9893	102.8908	104.1585	105.4262	(39)
Average = Sum(39)m / 12 =												103.3662	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9936	0.9877	0.9819	0.9527	0.9469	0.9177	0.9177	0.9119	0.9294	0.9469	0.9586	0.9702	(40)
HLP (average)												0.9513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8065 (42)
Average daily hot water use (litres/day)	100.8553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9408	106.9066	102.8724	98.8382	94.8040	90.7698	90.7698	94.8040	98.8382	102.8724	106.9066	110.9408	(44)
Energy conte	164.5220	143.8920	148.4837	129.4517	124.2120	107.1855	99.3231	113.9747	115.3359	134.4129	146.7222	159.3308	(45)
Energy content (annual)										Total = Sum(45)m =		1586.8466	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6783	21.5838	22.2726	19.4178	18.6318	16.0778	14.8985	17.0962	17.3004	20.1619	22.0083	23.8996	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8229	10.6689	11.7893	11.3759	11.7247	11.3115	11.6668	11.7044	11.3466	11.7597	11.4153	11.8120 (61)

Total heat required for water heating calculated for each month

	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428 (64)

Total per year (kWh/year) = Sum(64)m = 1725.2445 (64)

Heat gains from water heating, kWh/month

	57.6593	50.5113	52.3181	45.8867	44.2317	38.4671	35.9416	40.8227	41.1858	47.6322	51.6390	55.9305 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.6522	23.6722	19.2516	14.5747	10.8947	9.1978	9.9385	12.9185	17.3392	22.0161	25.6960	27.3929	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)

Water heating gains (Table 5)

	77.4991	75.1657	70.3201	63.7315	59.4512	53.4265	48.3086	54.8692	57.2026	64.0218	71.7208	75.1754	(72)

Total internal gains

	441.8659	439.3503	423.0338	396.7590	369.8522	344.3236	328.0503	334.7930	348.5974	375.1028	405.4282	428.3868	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.7200	0.7000	0.7700	3.8625	(74)
East	7.9300	19.6403	0.7200	0.7000	0.7700	54.3982	(76)
West	4.1300	19.6403	0.7200	0.7000	0.7700	28.3309	(80)

Solar gains	86.5916	169.2171	279.0632	408.8511	503.5114	516.7050	491.3893	420.3163	325.0548	200.8183	107.9184	71.2524	(83)
Total gains	528.4575	608.5675	702.0970	805.6101	873.3636	861.0286	819.4396	755.1093	673.6522	575.9211	513.3466	499.6392	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.0439	50.3394	50.6385	52.1887	52.5102	54.1790	54.1790	54.5256	53.4989	52.5102	51.8711	51.2474	
alpha	4.3363	4.3560	4.3759	4.4792	4.5007	4.6119	4.6119	4.6350	4.5666	4.5007	4.4581	4.4165	
util living area													
	0.9965	0.9931	0.9825	0.9458	0.8535	0.6820	0.5211	0.5791	0.8339	0.9706	0.9936	0.9973	(86)
MIT	19.5232	19.6981	20.0053	20.4265	20.7525	20.9399	20.9861	20.9782	20.8413	20.4019	19.9057	19.5188	(87)
Th 2	20.0887	20.0936	20.0984	20.1229	20.1278	20.1524	20.1524	20.1574	20.1426	20.1278	20.1180	20.1082	(88)
util rest of house													
	0.9957	0.9914	0.9780	0.9313	0.8153	0.6104	0.4271	0.4834	0.7776	0.9602	0.9918	0.9967	(89)
MIT 2	18.0917	18.3500	18.7997	19.4184	19.8619	20.1038	20.1451	20.1448	19.9938	19.3953	18.6706	18.0985	(90)
Living area fraction										fLA = Living area / (4) =		0.1775	(91)
MIT	18.3458	18.5894	19.0137	19.5973	20.0200	20.2522	20.2944	20.2928	20.1443	19.5740	18.8898	18.3506	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3458	18.5894	19.0137	19.5973	20.0200	20.2522	20.2944	20.2928	20.1443	19.5740	18.8898	18.3506	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9873	0.9706	0.9206	0.8099	0.6193	0.4433	0.4995	0.7777	0.9514	0.9880	0.9947	(94)
Useful gains	524.8821	600.8311	681.4526	741.6291	707.3544	533.2458	363.2756	377.1464	523.9078	547.9405	507.1755	496.9811	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1516.4112	1469.2479	1335.1350	1107.4392	856.0528	563.6511	368.4132	385.7275	610.4051	923.3431	1228.0126	1491.8453	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	737.6977	583.5761	486.3397	263.3833	110.6316	0.0000	0.0000	0.0000	0.0000	279.2996	519.0027	740.1790	(98)
Space heating												3720.1097	(98)
Space heating per m2											(98) / (4) =	34.2362	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3987.2558	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	737.6977	583.5761	486.3397	263.3833	110.6316	0.0000	0.0000	0.0000	0.0000	279.2996	519.0027	740.1790	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	790.6727	625.4835	521.2644	282.2972	118.5762	0.0000	0.0000	0.0000	0.0000	299.3564	556.2730	793.3322	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	176.3450	154.5609	160.2729	140.8276	135.9367	118.4970	110.9899	125.6791	126.6825	146.1726	158.1375	171.1428	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5824	89.5217	89.3801	89.0123	88.2791	86.7000	86.7000	86.7000	86.7000	89.0300	89.4328	89.6013	(217)
Fuel for water heating, kWh/month													
	196.8523	172.6520	179.3161	158.2113	153.9851	136.6747	128.0160	144.9586	146.1159	164.1836	176.8228	191.0049	(219)
Water heating fuel used												1948.7934	(219)
Annual totals kWh/year													
Space heating fuel - main system												3987.2558	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.6862	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												4716.8667	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3987.2558	0.2160	861.2473	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1948.7934	0.2160	420.9394	(264)
Space and water heating			1282.1866	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.6862	0.5190	244.2861	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			649.4309	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.9800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.9800	ZC1
Total Floor Area	TFA	108.6600	
Assumed number of occupants	N	2.8065	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7036	ZC2
CO2 emissions from cooking, equation (L16)		1.7150	ZC3
Total CO2 emissions		22.3986	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.3986	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	54.3300 (1b)	x	2.3100 (2b)	=	125.5023	(1b) - (3b)
First floor	54.3300 (1c)	x	2.6300 (2c)	=	142.8879	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.3902	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1490 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3990 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3392 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4325	0.4240	0.4155	0.3731	0.3646	0.3222	0.3222	0.3137	0.3392	0.3646	0.3816	0.3985	(22b)
Effective ac	0.5935	0.5899	0.5863	0.5696	0.5665	0.5519	0.5519	0.5492	0.5575	0.5665	0.5728	0.5794	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.1000	1.3258	17.3674			(27)
Ground floor			54.3300	0.1300	7.0629			(28a)
External Wall	103.4200	15.2400	88.1800	0.1800	15.8724			(29a)
Main Roof	54.3300		54.3300	0.1300	7.0629			(30)
Total net area of external elements Aum(A, m2)			212.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.9336			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1252	(36)
Total fabric heat loss (33) + (36) =	60.0588	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.5664	52.2448	51.9295	50.4489	50.1719	48.8823	48.8823	48.6435	49.3790	50.1719	50.7323	51.3182	(38)
Heat transfer coeff	112.6252	112.3036	111.9884	110.5077	110.2307	108.9411	108.9411	108.7023	109.4379	110.2307	110.7911	111.3770	(39)
Average = Sum(39)m / 12 =												110.5064	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0365	1.0335	1.0306	1.0170	1.0145	1.0026	1.0026	1.0004	1.0072	1.0145	1.0196	1.0250	(40)
HLP (average)												1.0170	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8065 (42)
Average daily hot water use (litres/day)	100.8553 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.9408	106.9066	102.8724	98.8382	94.8040	90.7698	90.7698	94.8040	98.8382	102.8724	106.9066	110.9408	(44)
Energy conte	164.5220	143.8920	148.4837	129.4517	124.2120	107.1855	99.3231	113.9747	115.3359	134.4129	146.7222	159.3308	(45)
Energy content (annual)										Total = Sum(45)m =		1586.8466	(45)
Distribution loss (46)m = 0.15 x (45)m	24.6783	21.5838	22.2726	19.4178	18.6318	16.0778	14.8985	17.0962	17.3004	20.1619	22.0083	23.8996	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.7421	48.3111	44.7632	46.2553	48.3111	48.7421	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(64)
								Total per year (kWh/year) = Sum(64)m =				2171.1495	(64)
Heat gains from water heating, kWh/month													
	67.4433	59.3509	62.1106	55.2282	53.3782	46.8300	44.5888	49.9744	50.5347	57.4320	61.1139	65.7172	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.6522	23.6722	19.2516	14.5747	10.8947	9.1978	9.9385	12.9185	17.3392	22.0161	25.6960	27.3929	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)													
	90.6496	88.3199	83.4819	76.7059	71.7450	65.0416	59.9311	67.1698	70.1871	77.1936	84.8804	88.3296	(72)
Total internal gains													
	455.0164	452.5045	436.1956	409.7334	382.1460	355.9387	339.6728	347.0937	361.5819	388.2745	418.5878	441.5410	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0400	10.6334	0.6300	0.7000	0.7700	3.3797	(74)
East	7.9300	19.6403	0.6300	0.7000	0.7700	47.5984	(76)
West	4.1300	19.6403	0.6300	0.7000	0.7700	24.7896	(80)

Solar gains	75.7677	148.0650	244.1803	357.7447	440.5724	452.1169	429.9656	367.7768	284.4230	175.7160	94.4286	62.3458	(83)
Total gains	530.7841	600.5695	680.3759	767.4781	822.7185	808.0556	769.6384	714.8705	646.0049	563.9906	513.0164	503.8868	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9995	67.1914	67.3805	68.2833	68.4549	69.2652	69.2652	69.4174	68.9509	68.4549	68.1086	67.7504	
alpha	5.4666	5.4794	5.4920	5.5522	5.5637	5.6177	5.6177	5.6278	5.5967	5.5637	5.5406	5.5167	
util living area													
	0.9993	0.9984	0.9951	0.9799	0.9240	0.7799	0.6056	0.6684	0.9062	0.9901	0.9985	0.9995	(86)
MIT	19.8082	19.9329	20.1635	20.4818	20.7652	20.9405	20.9883	20.9803	20.8494	20.4789	20.0901	19.7905	(87)
Th 2	20.0530	20.0555	20.0579	20.0692	20.0713	20.0812	20.0812	20.0830	20.0774	20.0713	20.0670	20.0625	(88)
util rest of house													
	0.9990	0.9978	0.9932	0.9717	0.8918	0.6982	0.4880	0.5504	0.8537	0.9848	0.9979	0.9993	(89)
MIT 2	18.4451	18.6293	18.9676	19.4354	19.8259	20.0383	20.0764	20.0740	19.9439	19.4371	18.8679	18.4262	(90)
Living area fraction										fLA = Living area / (4) =		0.1775	(91)
MIT	18.6871	18.8607	19.1799	19.6212	19.9926	20.1985	20.2383	20.2349	20.1047	19.6220	19.0849	18.6684	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6871	18.8607	19.1799	19.6212	19.9926	20.1985	20.2383	20.2349	20.1047	19.6220	19.0849	18.6684	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9968	0.9908	0.9664	0.8885	0.7097	0.5089	0.5711	0.8556	0.9811	0.9968	0.9989	(94)
Useful gains	529.9838	598.6367	674.0921	741.7202	731.0041	573.4463	391.6815	408.2727	552.6972	553.3309	511.3923	503.3187	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1620.3487	1567.8352	1420.0009	1184.7717	914.1045	609.9053	396.3616	416.8652	657.1377	994.5069	1327.8210	1611.4478	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	811.2314	651.3014	554.9561	318.9971	136.2266	0.0000	0.0000	0.0000	0.0000	328.2350	587.8287	824.4480	(98)
Space heating												4213.2244	(98)
Space heating per m2											(98) / (4) =	38.7744	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4510.9469	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	811.2314	651.3014	554.9561	318.9971	136.2266	0.0000	0.0000	0.0000	0.0000	328.2350	587.8287	824.4480	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	868.5562	697.3248	594.1714	341.5386	145.8529	0.0000	0.0000	0.0000	0.0000	351.4293	629.3669	882.7067	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.4809	189.9194	199.4426	178.1938	172.5230	151.9487	145.5784	162.2858	164.0781	185.3718	196.0373	210.2897	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0750	87.9038	87.4907	86.5006	84.4637	80.3000	80.3000	80.3000	80.3000	86.4744	87.6431	88.1468	(217)
Fuel for water heating, kWh/month													
	244.6561	216.0536	227.9586	206.0029	204.2570	189.2262	181.2931	202.0994	204.3313	214.3661	223.6768	238.5676	(219)
Water heating fuel used												2552.4888	(219)
Annual totals kWh/year													
Space heating fuel - main system												4510.9469	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												470.6862	(232)
Total delivered energy for all uses												7609.1219	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4510.9469	0.2160	974.3645	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2552.4888	0.2160	551.3376	(264)
Space and water heating			1525.7021	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	470.6862	0.5190	244.2861	(268)
Total CO2, kg/m2/year			1808.9132	(272)
Emissions per m2 for space and water heating			14.0411	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2482	(272b)
Emissions per m2 for pumps and fans			0.3582	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0411 * 1.00) + 2.2482 + 0.3582, rounded to 2 d.p.			16.6500	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 460 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 460	**Prop Type Ref**	As
Property	LOC-S Lockton - Semi SG, Plot 460, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.98	**TER**	16.65
Environmental	96 A	**% DER<TER**	64.08		
CO_2 Emissions (t/year)	0.20	**DFEE**	37.96	**TFEE**	49.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	20.96 m	54.33 m²	2.31 m
1st Storey:	20.96 m	54.33 m²	2.63 m

7.0 Living Area	19.29	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	179.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	103.42	88.18

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	46.44

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	54.33	54.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	54.33

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					2.72	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.31	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.52	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.52	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
D2 W8	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.80	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.56	0.065	No
Independently assessed	E3 Sill	7.72	0.004	No
Independently assessed	E4 Jamb	24.75	0.005	No
Independently assessed	E5 Ground floor (normal)	20.96	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	20.96	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	11.55	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	9.41	0.051	No
Independently assessed	E16 Corner (normal)	9.87	0.037	No
Independently assessed	E18 Party wall between dwellings	9.87	0.030	No
Independently assessed	P1 Party wall - Ground floor	9.41	0.046	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.41	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	9.41	0.037	No

Y-value	0.022	W/m²K

18.0 Pressure Testing — Yes

Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System — No

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 460 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 460	**Prop Type Ref**	As
Property	LOC-S Lockton - Semi SG, Plot 460, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	5.98	**TER**	16.65
Environmental	96 A	**% DER<TER**	64.08		
CO_2 Emissions (t/year)	0.20	**DFEE**	37.96	**TFEE**	49.74
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.69		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	108.66	m^2	
DER	5.98	$kgCO_2/yr/m^2$	
TER	16.65	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.98	$kgCO_2/yr/m^2$	
Reduction DER/TER	64.08	%	
CfSH ENE1 credits achieved	6.5		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached		
Fabric energy efficiency (F.E.E.)	37.96	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	9.0		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	108.66	m^2	
DER	16.43	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.70	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.72	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.85	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.85	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	8.00	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.70	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.72	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	24.42	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	24.42	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 461 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 461	**Prop Type Ref**	As
Property	L363-R - Det SG, Plot 461, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.06	**TER**	17.94
Environmental	95 A	**% DER<TER**	60.64		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.72	**TFEE**	54.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 99 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.94 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.06 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)54.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.07 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing East: 7.03 m², No overhang
Windows facing South: 0.72 m², No overhang
Windows facing West: 5.17 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.43 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1631	(8)
Pressure test		Yes	
Measured/design AP50		4.5000	
Infiltration rate		0.3881	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3299	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4206	0.4123	0.4041	0.3629	0.3546	0.3134	0.3134	0.3051	0.3299	0.3546	0.3711	0.3876	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation:	0.5000	(23a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.6706	0.6623	0.6541	0.6129	0.6046	0.5634	0.5634	0.5551	0.5799	0.6046	0.6211	0.6376	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			13.8800	1.2357	17.1521			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.0200	127.5400	0.2100	26.7834			(29a)
Main Roof	49.6500		49.6500	0.0700	3.4755			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.0755			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8243	(36)
Total fabric heat loss					(33) + (36) =		61.8998	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.2769	53.6094	52.9419	49.6045	48.9370	45.5995	45.5995	44.9320	46.9345	48.9370	50.2720	51.6070	(38)
Heat transfer coeff	116.1768	115.5093	114.8418	111.5043	110.8368	107.4994	107.4994	106.8319	108.8343	110.8368	112.1718	113.5068	(39)
Average = Sum(39)m / 12 =												111.3374	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1700	1.1632	1.1565	1.1229	1.1162	1.0826	1.0826	1.0758	1.0960	1.1162	1.1296	1.1431	(40)
HLP (average)												1.1212	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330	(42)
Average daily hot water use (litres/day)	99.1076	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.8169 10.6637 11.7839 11.3667 11.7162 11.3045 11.6603 11.6966 11.3384 11.7548 11.4100 11.8062 (61)
Total heat required for water heating calculated for each month
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
173.4880 152.0622 157.6945 138.5751 133.7757 116.6326 109.2622 123.6962 124.6756 143.8385 155.5896 168.3760 (64)
Total per year (kWh/year) = Sum(64)m = 1697.6662 (64)
Heat gains from water heating, kWh/month
56.7099 49.6809 51.4612 45.1385 43.5138 37.8477 35.3677 40.1640 40.5192 46.8565 50.7922 55.0110 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
24.4155 21.6856 17.6359 13.3515 9.9804 8.4259 9.1045 11.8343 15.8840 20.1684 23.5395 25.0941 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
255.1911 257.8392 251.1661 236.9599 219.0271 202.1728 190.9131 188.2650 194.9381 209.1443 227.0771 243.9314 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 36.6648 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 -109.3180 (71)
Water heating gains (Table 5)
76.2229 73.9299 69.1683 62.6923 58.4863 52.5663 47.5372 53.9839 56.2767 62.9792 70.5448 73.9395 (72)
Total internal gains
422.8238 420.4490 404.9646 379.9980 354.4881 330.1592 314.5491 321.0775 334.0931 359.2862 388.1557 409.9593 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.7200	0.7000	0.7700	3.5654	(74)
East	7.0300	19.6403	0.7200	0.7000	0.7700	48.2244	(76)
South	0.7200	46.7521	0.7200	0.7000	0.7700	11.7570	(78)
West	5.1700	19.6403	0.7200	0.7000	0.7700	35.4651	(80)

Solar gains 99.0119 189.7830 305.7197 439.5350 535.8410 547.9311 521.8545 449.6688 353.1149 223.1400 122.6854 81.9536 (83)
Total gains 521.8357 610.2320 710.6844 819.5330 890.3291 878.0904 836.4036 770.7463 687.2080 582.4262 510.8411 491.9129 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.4851	47.7595	48.0371	49.4749	49.7729	51.3181	51.3181	51.6388	50.6887	49.7729	49.1805	48.6021	
alpha	4.1657	4.1840	4.2025	4.2983	4.3182	4.4212	4.4212	4.4426	4.3792	4.3182	4.2787	4.2401	

util living area
0.9969 0.9936 0.9838 0.9504 0.8662 0.7049 0.5448 0.6034 0.8483 0.9733 0.9943 0.9976 (86)

MIT	19.4117	19.5960	19.9163	20.3555	20.7063	20.9213	20.9803	20.9699	20.8091	20.3371	19.8138	19.4067	(87)
Th 2	19.9441	19.9495	19.9549	19.9822	19.9876	20.0151	20.0151	20.0206	20.0041	19.9876	19.9767	19.9658	(88)

util rest of house
0.9961 0.9918 0.9790 0.9350 0.8244 0.6223 0.4324 0.4899 0.7858 0.9623 0.9924 0.9970 (89)

MIT 2	17.8181	18.0904	18.5593	19.2052	19.6817	19.9555	20.0060	20.0052	19.8333	19.1920	18.4274	17.8251	(90)

Living area fraction fLA = Living area / (4) = 0.1233 (91)

MIT	18.0145	18.2760	18.7265	19.3470	19.8080	20.0745	20.1261	20.1241	19.9536	19.3332	18.5983	18.0200	(92)

Temperature adjustment 0.0000
adjusted MIT 18.0145 18.2760 18.7265 19.3470 19.8080 20.0745 20.1261 20.1241 19.9536 19.3332 18.5983 18.0200 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9875	0.9709	0.9226	0.8157	0.6277	0.4456	0.5026	0.7820	0.9524	0.9884	0.9950	(94)
Useful gains	518.4690	602.5973	690.0187	756.0930	726.2684	551.1530	372.6975	387.3664	537.4090	554.6961	504.9319	489.4357	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W
1593.3067 1545.0552 1404.1158 1164.8814 898.6657 588.5055 379.0488 397.8515 637.0714 967.9572 1289.7867 1568.6670 (97)

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh
799.6793 633.3318 531.2882 294.3276 128.2636 0.0000 0.0000 0.0000 0.0000 307.4662 565.0954 802.9481 (98)
Space heating 4062.4002 (98)
Space heating per m2 (98) / (4) = 40.9104 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4354.1267	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	799.6793	633.3318	531.2882	294.3276	128.2636	0.0000	0.0000	0.0000	0.0000	307.4662	565.0954	802.9481	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	857.1053	678.8122	569.4408	315.4637	137.4744	0.0000	0.0000	0.0000	0.0000	329.5458	605.6757	860.6089	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.4880	152.0622	157.6945	138.5751	133.7757	116.6326	109.2622	123.6962	124.6756	143.8385	155.5896	168.3760	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.6365	89.5798	89.4499	89.1155	88.4256	86.7000	86.7000	86.7000	86.7000	89.1206	89.4977	89.6547	(217)
Fuel for water heating, kWh/month													
	193.5462	169.7504	176.2936	155.5005	151.2863	134.5243	126.0233	142.6715	143.8012	161.3976	173.8476	187.8050	(219)
Water heating fuel used												1916.4476	(219)
Annual totals kWh/year													
Space heating fuel - main system												4354.1267	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1851	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.43 * 908 * 1.00) =										-1764.8686		-1764.8686	(233)
Total delivered energy for all uses												5011.8907	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4354.1267	0.2160	940.4914	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.4476	0.2160	413.9527	(264)
Space and water heating			1354.4440	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1851	0.5190	223.7851	(268)
Energy saving/generation technologies				
PV Unit	-1764.8686	0.5190	-915.9668	(269)
Total CO2, kg/year			701.1873	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.0600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.0600	ZC1
Total Floor Area	TFA	99.3000	
Assumed number of occupants	N	2.7330	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.8589	ZC3
Total CO2 emissions		24.1476	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1476	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	49.6500 (1b)	x	2.3100 (2b)	=	114.6915	(1b) - (3b)
First floor	49.6500 (1c)	x	2.6300 (2c)	=	130.5795	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	99.3000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.2710	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1223	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3723	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4035	0.3956	0.3877	0.3481	0.3402	0.3006	0.3006	0.2927	0.3165	0.3402	0.3560	0.3718	(22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5579	0.5452	0.5452	0.5428	0.5501	0.5579	0.5634	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			13.8800	1.3258	18.4015			(27)
Ground floor			49.6500	0.1300	6.4545			(28a)
External Wall	143.5600	16.0200	127.5400	0.1800	22.9572			(29a)
Main Roof	49.6500		49.6500	0.1300	6.4545			(30)
Total net area of external elements Aum(A, m2)			242.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		56.8357			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.6524	(36)
Total fabric heat loss (33) + (36) =	67.4881	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.0585	46.8027	46.5519	45.3740	45.1536	44.1276	44.1276	43.9376	44.5228	45.1536	45.5994	46.0655	(38)
Heat transfer coeff	114.5466	114.2908	114.0400	112.8621	112.6417	111.6157	111.6157	111.4258	112.0109	112.6417	113.0875	113.5536	(39)
Average = Sum(39)m / 12 =												112.8610	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1535	1.1510	1.1484	1.1366	1.1344	1.1240	1.1240	1.1221	1.1280	1.1344	1.1388	1.1435	(40)
HLP (average)												1.1366	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7330 (42)
Average daily hot water use (litres/day)	99.1076 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.0183	105.0540	101.0897	97.1254	93.1611	89.1968	89.1968	93.1611	97.1254	101.0897	105.0540	109.0183	(44)
Energy conte	161.6710	141.3985	145.9106	127.2084	122.0595	105.3281	97.6019	111.9996	113.3373	132.0837	144.1797	156.5698	(45)
Energy content (annual)										Total = Sum(45)m =		1559.3481	(45)
Distribution loss (46)m = 0.15 x (45)m	24.2507	21.2098	21.8866	19.0813	18.3089	15.7992	14.6403	16.7999	17.0006	19.8126	21.6269	23.4855	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.8975	47.4739	43.9875	45.4537	47.4739	47.8975	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
								Total per year (kWh/year) = Sum(64)m =				2138.7101	(64)
Heat gains from water heating, kWh/month													
	66.4953	58.5219	61.2550	54.2712	52.4533	46.0184	43.8161	49.1084	49.6590	56.6575	60.2685	64.7992	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	136.6475	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.4155	21.6856	17.6359	13.3515	9.9804	8.4259	9.1045	11.8343	15.8840	20.1684	23.5395	25.0941	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	255.1911	257.8392	251.1661	236.9599	219.0271	202.1728	190.9131	188.2650	194.9381	209.1443	227.0771	243.9314	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	36.6648	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	-109.3180	(71)
Water heating gains (Table 5)													
	89.3755	87.0861	82.3320	75.3766	70.5017	63.9145	58.8926	66.0059	68.9709	76.1526	83.7063	87.0957	(72)
Total internal gains													
	435.9763	433.6052	418.1283	392.6823	366.5035	341.5075	325.9044	333.0995	346.7872	372.4596	401.3172	423.1154	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9600	10.6334	0.6300	0.7000	0.7700	3.1197	(74)
East	7.0300	19.6403	0.6300	0.7000	0.7700	42.1963	(76)
South	0.7200	46.7521	0.6300	0.7000	0.7700	10.2874	(78)
West	5.1700	19.6403	0.6300	0.7000	0.7700	31.0320	(80)

Solar gains	86.6354	166.0601	267.5048	384.5931	468.8609	479.4397	456.6227	393.4602	308.9755	195.2475	107.3497	71.7094	(83)
Total gains	522.6117	599.6653	685.6331	777.2754	835.3643	820.9472	782.5271	726.5597	655.7628	567.7071	508.6669	494.8248	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2011	60.3359	60.4686	61.0997	61.2192	61.7819	61.7819	61.8872	61.5639	61.2192	60.9778	60.7275	
alpha	5.0134	5.0224	5.0312	5.0733	5.0813	5.1188	5.1188	5.1258	5.1043	5.0813	5.0652	5.0485	
util living area													
	0.9989	0.9976	0.9930	0.9745	0.9142	0.7734	0.6047	0.6661	0.8966	0.9869	0.9978	0.9992	(86)
MIT	19.6854	19.8257	20.0797	20.4234	20.7308	20.9245	20.9830	20.9728	20.8244	20.4203	19.9913	19.6618	(87)
Th 2	19.9573	19.9594	19.9615	19.9711	19.9729	19.9813	19.9813	19.9828	19.9780	19.9729	19.9692	19.9654	(88)
util rest of house													
	0.9985	0.9967	0.9903	0.9640	0.8776	0.6851	0.4762	0.5377	0.8379	0.9798	0.9968	0.9989	(89)
MIT 2	18.1969	18.4035	18.7752	19.2764	19.6968	19.9281	19.9747	19.9709	19.8265	19.2789	18.6529	18.1681	(90)
Living area fraction									fLA = Living area / (4) =			0.1233	(91)
MIT	18.3804	18.5788	18.9360	19.4178	19.8243	20.0509	20.0990	20.0944	19.9495	19.4196	18.8179	18.3522	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3804	18.5788	18.9360	19.4178	19.8243	20.0509	20.0990	20.0944	19.9495	19.4196	18.8179	18.3522	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9950	0.9865	0.9564	0.8712	0.6918	0.4918	0.5528	0.8358	0.9742	0.9952	0.9982	(94)
Useful gains	521.3674	596.6517	676.3740	743.3752	727.7545	567.9569	384.8822	401.6428	548.1025	553.0531	506.2056	493.9289	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1612.8643	1563.3567	1418.1993	1187.0631	915.1307	608.4071	390.5398	411.6488	655.2054	993.4533	1325.1497	1607.0390	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	812.0737	649.6258	551.9180	319.4553	139.4079	0.0000	0.0000	0.0000	0.0000	327.6577	589.6397	828.1539	(98)
Space heating												4217.9321	(98)
Space heating per m2											(98) / (4) =	42.4767	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4515.9872	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	812.0737	649.6258	551.9180	319.4553	139.4079	0.0000	0.0000	0.0000	0.0000	327.6577	589.6397	828.1539	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	869.4579	695.5308	590.9187	342.0292	149.2590	0.0000	0.0000	0.0000	0.0000	350.8113	631.3059	886.6744	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.6299	187.4259	196.8695	175.1059	169.5334	149.3155	143.0557	159.4735	161.2347	183.0426	193.4947	207.5287	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1006	87.9238	87.5062	86.5458	84.5633	80.3000	80.3000	80.3000	80.3000	86.5005	87.6753	88.1776	(217)
Fuel for water heating, kWh/month													
	241.3490	213.1686	224.9777	202.3274	200.4810	185.9471	178.1515	198.5972	200.7905	211.6087	220.6946	235.3530	(219)
Water heating fuel used												2513.4464	(219)
Annual totals kWh/year													
Space heating fuel - main system												4515.9872	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												431.1851	(232)
Total delivered energy for all uses												7535.6187	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4515.9872	0.2160	975.4532	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2513.4464	0.2160	542.9044	(264)
Space and water heating			1518.3577	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	431.1851	0.5190	223.7851	(268)
Total CO2, kg/m2/year			1781.0677	(272)
Emissions per m2 for space and water heating			15.2906	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2536	(272b)
Emissions per m2 for pumps and fans			0.3920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2906 * 1.00) + 2.2536 + 0.3920, rounded to 2 d.p.			17.9400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 461 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 461	**Prop Type Ref**	As
Property	L363-R - Det SG, Plot 461, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.06	**TER**	17.94
Environmental	95 A	**% DER<TER**	60.64		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.72	**TFEE**	54.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	29.09 m	49.65 m²	2.31 m
1st Storey:	29.09 m	49.65 m²	2.63 m

7.0 Living Area	12.24	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	143.56	127.54

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	49.65	49.65

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.13	49.65

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.50	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.41	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.78	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					1.41	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
D2 W10	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W8	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.48	100
W9	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	11.14	0.065	No
Independently assessed	E3 Sill	8.53	0.004	No
Independently assessed	E4 Jamb	29.85	0.005	No
Independently assessed	E5 Ground floor (normal)	29.09	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	29.09	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.94	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	18.15	0.051	No
Independently assessed	E16 Corner (normal)	19.74	0.037	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	One Dwelling	

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.43	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£46	A 95	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 461 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 461	**Prop Type Ref**	As
Property	L363-R - Det SG, Plot 461, Boorley Gardens, Southampton, SO32		

SAP Rating	94 A	**DER**	7.06	**TER**	17.94
Environmental	95 A	**% DER<TER**	60.64		
CO_2 Emissions (t/year)	0.26	**DFEE**	42.72	**TFEE**	54.82
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.06		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	99.3	m^2	
DER	7.06	$kgCO_2/yr/m^2$	
TER	17.94	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.06	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.64	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.72	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.8		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	99.3	m^2	
DER	18.63	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	35.72	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	35.72	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.40	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	15.23	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.86	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	26.49	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	26.49	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	26	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 462 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 462	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 462, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.15	**TER**	18.04
Environmental	95 A	**% DER<TER**	60.37		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.92	**TFEE**	61.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 118 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.04 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.15 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.41 m², No overhang
Windows facing East: 9.86 m², No overhang
Windows facing West: 9.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.020 W/m²K
Photovoltaic array 2.84 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1721	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3971	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3375	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4303	0.4219	0.4134	0.3713	0.3628	0.3206	0.3206	0.3122	0.3375	0.3628	0.3797	0.3966	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation: 0.5000 (23a)

Effective ac	0.6803	0.6719	0.6634	0.6213	0.6128	0.5706	0.5706	0.5622	0.5875	0.6128	0.6297	0.6466	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			27.3200	1.2357	33.7605			(27)
Opening Type 8			2.1400	1.5000	3.2100			(26a)
Ground floor			59.5300	0.1200	7.1436			(28a)
External Wall	169.1800	29.4600	139.7200	0.2100	29.3412			(29a)
Main Roof	58.2000		58.2000	0.0700	4.0740			(30)
Bay roof	1.3200		1.3200	0.1600	0.2112			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.7405			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							211.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7786	(36)
Total fabric heat loss					(33) + (36) =		83.5191	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	65.2373	64.4282	63.6191	59.5735	58.7644	54.7189	54.7189	53.9098	56.3371	58.7644	60.3827	62.0009	(38)
Heat transfer coeff	148.7564	147.9473	147.1382	143.0926	142.2835	138.2380	138.2380	137.4289	139.8562	142.2835	143.9017	145.5200	(39)
Average = Sum(39)m / 12 =												142.8904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2635	1.2567	1.2498	1.2154	1.2086	1.1742	1.1742	1.1673	1.1879	1.2086	1.2223	1.2360	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8541 (42)
Average daily hot water use (litres/day) 101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.8268   10.6723   11.7927   11.3819   11.7303   11.3161   11.6710   11.7095   11.3520   11.7629   11.4188   11.8158 (61)
Total heat required for water heating calculated for each month
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              178.1915  156.1759  161.9394  142.2835  137.3334  119.7021  112.1066  126.9607  127.9797  147.6812  159.7843  172.9311 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1743.0693 (64)
Heat gains from water heating, kWh/month
               58.2730   51.0480   52.8720   46.3702   44.6956   38.8674   36.3126   41.2484   41.6167   48.1336   52.1862   56.5248 (65)


-------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050  142.7050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               25.1608   22.3476   18.1743   13.7591   10.2851    8.6831    9.3824   12.1956   16.3689   20.7841   24.2581   25.8601 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              282.2278  285.1565  277.7764  262.0651  242.2324  223.5924  211.1397  208.2111  215.5912  231.3025  251.1352  269.7752 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705   37.2705 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 -114.1640 (71)
Water heating gains (Table 5)
               78.3239   75.9643   71.0645   64.4031   60.0748   53.9824   48.8072   55.4414   57.8010   64.6956   72.4809   75.9742 (72)
Total internal gains
              454.5240  452.2799  435.8267  409.0388  381.4037  355.0694  338.1409  344.6596  358.5726  385.5938  416.6857  440.4210 (73)


-------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------

[Jan]                                  Area          Solar flux              g                FF            Access            Gains
                                       m2             Table 6a       Specific data    Specific data       factor                W
                                                         W/m2       or Table 6b      or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                 8.4100            10.6334            0.7200           0.7000           0.7700           31.2343 (74)
East                                  9.8600            19.6403            0.7200           0.7000           0.7700           67.6376 (76)
West                                  9.0500            19.6403            0.7200           0.7000           0.7700           62.0811 (80)
-------------------------------------------------------------------------------------------------------------------

Solar gains   160.9530  313.4476  519.3306  772.4055  966.4155  999.5807  947.3155  799.3376  607.9873  372.1580  200.2755  132.7128 (83)
Total gains   615.4770  765.7275  955.1573 1181.4443 1347.8192 1354.6501 1285.4563 1143.9972  966.5599  757.7517  616.9612  573.1338 (84)


-------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           46.3865   46.6402   46.8966   48.2225   48.4967   49.9160   49.9160   50.2099   49.3384   48.4967   47.9514   47.4181
alpha          4.0924    4.1093    4.1264    4.2148    4.2331    4.3277    4.3277    4.3473    4.2892    4.2331    4.1968    4.1612
util living area
               0.9975    0.9936    0.9796    0.9266    0.8014    0.6131    0.4632    0.5330    0.8103    0.9704    0.9950    0.9982 (86)

MIT           19.3374   19.5568   19.9322   20.4284   20.7814   20.9510   20.9884   20.9797   20.8358   20.3308   19.7572   19.3259 (87)
Th 2          19.8695   19.8749   19.8804   19.9077   19.9132   19.9407   19.9407   19.9462   19.9297   19.9132   19.9022   19.8913 (88)
util rest of house
               0.9968    0.9916    0.9733    0.9043    0.7472    0.5263    0.3565    0.4200    0.7363    0.9575    0.9932    0.9976 (89)
MIT 2         17.6527   17.9763   18.5237   19.2413   19.7006   19.9072   19.9360   19.9370   19.7927   19.1237   18.2879   17.6502 (90)
Living area fraction                                                                    fLA = Living area / (4) =      0.2538 (91)
MIT           18.0803   18.3775   18.8811   19.5426   19.9749   20.1721   20.2031   20.2017   20.0574   19.4301   18.6608   18.0755 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT  18.0803   18.3775   18.8811   19.5426   19.9749   20.1721   20.2031   20.2017   20.0574   19.4301   18.6608   18.0755 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9949    0.9878    0.9656    0.8952    0.7506    0.5462    0.3835    0.4483    0.7464    0.9498    0.9902    0.9962 (94)
Useful gains  612.3385  756.4185  922.3135 1057.6421 1011.7295  739.9047  493.0132  512.9084  721.4090  719.6825  610.8858  570.9556 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             2049.9024 1993.9525 1821.7393 1522.8777 1177.3803  770.2737  498.0861  522.4584  833.1820 1256.3746 1663.6174 2019.1602 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             1069.5475  831.6229  669.1727  334.9696  123.2442    0.0000    0.0000    0.0000    0.0000  399.2989  757.9668 1077.4642 (98)
Space heating                                                                                                         5263.2868 (98)
Space heating per m2                                                                                 (98) / (4) =     44.7064 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Not applicable
```

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5641.2506	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1069.5475	831.6229	669.1727	334.9696	123.2442	0.0000	0.0000	0.0000	0.0000	399.2989	757.9668	1077.4642	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1146.3532	891.3428	717.2270	359.0242	132.0945	0.0000	0.0000	0.0000	0.0000	427.9731	812.3974	1154.8384	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	178.1915	156.1759	161.9394	142.2835	137.3334	119.7021	112.1066	126.9607	127.9797	147.6812	159.7843	172.9311	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7677	89.7111	89.5753	89.1958	88.3662	86.7000	86.7000	86.7000	86.7000	89.2989	89.6519	89.7844	(217)
Fuel for water heating, kWh/month													
	198.5029	174.0877	180.7858	159.5181	155.4140	138.0647	129.3040	146.4368	147.6121	165.3785	178.2274	192.6071	(219)
Water heating fuel used												1965.9391	(219)
Annual totals kWh/year													
Space heating fuel - main system												5641.2506	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.84 * 908 * 1.00) =										-2062.6448		-2062.6448	(233)
Total delivered energy for all uses												6063.8928	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5641.2506	0.2160	1218.5101	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1965.9391	0.2160	424.6428	(264)
Space and water heating			1643.1530	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Energy saving/generation technologies				
PV Unit	-2062.6448	0.5190	-1070.5127	(269)
Total CO2, kg/year			842.1819	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			7.1500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		7.1500	ZC1
Total Floor Area	TFA	117.7300	
Assumed number of occupants	N	2.8541	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2056	ZC2
CO2 emissions from cooking, equation (L16)		1.5926	ZC3
Total CO2 emissions		22.9482	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		22.9482	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.5300 (1b)	x	2.3100 (2b)	=	137.5143	(1b) - (3b)
First floor	58.2000 (1c)	x	2.6300 (2c)	=	153.0660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.7300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	290.5803	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1377	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3877	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3295	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4201	0.4119	0.4036	0.3625	0.3542	0.3130	0.3130	0.3048	0.3295	0.3542	0.3707	0.3872	(22b)
Effective ac	0.5883	0.5848	0.5815	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5750	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1400	1.2000	2.5680			(26a)
TER Opening Type (Uw = 1.40)			27.3200	1.3258	36.2197			(27)
Ground floor			59.5300	0.1300	7.7389			(28a)
External Wall	169.1800	29.4600	139.7200	0.1800	25.1496			(29a)
Main Roof	58.2000		58.2000	0.1300	7.5660			(30)
Bay roof	1.3200		1.3200	0.1300	0.1716			(30)
Total net area of external elements Aum(A, m2)			288.2300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.4138			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7173	(36)
Total fabric heat loss (33) + (36) =	93.1311	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.4083	56.0797	55.7576	54.2447	53.9616	52.6439	52.6439	52.3999	53.1515	53.9616	54.5342	55.1329	(38)
Heat transfer coeff	149.5394	149.2108	148.8887	147.3758	147.0927	145.7750	145.7750	145.5310	146.2826	147.0927	147.6653	148.2640	(39)
Average = Sum(39)m / 12 =												147.3744	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2702	1.2674	1.2647	1.2518	1.2494	1.2382	1.2382	1.2361	1.2425	1.2494	1.2543	1.2594	(40)
HLP (average)												1.2518	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8541 (42)
Average daily hot water use (litres/day)	101.9849 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.1834	108.1040	104.0246	99.9452	95.8658	91.7864	91.7864	95.8658	99.9452	104.0246	108.1040	112.1834	(44)
Energy conte	166.3647	145.5036	150.1467	130.9015	125.6031	108.3860	100.4355	115.2512	116.6277	135.9183	148.3655	161.1153	(45)
Energy content (annual)										Total = Sum(45)m =		1604.6192	(45)
Distribution loss (46)m = 0.15 x (45)m	24.9547	21.8255	22.5220	19.6352	18.8405	16.2579	15.0653	17.2877	17.4942	20.3878	22.2548	24.1673	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.2880	48.8522	45.2645	46.7733	48.8522	49.2880	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742 (64)
								Total per year (kWh/year) = Sum(64)m =				2192.1155 (64)
Heat gains from water heating, kWh/month												
	68.0560	59.8868	62.6635	55.8468	53.9761	47.3545	45.0881	50.5341	51.1007	57.9326	61.6603	66.3106 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	142.7050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	25.1608	22.3476	18.1743	13.7591	10.2851	8.6831	9.3824	12.1956	16.3689	20.7841	24.2581	25.8601	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	282.2278	285.1565	277.7764	262.0651	242.2324	223.5924	211.1397	208.2111	215.5912	231.3025	251.1352	269.7752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	37.2705	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	-114.1640	(71)
Water heating gains (Table 5)													
	91.4731	89.1173	84.2251	77.5650	72.5485	65.7701	60.6023	67.9221	70.9732	77.8664	85.6393	89.1271	(72)
Total internal gains													
	467.6733	465.4329	448.9873	422.2006	393.8774	366.8571	349.9360	357.1404	371.7448	398.7645	429.8442	453.5739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.4100	10.6334	0.6300	0.7000	0.7700	27.3300	(74)
East	9.8600	19.6403	0.6300	0.7000	0.7700	59.1829	(76)
West	9.0500	19.6403	0.6300	0.7000	0.7700	54.3210	(80)

Solar gains	140.8339	274.2667	454.4143	675.8548	845.6135	874.6331	828.9010	699.4204	531.9889	325.6382	175.2411	116.1237	(83)
Total gains	608.5071	739.6995	903.4016	1098.0554	1239.4910	1241.4902	1178.8370	1056.5608	903.7338	724.4027	605.0852	569.6976	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6725	54.7929	54.9115	55.4752	55.5819	56.0843	56.0843	56.1784	55.8897	55.5819	55.3664	55.1428	
alpha	4.6448	4.6529	4.6608	4.6983	4.7055	4.7390	4.7390	4.7452	4.7260	4.7055	4.6911	4.6762	
util living area													
	0.9989	0.9971	0.9899	0.9580	0.8628	0.6916	0.5298	0.6049	0.8677	0.9842	0.9977	0.9992	(86)
MIT	19.5250	19.6998	20.0118	20.4272	20.7661	20.9417	20.9868	20.9762	20.8233	20.3600	19.8658	19.4970	(87)
Th 2	19.8643	19.8665	19.8686	19.8788	19.8807	19.8896	19.8896	19.8912	19.8861	19.8807	19.8768	19.8728	(88)
util rest of house													
	0.9985	0.9961	0.9861	0.9416	0.8123	0.5948	0.4034	0.4730	0.7973	0.9755	0.9967	0.9989	(89)
MIT 2	17.8979	18.1547	18.6101	19.2088	19.6552	19.8519	19.8849	19.8817	19.7415	19.1251	18.4051	17.8628	(90)
Living area fraction									fLA = Living area / (4) =			0.2538	(91)
MIT	18.3108	18.5469	18.9659	19.5180	19.9371	20.1285	20.1646	20.1594	20.0160	19.4385	18.7758	18.2776	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3108	18.5469	18.9659	19.5180	19.9371	20.1285	20.1646	20.1594	20.0160	19.4385	18.7758	18.2776	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9943	0.9818	0.9349	0.8152	0.6171	0.4357	0.5066	0.8070	0.9707	0.9952	0.9983	(94)
Useful gains	607.1216	735.4513	886.9497	1026.5473	1010.4606	766.0973	513.5813	535.2291	729.3225	703.1812	602.1882	568.7415	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2095.1725	2036.2617	1856.0305	1564.8365	1211.6226	805.9198	519.6246	547.1152	865.4141	1300.0756	1724.1079	2087.1949	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1107.1098	874.1446	720.9961	387.5682	149.6645	0.0000	0.0000	0.0000	0.0000	444.0894	807.7822	1129.7293	(98)
Space heating												5621.0841	(98)
Space heating per m2											(98) / (4) =	47.7456	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6018.2913	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1107.1098	874.1446	720.9961	387.5682	149.6645	0.0000	0.0000	0.0000	0.0000	444.0894	807.7822	1129.7293	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1185.3424	935.9150	771.9444	414.9553	160.2403	0.0000	0.0000	0.0000	0.0000	475.4705	864.8631	1209.5603	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.3236	191.5310	201.1056	180.1896	174.4553	153.6505	147.2089	164.1034	165.9157	186.8772	197.6806	212.0742	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5720	88.4016	87.9864	86.9299	84.6680	80.3000	80.3000	80.3000	80.3000	87.1533	88.2185	88.6379	(217)
Fuel for water heating, kWh/month													
	245.3638	216.6601	228.5644	207.2815	206.0462	191.3456	183.3236	204.3629	206.6198	214.4235	224.0807	239.2590	(219)
Water heating fuel used												2567.3312	(219)
Annual totals kWh/year													
Space heating fuel - main system												6018.2913	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												444.3479	(232)
Total delivered energy for all uses												9104.9704	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6018.2913	0.2160	1299.9509	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2567.3312	0.2160	554.5435	(264)
Space and water heating			1854.4945	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	444.3479	0.5190	230.6166	(268)
Total CO2, kg/m2/year			2124.0360	(272)
Emissions per m2 for space and water heating			15.7521	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9589	(272b)
Emissions per m2 for pumps and fans			0.3306	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7521 * 1.00) + 1.9589 + 0.3306, rounded to 2 d.p.			18.0400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 462 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 462	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 462, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.15	**TER**	18.04
Environmental	95 A	**% DER<TER**	60.37		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.92	**TFEE**	61.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	35.08 m	59.53 m²	2.31 m
1st Storey:	33.58 m	58.20 m²	2.63 m

7.0 Living Area	29.88	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	211.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	169.18	139.72

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	58.20	58.20
Bay roof	External Flat Roof	0.16	1.32	1.32

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	59.53

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W4	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.47	100
W5	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W6	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.50	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					0.81	100
D2 W14	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					3.34	100
W7	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.96	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W10	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					0.78	100

W11	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		0.78	100
D3 W15	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		3.34	100
W12	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00		1.88	100
W13	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00		1.41	100
W14*	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00		0.72	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	18.61	0.065	No
Independently assessed	E3 Sill	14.41	0.004	No
Independently assessed	E4 Jamb	47.85	0.005	No
Independently assessed	E5 Ground floor (normal)	35.08	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	33.58	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.60	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	14.98	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	29.30	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	9.56	-0.092	No

Y-value	0.020	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No

Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2	None	

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
2.84	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 96	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 462 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 462	**Prop Type Ref**	As
Property	L461-R - Det SG, Plot 462, Boorley Gardens, Southampton, SO32		

SAP Rating	95 A	**DER**	7.15	**TER**	18.04
Environmental	95 A	**% DER<TER**	60.37		
CO_2 Emissions (t/year)	0.31	**DFEE**	46.92	**TFEE**	61.28
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.43		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	117.73	m^2	
DER	7.15	$kgCO_2/yr/m^2$	
TER	18.04	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	7.15	$kgCO_2/yr/m^2$	
Reduction DER/TER	60.37	%	
CfSH ENE1 credits achieved	6.3		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	46.92	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	6.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	117.73	m^2	
DER	18.40	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	34.20	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	34.20	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	9.30	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	14.21	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.59	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	25.10	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	25.10	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	27	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 659 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 659 EPC	**Prop Type Ref**	
Property	11 Kittiwake Place, Boorley Green, Southampton , SO32 2ZB		

SAP Rating	87 B	**DER**	14.54	**TER**	18.60
Environmental	89 B	**% DER<TER**	21.84		
CO_2 Emissions (t/year)	0.85	**DFEE**	47.36	**TFEE**	52.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.60 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.54 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.47 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.03 m², No overhang
Windows facing East: 6.45 m², No overhang
Windows facing West: 4.54 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5151	0.5050	0.4949	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747	(22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4528	41.1152	40.7843	39.2301	38.9393	37.5857	37.5857	37.3350	38.1071	38.9393	39.5276	40.1426	(38)
Heat transfer coeff	97.5096	97.1720	96.8411	95.2869	94.9961	93.6425	93.6425	93.3918	94.1639	94.9961	95.5844	96.1994	(39)
Average = Sum(39)m / 12 =												95.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2327	1.2285	1.2243	1.2046	1.2010	1.1838	1.1838	1.1807	1.1904	1.2010	1.2084	1.2162	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4466	18.1605	14.7691	11.1812	8.3581	7.0562	7.6245	9.9106	13.3020	16.8900	19.7131	21.0149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	371.9246	369.7602	356.2459	334.5205	312.4966	291.3178	277.6068	283.6343	294.8473	316.7835	341.9377	360.7688	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.7200	0.7000	0.7700	3.8254	(74)
East	6.4500	19.6403	0.7200	0.7000	0.7700	44.2457	(76)
West	4.5400	19.6403	0.7200	0.7000	0.7700	31.1435	(80)

Solar gains	79.2145	154.7876	255.2961	374.1704	460.9853	473.1598	449.9376	384.7270	297.4079	183.6962	98.7205	65.1854	(83)
Total gains	451.1391	524.5478	611.5421	708.6909	773.4818	764.4776	727.5443	668.3613	592.2552	500.4797	440.6581	425.9542	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3335	56.5292	56.7223	57.6475	57.8240	58.6599	58.6599	58.8173	58.3351	57.8240	57.4681	57.1007	
alpha	4.7556	4.7686	4.7815	4.8432	4.8549	4.9107	4.9107	4.9212	4.8890	4.8549	4.8312	4.8067	
util living area													
	0.9984	0.9964	0.9893	0.9613	0.8793	0.7168	0.5507	0.6146	0.8662	0.9815	0.9968	0.9988	(86)
MIT	19.6221	19.7805	20.0638	20.4454	20.7608	20.9394	20.9866	20.9778	20.8389	20.4156	19.9551	19.6031	(87)
Th 2	19.8939	19.8973	19.9006	19.9163	19.9192	19.9329	19.9329	19.9355	19.9277	19.9192	19.9133	19.9071	(88)
util rest of house													
	0.9978	0.9951	0.9853	0.9461	0.8331	0.6228	0.4251	0.4861	0.7970	0.9717	0.9954	0.9984	(89)
MIT 2	18.0601	18.2937	18.7079	19.2634	19.6842	19.8927	19.9281	19.9264	19.7952	19.2318	18.5606	18.0415	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.3627	18.5816	18.9705	19.4923	19.8927	20.0954	20.1331	20.1300	19.9974	19.4611	18.8307	18.3439	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3627	18.5816	18.9705	19.4923	19.8927	20.0954	20.1331	20.1300	19.9974	19.4611	18.8307	18.3439	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9966	0.9928	0.9805	0.9385	0.8318	0.6383	0.4495	0.5109	0.8024	0.9659	0.9933	0.9974	(94)
Useful gains	449.6053	520.7644	599.6466	665.0874	643.3470	487.9524	327.0480	341.4525	475.2229	483.4097	437.7098	424.8516	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1371.2434	1329.4707	1207.6562	1009.3068	778.2742	514.6057	330.8480	348.3513	555.3196	841.7708	1121.2730	1360.6359	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	685.6987	543.4506	452.3592	247.8380	100.3858	0.0000	0.0000	0.0000	0.0000	266.6207	492.1655	696.2235	(98)
Space heating												3484.7420	(98)
Space heating per m2											(98) / (4) =	44.0549	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3751.0678 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	685.6987	543.4506	452.3592	247.8380	100.3858	0.0000	0.0000	0.0000	0.0000	266.6207	492.1655	696.2235	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	738.1041	584.9845	486.9313	266.7793	108.0579	0.0000	0.0000	0.0000	0.0000	286.9975	529.7799	749.4333	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2692	89.2166	89.0909	88.7737	88.0942	86.7000	86.7000	86.7000	86.7000	88.7997	89.1486	89.2917	(217)
Fuel for water heating, kWh/month													
	181.8640	159.5201	165.7180	146.2376	142.3330	126.1921	118.3152	133.8039	134.8180	151.7424	163.3894	176.4907	(219)
Water heating fuel used												1800.4243	(219)
Annual totals kWh/year													
Space heating fuel - main system												3751.0678	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	361.0938 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 0.73 * 908 * 1.00) =	-530.1869 -530.1869 (233)
Total delivered energy for all uses	5457.3991 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3751.0678	0.2160	810.2307	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1800.4243	0.2160	388.8917	(264)
Space and water heating			1199.1223	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.0938	0.5190	187.4077	(268)
Energy saving/generation technologies				
PV Unit	-530.1869	0.5190	-275.1670	(269)
Total CO2, kg/year			1150.2880	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.5400 ZC1
Total Floor Area	TFA	79.1000
Assumed number of occupants	N	2.4456
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.2977 ZC2
CO2 emissions from cooking, equation (L16)		2.2464 ZC3
Total CO2 emissions		33.0842 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		33.0842 ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.0200	1.3258	15.9356			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	14.1400	75.0000	0.1800	13.5000			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.2626			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3124	(36)
Total fabric heat loss (33) + (36) =	51.5750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	90.5244	90.2840	90.0484	88.9418	88.7347	87.7708	87.7708	87.5923	88.1421	88.7347	89.1536	89.5915	(39)
Average = Sum(39)m / 12 =												88.9408	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1384	1.1244	1.1218	1.1096	1.1096	1.1074	1.1143	1.1218	1.1271	1.1326	(40)
HLP (average)												1.1244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	45.0236	47.9665	44.5988	44.2044	40.9581	42.3234	44.2044	44.5988	47.9665	48.2395	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
								Total per year (kWh/year) = Sum(64)m =				2003.9586	(64)
Heat gains from water heating, kWh/month													
	62.7932	55.0330	57.1657	50.5335	48.8408	42.8492	40.7985	45.7263	46.2390	52.8849	56.6980	61.2139	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4466	18.1605	14.7691	11.1812	8.3581	7.0562	7.6245	9.9106	13.3020	16.8900	19.7131	21.0149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	84.3995	81.8944	76.8356	70.1855	65.6463	59.5128	54.8367	61.4601	64.2209	71.0818	78.7473	82.2767	(72)
Total internal gains													
	385.0788	382.5451	368.4061	346.0573	323.4074	301.6038	287.8972	294.5492	306.3902	328.9497	354.7260	373.9255	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.6300	0.7000	0.7700	3.3472	(74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(76)
West	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(80)

Solar gains	69.3127	135.4392	223.3841	327.3991	403.3621	414.0148	393.6954	336.6362	260.2319	160.7342	86.3804	57.0372	(83)
Total gains	454.3915	517.9842	591.7902	673.4564	726.7695	715.6186	681.5925	631.1854	566.6221	489.6839	441.1064	430.9627	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6804	60.8419	61.0011	61.7601	61.9043	62.5841	62.5841	62.7116	62.3205	61.9043	61.6134	61.3123	
alpha	5.0454	5.0561	5.0667	5.1173	5.1270	5.1723	5.1723	5.1808	5.1547	5.1270	5.1076	5.0875	
util living area													
	0.9984	0.9965	0.9900	0.9640	0.8850	0.7228	0.5532	0.6143	0.8657	0.9814	0.9967	0.9988	(86)
MIT	19.7424	19.8853	20.1435	20.4906	20.7827	20.9468	20.9891	20.9818	20.8594	20.4722	20.0467	19.7199	(87)
Th 2	19.9647	19.9672	19.9696	19.9809	19.9831	19.9930	19.9930	19.9948	19.9892	19.9831	19.9788	19.9743	(88)
util rest of house													
	0.9978	0.9953	0.9863	0.9500	0.8415	0.6328	0.4335	0.4920	0.7987	0.9718	0.9953	0.9983	(89)
MIT 2	18.2855	18.4958	18.8731	19.3768	19.7673	19.9571	19.9889	19.9872	19.8728	19.3595	18.7404	18.2594	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.5677	18.7649	19.1191	19.5926	19.9640	20.1488	20.1826	20.1798	20.0638	19.5750	18.9934	18.5423	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5677	18.7649	19.1191	19.5926	19.9640	20.1488	20.1826	20.1798	20.0638	19.5750	18.9934	18.5423	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9932	0.9821	0.9432	0.8405	0.6478	0.4568	0.5156	0.8046	0.9665	0.9933	0.9974	(94)
Useful gains	452.8749	514.4615	581.1862	635.2127	610.8542	463.5850	311.3246	325.4159	455.8789	473.2674	438.1719	429.8565	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1291.5741	1251.7805	1136.3332	951.0154	733.2997	487.0194	314.4492	331.0838	525.6657	796.3965	1060.3400	1284.9487	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	623.9922	495.4783	413.0293	227.3780	91.0995	0.0000	0.0000	0.0000	0.0000	240.4080	447.9610	636.1886	(98)
Space heating												3175.5350	(98)
Space heating per m2											(98) / (4) =	40.1458	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3399.9304	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	623.9922	495.4783	413.0293	227.3780	91.0995	0.0000	0.0000	0.0000	0.0000	240.4080	447.9610	636.1886	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	668.0859	530.4907	442.2155	243.4454	97.5369	0.0000	0.0000	0.0000	0.0000	257.3962	479.6156	681.1441	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.4958	176.6841	183.8283	163.0465	157.8577	139.0323	133.2035	148.4907	150.1306	170.9536	182.4896	196.7458	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7072	87.5068	87.0286	85.8886	83.7229	80.3000	80.3000	80.3000	80.3000	85.9094	87.2244	87.7917	(217)
Fuel for water heating, kWh/month													
	229.7367	201.9088	211.2275	189.8349	188.5480	173.1411	165.8823	184.9199	186.9622	198.9929	209.2186	224.1052	(219)
Water heating fuel used												2364.4782	(219)
Annual totals kWh/year													
Space heating fuel - main system												3399.9304	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.0938	(232)
Total delivered energy for all uses												6200.5024	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3399.9304	0.2160	734.3850	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2364.4782	0.2160	510.7273	(264)
Space and water heating			1245.1123	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.0938	0.5190	187.4077	(268)
Total CO2, kg/m2/year			1471.4449	(272)
Emissions per m2 for space and water heating			15.7410	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3692	(272b)
Emissions per m2 for pumps and fans			0.4921	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7410 * 1.00) + 2.3692 + 0.4921, rounded to 2 d.p.			18.6000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.3746	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3184	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4060	0.3980	0.3901	0.3503	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3741	(22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5458	0.5458	0.5434	0.5507	0.5586	0.5642	0.5700	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.1585	37.9489	37.7433	36.7781	36.5975	35.7568	35.7568	35.6011	36.0806	36.5975	36.9628	37.3448	(38)
Heat transfer coeff	94.2153	94.0057	93.8002	92.8349	92.6543	91.8136	91.8136	91.6579	92.1374	92.6543	93.0196	93.4016	(39)
Average = Sum(39)m / 12 =												92.8340	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1911	1.1884	1.1858	1.1736	1.1714	1.1607	1.1607	1.1588	1.1648	1.1714	1.1760	1.1808	(40)
HLP (average)												1.1736	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.4466	18.1605	14.7691	11.1812	8.3581	7.0562	7.6245	9.9106	13.3020	16.8900	19.7131	21.0149 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225 (71)

Water heating gains (Table 5)

	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394 (72)

Total internal gains

	340.6754	339.2844	327.3752	307.8304	287.2226	268.0366	256.0175	259.8752	270.3158	289.9953	312.6011	330.2882 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.7200	0.7000	0.7700	3.8254	(74)
East	6.4500	19.6403	0.7200	0.7000	0.7700	44.2457	(76)
West	4.5400	19.6403	0.7200	0.7000	0.7700	31.1435	(80)

Solar gains	79.2145	154.7876	255.2961	374.1704	460.9853	473.1598	449.9376	384.7270	297.4079	183.6962	98.7205	65.1854	(83)
Total gains	419.8899	494.0720	582.6713	682.0007	748.2078	741.1963	705.9551	644.6022	567.7238	473.6916	411.3216	395.4735	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.3032	58.4332	58.5613	59.1702	59.2855	59.8284	59.8284	59.9300	59.6181	59.2855	59.0526	58.8112	
alpha	4.8869	4.8955	4.9041	4.9447	4.9524	4.9886	4.9886	4.9953	4.9745	4.9524	4.9368	4.9207	
util living area	0.9988	0.9972	0.9910	0.9649	0.8849	0.7241	0.5566	0.6246	0.8760	0.9847	0.9976	0.9992	(86)
MIT	19.6400	19.7964	20.0767	20.4500	20.7639	20.9397	20.9869	20.9775	20.8361	20.4120	19.9570	19.6139	(87)
Th 2	19.9271	19.9293	19.9313	19.9411	19.9430	19.9515	19.9515	19.9531	19.9482	19.9430	19.9393	19.9354	(88)
util rest of house	0.9984	0.9962	0.9876	0.9510	0.8404	0.6315	0.4320	0.4968	0.8102	0.9765	0.9966	0.9989	(89)
MIT 2	18.6861	18.8438	19.1240	19.4962	19.7834	19.9239	19.9483	19.9467	19.8548	19.4662	19.0124	18.6665	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8709	19.0283	19.3085	19.6809	19.9733	20.1207	20.1494	20.1464	20.0449	19.6494	19.1953	18.8500	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8709	19.0283	19.3085	19.6809	19.9733	20.1207	20.1494	20.1464	20.0449	19.6494	19.1953	18.8500	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9950	0.9850	0.9467	0.8419	0.6477	0.4563	0.5217	0.8174	0.9734	0.9956	0.9984	(94)
Useful gains	418.9970	491.6138	573.9195	645.6797	629.9279	480.0457	322.1377	336.3176	464.0366	461.0832	409.5010	394.8475	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1372.7975	1328.1382	1201.4431	1000.8422	766.5576	506.8729	325.8847	343.3833	547.7454	838.4653	1125.1008	1368.3334	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	709.6276	562.1444	466.8775	255.7170	101.6525	0.0000	0.0000	0.0000	0.0000	280.7723	515.2318	724.2735	(98)
Space heating												3616.2968	(98)
Space heating per m2											(98) / (4) =	45.7180	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	863.0476	679.4205	696.6000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8733	0.9299	0.9024	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	753.6721	631.7654	628.5782	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	957.9010	914.8638	844.8186	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	147.0448	210.6252	160.8829	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												518.5529 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.7612	52.6563	40.2207	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												129.6382 (107)
Space cooling per m2												1.6389 (108)
Energy for space heating												45.7180 (99)
Energy for space cooling												1.6389 (108)
Total												47.3570 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1511	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3409	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4347	0.4262	0.4176	0.3750	0.3665	0.3239	0.3239	0.3154	0.3409	0.3665	0.3836	0.4006	(22b)
Effective ac	0.5945	0.5908	0.5872	0.5703	0.5672	0.5525	0.5525	0.5497	0.5581	0.5672	0.5736	0.5802	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			12.0200	1.3258	15.9356			(27)
Ground floor			39.5500	0.1300	5.1415			(28a)
External Wall	89.1400	14.1400	75.0000	0.1800	13.5000			(29a)
Main Roof	39.5500		39.5500	0.1300	5.1415			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.2626			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.3124	(36)
Total fabric heat loss (33) + (36) =	51.5750	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9494	38.7091	38.4735	37.3668	37.1597	36.1959	36.1959	36.0174	36.5671	37.1597	37.5786	38.0165	(38)
Heat transfer coeff	90.5244	90.2840	90.0484	88.9418	88.7347	87.7708	87.7708	87.5923	88.1421	88.7347	89.1536	89.5915	(39)
Average = Sum(39)m / 12 =												88.9408	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1444	1.1414	1.1384	1.1244	1.1218	1.1096	1.1096	1.1074	1.1143	1.1218	1.1271	1.1326	(40)
HLP (average)												1.1244	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456	(42)
Average daily hot water use (litres/day)	92.2821	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9891	27.9779	28.8706	25.1701	24.1513	20.8408	19.3120	22.1608	22.4255	26.1348	28.5281	30.9797	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.4466	18.1605	14.7691	11.1812	8.3581	7.0562	7.6245	9.9106	13.3020	16.8900	19.7131	21.0149	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	42.9961	41.6337	38.8046	34.9585	32.4615	28.9455	25.9570	29.7861	31.1465	35.1274	39.6224	41.6394	(72)
Total internal gains													
	340.6754	339.2844	327.3752	307.8304	287.2226	268.0366	256.0175	259.8752	270.3158	289.9953	312.6011	330.2882	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.6300	0.7000	0.7700	3.3472	(74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150	(76)
West	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(80)

Solar gains	69.3127	135.4392	223.3841	327.3991	403.3621	414.0148	393.6954	336.6362	260.2319	160.7342	86.3804	57.0372	(83)
Total gains	409.9881	474.7236	550.7593	635.2294	690.5847	682.0514	649.7129	596.5113	530.5478	450.7295	398.9815	387.3254	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6804	60.8419	61.0011	61.7601	61.9043	62.5841	62.5841	62.7116	62.3205	61.9043	61.6134	61.3123	
alpha	5.0454	5.0561	5.0667	5.1173	5.1270	5.1723	5.1723	5.1808	5.1547	5.1270	5.1076	5.0875	
util living area													
	0.9990	0.9976	0.9927	0.9713	0.9014	0.7473	0.5774	0.6440	0.8889	0.9869	0.9979	0.9993	(86)
MIT	19.6900	19.8347	20.0970	20.4522	20.7581	20.9378	20.9868	20.9775	20.8368	20.4295	19.9972	19.6683	(87)
Th 2	19.9647	19.9672	19.9696	19.9809	19.9831	19.9930	19.9930	19.9948	19.9892	19.9831	19.9788	19.9743	(88)
util rest of house													
	0.9986	0.9968	0.9899	0.9597	0.8617	0.6581	0.4539	0.5186	0.8282	0.9798	0.9970	0.9990	(89)
MIT 2	18.7660	18.9122	19.1751	19.5325	19.8161	19.9637	19.9895	19.9882	19.8940	19.5165	19.0841	18.7519	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.9449	19.0909	19.3537	19.7106	19.9985	20.1524	20.1827	20.1798	20.0766	19.6933	19.2609	18.9294	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9449	19.0909	19.3537	19.7106	19.9985	20.1524	20.1827	20.1798	20.0766	19.6933	19.2609	18.9294	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9958	0.9877	0.9558	0.8624	0.6735	0.4781	0.5430	0.8345	0.9771	0.9962	0.9986	(94)
Useful gains	409.2279	472.7449	543.9826	607.1653	595.5707	459.3728	310.6087	323.9178	442.7576	440.3881	397.4498	386.7896	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1325.7247	1281.2112	1157.4528	961.5169	736.3677	487.3370	314.4552	331.0825	526.7872	806.8909	1084.1914	1319.6244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	681.8736	543.2894	456.4218	255.1332	104.7530	0.0000	0.0000	0.0000	0.0000	272.6780	494.4539	694.0291	(98)
Space heating												3502.6320	(98)
Space heating per m2											(98) / (4) =	44.2811	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	825.0458	649.5042	665.7018	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8675	0.9273	0.9002	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	715.7102	602.2975	599.2533	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	888.7706	849.1261	788.6085	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.6035	183.6405	140.8803	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												449.1242	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   31.1509   45.9101   35.2201    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          112.2811 (107)
Space cooling per m2                                                                                                     1.4195 (108)
Energy for space heating                                                                                                44.2811 (99)
Energy for space cooling                                                                                                 1.4195 (108)
Total                                                                                                                   45.7005 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    52.6 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4242	0.3939	0.4040	0.3838	0.3838	0.3737	0.3636	0.3535	0.3434	0.3737	0.3535	0.3737	(22b)
Effective ac	0.5900	0.5776	0.5816	0.5737	0.5737	0.5698	0.5661	0.5625	0.5590	0.5698	0.5625	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6552	37.8430	38.1071	37.5857	37.5857	37.3350	37.0910	36.8537	36.6231	37.3350	36.8537	37.3350	(38)
Heat transfer coeff	94.7120	93.8998	94.1639	93.6425	93.6425	93.3918	93.1478	92.9105	92.6799	93.3918	92.9105	93.3918	(39)
Average = Sum(39)m / 12 =												93.4904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1974	1.1871	1.1904	1.1838	1.1838	1.1807	1.1776	1.1746	1.1717	1.1807	1.1746	1.1807	(40)
HLP (average)												1.1819	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1166	45.4013	36.9228	27.9529	20.8951	17.6406	19.0613	24.7765	33.2550	42.2249	49.2827	52.5372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.0924	546.6108	525.2075	492.1352	458.3468	428.1384	410.5520	418.8968	437.9988	471.2819	508.2005	536.0612	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	13.4839	0.7200	0.7000	0.7700	4.8508	(74)
East	6.4500	25.1925	0.7200	0.7000	0.7700	56.7539	(76)
West	4.5400	25.1925	0.7200	0.7000	0.7700	39.9477	(80)

Solar gains	101.5524	168.8928	280.2649	411.7637	480.7224	535.3347	505.3283	443.7963	344.3610	216.1490	126.1642	82.1293 (83)
Total gains	652.6448	715.5036	805.4724	903.8988	939.0692	963.4731	915.8803	862.6931	782.3597	687.4309	634.3647	618.1905 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9974	58.4991	58.3351	58.6599	58.6599	58.8173	58.9714	59.1220	59.2691	58.8173	59.1220	58.8173	
alpha	4.8665	4.8999	4.8890	4.9107	4.9107	4.9212	4.9314	4.9415	4.9513	4.9212	4.9415	4.9212	
util living area													
	0.9907	0.9849	0.9630	0.8946	0.7556	0.5388	0.3941	0.4167	0.6924	0.9204	0.9805	0.9923	(86)
MIT	19.9661	20.0925	20.3604	20.6834	20.8981	20.9844	20.9973	20.9966	20.9501	20.6884	20.2965	19.9600	(87)
Th 2	19.9221	19.9303	19.9277	19.9329	19.9329	19.9355	19.9380	19.9404	19.9427	19.9355	19.9404	19.9355	(88)
util rest of house													
	0.9877	0.9800	0.9507	0.8614	0.6881	0.4445	0.2882	0.3053	0.5974	0.8863	0.9728	0.9898	(89)
MIT 2	18.5804	18.7685	19.1482	19.5901	19.8467	19.9274	19.9373	19.9395	19.9107	19.6105	19.0721	18.5814	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9743	0.9429	0.8567	0.6961	0.4624	0.3088	0.3270	0.6137	0.8817	0.9667	0.9860	(94)
Useful gains	641.7963	697.1276	759.4435	774.3376	653.7191	445.4708	282.8054	282.0687	480.1368	606.1169	613.2154	609.5474	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1321.1218	1288.7693	1166.0310	964.6929	707.0335	451.2774	283.4077	282.8384	501.5831	786.2938	1060.0364	1293.3313	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.4182	397.5832	302.5011	137.0558	39.6659	0.0000	0.0000	0.0000	0.0000	134.0516	321.7111	508.7352	(98)
Space heating												2346.7221	(98)
RHI space heating demand												2347	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.3900 (2b)	=	94.5245	(1b) - (3b)
First floor	39.5500 (1c)	x	2.6300 (2c)	=	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518 (8)
Pressure test		Yes
Measured/design AP50		4.4700
Infiltration rate		0.4753 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5151	0.5050	0.4949	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747	(22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4528	41.1152	40.7843	39.2301	38.9393	37.5857	37.5857	37.3350	38.1071	38.9393	39.5276	40.1426	(38)
Heat transfer coeff	97.5096	97.1720	96.8411	95.2869	94.9961	93.6425	93.6425	93.3918	94.1639	94.9961	95.5844	96.1994	(39)
Average = Sum(39)m / 12 =												95.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2327	1.2285	1.2243	1.2046	1.2010	1.1838	1.1838	1.1807	1.1904	1.2010	1.2084	1.2162	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1166	45.4013	36.9228	27.9529	20.8951	17.6406	19.0613	24.7765	33.2550	42.2249	49.2827	52.5372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.0924	546.6108	525.2075	492.1352	458.3468	428.1384	410.5520	418.8968	437.9988	471.2819	508.2005	536.0612	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.7200	0.7000	0.7700	3.8254	(74)
East	6.4500	19.6403	0.7200	0.7000	0.7700	44.2457	(76)
West	4.5400	19.6403	0.7200	0.7000	0.7700	31.1435	(80)

Solar gains	79.2145	154.7876	255.2961	374.1704	460.9853	473.1598	449.9376	384.7270	297.4079	183.6962	98.7205	65.1854	(83)
Total gains	630.3069	701.3984	780.5036	866.3055	919.3321	901.2982	860.4895	803.6238	735.4067	654.9781	606.9210	601.2466	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3335	56.5292	56.7223	57.6475	57.8240	58.6599	58.6599	58.8173	58.3351	57.8240	57.4681	57.1007	
alpha	4.7556	4.7686	4.7815	4.8432	4.8549	4.9107	4.9107	4.9212	4.8890	4.8549	4.8312	4.8067	
util living area													
	0.9933	0.9879	0.9723	0.9233	0.8123	0.6319	0.4720	0.5229	0.7750	0.9496	0.9875	0.9946	(86)
MIT	19.8276	19.9797	20.2440	20.5849	20.8392	20.9649	20.9931	20.9889	20.9060	20.5695	20.1433	19.8055	(87)
Th 2	19.8939	19.8973	19.9006	19.9163	19.9192	19.9329	19.9329	19.9355	19.9277	19.9192	19.9133	19.9071	(88)
util rest of house													
	0.9911	0.9839	0.9630	0.8978	0.7552	0.5400	0.3611	0.4078	0.6911	0.9273	0.9827	0.9928	(89)
MIT 2	18.3591	18.5819	18.9636	19.4480	19.7702	19.9111	19.9306	19.9312	19.8577	19.4404	18.8322	18.3364	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6435	18.8526	19.2116	19.6682	19.9773	20.1152	20.1364	20.1361	20.0607	19.6590	19.0861	18.6209	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6435	18.8526	19.2116	19.6682	19.9773	20.1152	20.1364	20.1361	20.0607	19.6590	19.0861	18.6209	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9787	0.9554	0.8908	0.7587	0.5565	0.3827	0.4301	0.7027	0.9204	0.9776	0.9897	(94)
Useful gains	622.4057	686.4537	745.6724	771.6854	697.4523	501.5849	329.2743	345.6430	516.7488	602.8631	593.3317	595.0758	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1398.6297	1355.8067	1231.0060	1026.0697	786.3088	516.4560	331.1537	348.9198	561.2872	860.5744	1145.6842	1387.2857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	577.5107	449.8053	361.0882	183.1567	66.1092	0.0000	0.0000	0.0000	0.0000	191.7373	397.6938	589.4042	(98)
Space heating												2816.5054	(98)
Space heating per m2											(98) / (4) =	35.6069	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3031.7603	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	577.5107	449.8053	361.0882	183.1567	66.1092	0.0000	0.0000	0.0000	0.0000	191.7373	397.6938	589.4042	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	621.6477	484.1822	388.6848	197.1547	71.1617	0.0000	0.0000	0.0000	0.0000	206.3910	428.0881	634.4501	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1778	89.1095	88.9472	88.5444	87.7787	86.7000	86.7000	86.7000	86.7000	88.5511	89.0192	89.2054	(217)
Fuel for water heating, kWh/month													
	182.0506	159.7118	165.9856	146.6163	142.8447	126.1921	118.3152	133.8039	134.8180	152.1684	163.6268	176.6614	(219)
Water heating fuel used												1802.7948	(219)
Annual totals kWh/year													
Space heating fuel - main system												3031.7603	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.0938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 908 * 1.00) =										-530.1869		-530.1869	(233)
Total delivered energy for all uses												4740.4621	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3031.7603	3.4800	105.5053	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1802.7948	3.4800	62.7373	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	361.0938	13.1900	47.6283	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-530.1869	13.1900	-69.9316	(252)
Total energy cost			275.8316	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9335	(257)
SAP value		86.9775	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3031.7603	0.2160	654.8602	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.7948	0.2160	389.4037	(264)
Space and water heating			1044.2639	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.0938	0.5190	187.4077	(268)
Energy saving/generation technologies				
PV Unit	-530.1869	0.5190	-275.1670	(269)
Total kg/year			995.4296	(272)
CO2 emissions per m2			12.5800	(273)
EI value			89.2516	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8809 = 3.950, stars = 4
Water heating environmental impact	0.216 / 0.8809 = 0.2452, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4242	0.3939	0.4040	0.3838	0.3838	0.3737	0.3636	0.3535	0.3434	0.3737	0.3535	0.3737	(22b)
Effective ac	0.5900	0.5776	0.5816	0.5737	0.5737	0.5698	0.5661	0.5625	0.5590	0.5698	0.5625	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6552	37.8430	38.1071	37.5857	37.5857	37.3350	37.0910	36.8537	36.6231	37.3350	36.8537	37.3350	(38)
Heat transfer coeff	94.7120	93.8998	94.1639	93.6425	93.6425	93.3918	93.1478	92.9105	92.6799	93.3918	92.9105	93.3918	(39)
Average = Sum(39)m / 12 =												93.4904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1974	1.1871	1.1904	1.1838	1.1838	1.1807	1.1776	1.1746	1.1717	1.1807	1.1746	1.1807	(40)
HLP (average)												1.1819	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (64)
								Total per year (kWh/year) = Sum(64)m =				1590.3950 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1166	45.4013	36.9228	27.9529	20.8951	17.6406	19.0613	24.7765	33.2550	42.2249	49.2827	52.5372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.0924	546.6108	525.2075	492.1352	458.3468	428.1384	410.5520	418.8968	437.9988	471.2819	508.2005	536.0612	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	13.4839	0.7200	0.7000	0.7700	4.8508	(74)
East	6.4500	25.1925	0.7200	0.7000	0.7700	56.7539	(76)
West	4.5400	25.1925	0.7200	0.7000	0.7700	39.9477	(80)

Solar gains	101.5524	168.8928	280.2649	411.7637	480.7224	535.3347	505.3283	443.7963	344.3610	216.1490	126.1642	82.1293	(83)
Total gains	652.6448	715.5036	805.4724	903.8988	939.0692	963.4731	915.8803	862.6931	782.3597	687.4309	634.3647	618.1905	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9974	58.4991	58.3351	58.6599	58.6599	58.8173	58.9714	59.1220	59.2691	58.8173	59.1220	58.8173	
alpha	4.8665	4.8999	4.8890	4.9107	4.9107	4.9212	4.9314	4.9415	4.9513	4.9212	4.9415	4.9212	
util living area													
	0.9907	0.9849	0.9630	0.8946	0.7556	0.5388	0.3941	0.4167	0.6924	0.9204	0.9805	0.9923	(86)
MIT	19.9661	20.0925	20.3604	20.6834	20.8981	20.9844	20.9973	20.9966	20.9501	20.6884	20.2965	19.9600	(87)
Th 2	19.9221	19.9303	19.9277	19.9329	19.9329	19.9355	19.9380	19.9404	19.9427	19.9355	19.9404	19.9355	(88)
util rest of house													
	0.9877	0.9800	0.9507	0.8614	0.6881	0.4445	0.2882	0.3053	0.5974	0.8863	0.9728	0.9898	(89)
MIT 2	18.5804	18.7685	19.1482	19.5901	19.8467	19.9274	19.9373	19.9395	19.9107	19.6105	19.0721	18.5814	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9743	0.9429	0.8567	0.6961	0.4624	0.3088	0.3270	0.6137	0.8817	0.9667	0.9860	(94)
Useful gains	641.7963	697.1276	759.4435	774.3376	653.7191	445.4708	282.8054	282.0687	480.1368	606.1169	613.2154	609.5474	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1321.1218	1288.7693	1166.0310	964.6929	707.0335	451.2774	283.4077	282.8384	501.5831	786.2938	1060.0364	1293.3313	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	505.4182	397.5832	302.5011	137.0558	39.6659	0.0000	0.0000	0.0000	0.0000	134.0516	321.7111	508.7352	(98)
Space heating												2346.7221	(98)
Space heating per m2											(98) / (4) =	29.6678	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2526.0733	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	505.4182	397.5832	302.5011	137.0558	39.6659	0.0000	0.0000	0.0000	0.0000	134.0516	321.7111	508.7352	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	544.0454	427.9690	325.6201	147.5305	42.6974	0.0000	0.0000	0.0000	0.0000	144.2967	346.2983	547.6159	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1005	89.0338	88.8247	88.3144	87.4481	86.7000	86.7000	86.7000	86.7000	88.2669	88.8776	89.1220	(217)
Fuel for water heating, kWh/month													
	182.2085	159.8477	166.2146	146.9982	143.3847	126.1921	118.3152	133.8039	134.8180	152.6584	163.8874	176.8267	(219)
Water heating fuel used												1805.1553	(219)
Annual totals kWh/year													
Space heating fuel - main system												2526.0733	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.0938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1031 * 1.00) =										-602.1142		-602.1142	(233)
Total delivered energy for all uses												4165.2083	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2526.0733	7.3800	186.4242	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1805.1553	7.3800	133.2205	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	361.0938	28.6600	103.4895	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-602.1142	28.6600	-172.5659	(252)
Total energy cost			379.0632	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2526.0733	0.2160	545.6318	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1805.1553	0.2160	389.9135	(264)
Space and water heating			935.5454	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	361.0938	0.5190	187.4077	(268)
Energy saving/generation technologies				
PV Unit	-602.1142	0.5190	-312.4973	(269)
Total kg/year			849.3808	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2526.0733	1.2200	3081.8095	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1805.1553	1.2200	2202.2895	(264)
Space and water heating			5284.0990	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	361.0938	3.0700	1108.5579	(268)
Energy saving/generation technologies				
PV Unit	-602.1142	3.0700	-1848.4906	(269)
Primary energy kWh/year			4774.4163	(272)
Primary energy kWh/m2/year			60.3592	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 58	-185 kg (21.8%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 88	B 91
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£125	£139	-£14
Mains gas	£427	£355	£72
Space heating	£315	£315	£0
Water heating	£133	£76	£58
Lighting	£103	£103	£0
Generated (PV)	-£173	-£173	£0
Total cost of fuels	£379	£321	£58
Total cost of uses	£378	£321	£58
Delivered energy	53 kWh/m²	41 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	47 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518	(8)
Pressure test		Yes	
Measured/design AP50		4.4700	
Infiltration rate		0.4753	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5151	0.5050	0.4949	0.4444	0.4343	0.3838	0.3838	0.3737	0.4040	0.4343	0.4545	0.4747	(22b)
Effective ac	0.6327	0.6275	0.6225	0.5988	0.5943	0.5737	0.5737	0.5698	0.5816	0.5943	0.6033	0.6127	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.4528	41.1152	40.7843	39.2301	38.9393	37.5857	37.5857	37.3350	38.1071	38.9393	39.5276	40.1426	(38)
Heat transfer coeff	97.5096	97.1720	96.8411	95.2869	94.9961	93.6425	93.6425	93.3918	94.1639	94.9961	95.5844	96.1994	(39)
Average = Sum(39)m / 12 =												95.2855	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2327	1.2285	1.2243	1.2046	1.2010	1.1838	1.1838	1.1807	1.1904	1.2010	1.2084	1.2162	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046	(61)
Total heat required for water heating calculated for each month													
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m2	1079.5246	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1813.6014	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.2491	(H8)
Utilisation factor	0.5509	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	92.2821	(H14)
Volume ratio Veff/V	0.8127	(H15)
Solar storage volume factor	0.9585	(H16)
Solar input	-842.1367	(H17)

Solar input	-24.4203	-40.7504	-69.4027	-93.0132	-114.9100	-112.9749	-111.4819	-97.4023	-76.2855	-52.0940	-28.9660	-20.4356	(63)
								Solar input (sum of months) = Sum(63)m =				-842.1367	(63)
Output from w/h													
	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
								Total per year (kWh/year) = Sum(64)m =				760.7271	(64)
Heat gains from water heating, kWh/month													
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1166	45.4013	36.9228	27.9529	20.8951	17.6406	19.0613	24.7765	33.2550	42.2249	49.2827	52.5372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.0924	546.6108	525.2075	492.1352	458.3468	428.1384	410.5520	418.8968	437.9988	471.2819	508.2005	536.0612	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	10.6334	0.7200	0.7000	0.7700	3.8254	(74)
East	6.4500	19.6403	0.7200	0.7000	0.7700	44.2457	(76)
West	4.5400	19.6403	0.7200	0.7000	0.7700	31.1435	(80)

Solar gains	79.2145	154.7876	255.2961	374.1704	460.9853	473.1598	449.9376	384.7270	297.4079	183.6962	98.7205	65.1854	(83)
Total gains	630.3069	701.3984	780.5036	866.3055	919.3321	901.2982	860.4895	803.6238	735.4067	654.9781	606.9210	601.2466	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3335	56.5292	56.7223	57.6475	57.8240	58.6599	58.6599	58.8173	58.3351	57.8240	57.4681	57.1007	
alpha	4.7556	4.7686	4.7815	4.8432	4.8549	4.9107	4.9107	4.9212	4.8890	4.8549	4.8312	4.8067	
util living area													
	0.9933	0.9879	0.9723	0.9233	0.8123	0.6319	0.4720	0.5229	0.7750	0.9496	0.9875	0.9946	(86)
MIT	19.8276	19.9797	20.2440	20.5849	20.8392	20.9649	20.9931	20.9889	20.9060	20.5695	20.1433	19.8055	(87)
Th 2	19.8939	19.8973	19.9006	19.9163	19.9192	19.9329	19.9329	19.9355	19.9277	19.9192	19.9133	19.9071	(88)
util rest of house													
	0.9911	0.9839	0.9630	0.8978	0.7552	0.5400	0.3611	0.4078	0.6911	0.9273	0.9827	0.9928	(89)
MIT 2	18.3591	18.5819	18.9636	19.4480	19.7702	19.9111	19.9306	19.9312	19.8577	19.4404	18.8322	18.3364	(90)
Living area fraction									fLA = Living area / (4) =			0.1937	(91)
MIT	18.6435	18.8526	19.2116	19.6682	19.9773	20.1152	20.1364	20.1361	20.0607	19.6590	19.0861	18.6209	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6435	18.8526	19.2116	19.6682	19.9773	20.1152	20.1364	20.1361	20.0607	19.6590	19.0861	18.6209	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9787	0.9554	0.8908	0.7587	0.5565	0.3827	0.4301	0.7027	0.9204	0.9776	0.9897	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	622.4057	686.4537	745.6724	771.6854	697.4523	501.5849	329.2743	345.6430	516.7488	602.8631	593.3317	595.0758	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1398.6297	1355.8067	1231.0060	1026.0697	786.3088	516.4560	331.1537	348.9198	561.2872	860.5744	1145.6842	1387.2857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	577.5107	449.8053	361.0882	183.1567	66.1092	0.0000	0.0000	0.0000	0.0000	191.7373	397.6938	589.4042	(98)
Space heating												2816.5054	(98)
Space heating per m2											(98) / (4) =	35.6069	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3031.7603	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	577.5107	449.8053	361.0882	183.1567	66.1092	0.0000	0.0000	0.0000	0.0000	191.7373	397.6938	589.4042	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	621.6477	484.1822	388.6848	197.1547	71.1617	0.0000	0.0000	0.0000	0.0000	206.3910	428.0881	634.4501	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.9283	101.5680	78.2370	36.8073	10.4771	0.0000	0.0000	18.6057	40.6017	82.6527	116.6933	137.1559	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2648	89.2929	89.3130	89.3482	89.4484	86.7000	86.7000	86.7000	86.7000	88.9115	89.1535	89.2780	(217)
Fuel for water heating, kWh/month	154.5159	113.7470	87.5987	41.1953	11.7131	0.0000	0.0000	21.4599	46.8301	92.9607	130.8903	153.6280	(219)
Water heating fuel used												854.5389	(219)
Annual totals kWh/year													
Space heating fuel - main system												3031.7603	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.0938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 908 * 1.00) =										-530.1869		-530.1869	(233)
Total delivered energy for all uses												3842.2061	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3031.7603	3.4800	105.5053	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.5389	3.4800	29.7380	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	361.0938	13.1900	47.6283	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-530.1869	13.1900	-69.9316	(252)
Total energy cost			249.4273	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8442	(257)
SAP value		88.2241	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3031.7603	0.2160	654.8602	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.5389	0.2160	184.5804	(264)
Space and water heating			839.4406	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	361.0938	0.5190	187.4077 (268)
Energy saving/generation technologies			
PV Unit	-530.1869	0.5190	-275.1670 (269)
Total kg/year			816.5563 (272)
CO2 emissions per m2			10.3200 (273)
EI value			91.1830
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500	(1b)	x 2.3900	(2b) =	94.5245	(1b) - (3b)
First floor	39.5500	(1c)	x 2.6300	(2c) =	104.0165	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.5410	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2518 (8)
Pressure test		Yes
Measured/design AP50		4.4700
Infiltration rate		0.4753 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4040 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4242	0.3939	0.4040	0.3838	0.3838	0.3737	0.3636	0.3535	0.3434	0.3737	0.3535	0.3737	(22b)
Effective ac	0.5900	0.5776	0.5816	0.5737	0.5737	0.5698	0.5661	0.5625	0.5590	0.5698	0.5625	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			12.0200	1.2357	14.8536			(27)
Opening Type 8			2.1200	1.5000	3.1800			(26a)
Ground floor			39.5500	0.1900	7.5145			(28a)
External Wall	89.1400	14.1400	75.0000	0.2700	20.2500			(29a)
Main Roof	39.5500		39.5500	0.1600	6.3280			(30)
Total net area of external elements Aum(A, m2)			168.2400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.1261			(33)
Party Wall			43.5500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9307	(36)
Total fabric heat loss (33) + (36) =	56.0568	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6552	37.8430	38.1071	37.5857	37.5857	37.3350	37.0910	36.8537	36.6231	37.3350	36.8537	37.3350	(38)
Heat transfer coeff	94.7120	93.8998	94.1639	93.6425	93.6425	93.3918	93.1478	92.9105	92.6799	93.3918	92.9105	93.3918	(39)
Average = Sum(39)m / 12 =												93.4904	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1974	1.1871	1.1904	1.1838	1.1838	1.1807	1.1776	1.1746	1.1717	1.1807	1.1746	1.1807	(40)
HLP (average)												1.1819	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4456 (42)
Average daily hot water use (litres/day)	92.2821 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.5103	97.8190	94.1278	90.4365	86.7452	83.0539	83.0539	86.7452	90.4365	94.1278	97.8190	101.5103	(44)
Energy conte	150.5369	131.6605	135.8619	118.4477	113.6533	98.0742	90.8802	104.2863	105.5318	122.9872	134.2501	145.7869	(45)
Energy content (annual)										Total = Sum(45)m =		1451.9569	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5805	19.7491	20.3793	17.7671	17.0480	14.7111	13.6320	15.6429	15.8298	18.4481	20.1375	21.8680	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8117	10.6579	11.7778	11.3729	11.7338	11.3344	11.6992	11.7216	11.3554	11.7596	11.4092	11.8046 (61)
Total heat required for water heating calculated for each month												
	162.3486	142.3184	147.6396	129.8205	125.3872	109.4086	102.5793	116.0079	116.8872	134.7468	145.6593	157.5915 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3979 (H8)
Utilisation factor	0.5110 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2821 (H14)
Volume ratio Veff/V	0.8127 (H15)
Solar storage volume factor	0.9585 (H16)
Solar input	-874.1284 (H17)

Solar input	-28.5162	-40.5482	-69.6926	-94.0315	-110.4456	-117.9734	-115.4923	-103.3692	-80.9309	-55.9529	-33.7271	-23.4486 (63)
								Solar input (sum of months) = Sum(63)m =				-874.1284 (63)
Output from w/h												
	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429 (64)
								Total per year (kWh/year) = Sum(64)m =				737.7444 (64)
Heat gains from water heating, kWh/month												
	53.0064	46.4416	48.1185	42.2271	40.7232	35.4433	33.1424	37.6056	37.9282	43.8331	47.4905	51.4253 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	146.7338	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	51.1166	45.4013	36.9228	27.9529	20.8951	17.6406	19.0613	24.7765	33.2550	42.2249	49.2827	52.5372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.7004	328.0698	319.5791	301.5033	278.6860	257.2409	242.9142	239.5449	248.0356	266.1113	288.9287	310.3738	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	52.1189	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	71.2452	69.1095	64.6754	58.6487	54.7355	49.2268	44.5463	50.5452	52.6780	58.9155	65.9590	69.1200	(72)
Total internal gains													
	551.0924	546.6108	525.2075	492.1352	458.3468	428.1384	410.5520	418.8968	437.9988	471.2819	508.2005	536.0612	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0300	13.4839	0.7200	0.7000	0.7700	4.8508	(74)
East	6.4500	25.1925	0.7200	0.7000	0.7700	56.7539	(76)
West	4.5400	25.1925	0.7200	0.7000	0.7700	39.9477	(80)

Solar gains	101.5524	168.8928	280.2649	411.7637	480.7224	535.3347	505.3283	443.7963	344.3610	216.1490	126.1642	82.1293 (83)
Total gains	652.6448	715.5036	805.4724	903.8988	939.0692	963.4731	915.8803	862.6931	782.3597	687.4309	634.3647	618.1905 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9974	58.4991	58.3351	58.6599	58.6599	58.8173	58.9714	59.1220	59.2691	58.8173	59.1220	58.8173	
alpha	4.8665	4.8999	4.8890	4.9107	4.9107	4.9212	4.9314	4.9415	4.9513	4.9212	4.9415	4.9212	
util living area													
	0.9907	0.9849	0.9630	0.8946	0.7556	0.5388	0.3941	0.4167	0.6924	0.9204	0.9805	0.9923	(86)
MIT	19.9661	20.0925	20.3604	20.6834	20.8981	20.9844	20.9973	20.9966	20.9501	20.6884	20.2965	19.9600	(87)
Th 2	19.9221	19.9303	19.9277	19.9329	19.9329	19.9355	19.9380	19.9404	19.9427	19.9355	19.9404	19.9355	(88)
util rest of house													
	0.9877	0.9800	0.9507	0.8614	0.6881	0.4445	0.2882	0.3053	0.5974	0.8863	0.9728	0.9898	(89)
MIT 2	18.5804	18.7685	19.1482	19.5901	19.8467	19.9274	19.9373	19.9395	19.9107	19.6105	19.0721	18.5814	(90)
Living area fraction										fLA = Living area / (4) =		0.1937	(91)
MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8488	19.0249	19.3830	19.8019	20.0504	20.1321	20.1426	20.1442	20.1120	19.8193	19.3092	18.8484	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9834	0.9743	0.9429	0.8567	0.6961	0.4624	0.3088	0.3270	0.6137	0.8817	0.9667	0.9860	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	641.7963	697.1276	759.4435	774.3376	653.7191	445.4708	282.8054	282.0687	480.1368	606.1169	613.2154	609.5474	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1321.1218	1288.7693	1166.0310	964.6929	707.0335	451.2774	283.4077	282.8384	501.5831	786.2938	1060.0364	1293.3313	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	505.4182	397.5832	302.5011	137.0558	39.6659	0.0000	0.0000	0.0000	0.0000	134.0516	321.7111	508.7352	(98)
Space heating												2346.7221	(98)
Space heating per m2											(98) / (4) =	29.6678	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2526.0733	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	505.4182	397.5832	302.5011	137.0558	39.6659	0.0000	0.0000	0.0000	0.0000	134.0516	321.7111	508.7352	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	544.0454	427.9690	325.6201	147.5305	42.6974	0.0000	0.0000	0.0000	0.0000	144.2967	346.2983	547.6159	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.8324	101.7702	77.9470	35.7891	14.9416	0.0000	0.0000	12.6388	35.9563	78.7939	111.9322	134.1429	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2107	89.2288	89.2253	89.2182	89.0012	86.7000	86.7000	86.7000	86.7000	88.6882	89.0516	89.2129	(217)
Fuel for water heating, kWh/month	150.0184	114.0553	87.3598	40.1141	16.7880	0.0000	0.0000	14.5776	41.4721	88.8437	125.6936	150.3627	(219)
Water heating fuel used												829.2853	(219)
Annual totals kWh/year													
Space heating fuel - main system												2526.0733	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												361.0938	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1031 * 1.00) =										-602.1142		-602.1142	(233)
Total delivered energy for all uses												3239.3383	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2526.0733	7.3800	186.4242	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.2853	7.3800	61.2013	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	361.0938	28.6600	103.4895	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-602.1142	28.6600	-172.5659	(252)
Total energy cost			321.3740	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2526.0733	0.2160	545.6318	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.2853	0.2160	179.1256	(264)
Space and water heating			724.7575	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	361.0938	0.5190	187.4077	(268)
Energy saving/generation technologies				
PV Unit	-602.1142	0.5190	-312.4973	(269)
Total kg/year			664.5429	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2526.0733	1.2200	3081.8095	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.2853	1.2200	1011.7281	(264)
Space and water heating			4093.5376	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	361.0938	3.0700	1108.5579	(268)
Energy saving/generation technologies				
PV Unit	-602.1142	3.0700	-1848.4906	(269)
Primary energy kWh/year			3737.3549	(272)
Primary energy kWh/m2/year			47.2485	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	524.15	(P1)
Transmission heat loss coefficient	56.06	(37)
Summer heat loss coefficient	580.21	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0300	87.1704	0.7200	0.7000	0.7650	31.1559
East	6.4500	125.2818	0.7200	0.7000	0.7650	280.4027
West	4.5400	125.2818	0.7200	0.7000	0.7650	197.3687
total:						508.9273

	Jun	Jul	Aug	
Solar gains	548	509	446	(P3)
Internal gains	425	408	416	
Total summer gains	973	916	861	(P5)
Summer gain/loss ratio	1.68	1.58	1.48	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.33	19.13	19.03	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 659 - BG	**Issued on Date**	07/08/2024
Assessment Reference	Plot 659 EPC	**Prop Type Ref**	
Property	11 Kittiwake Place, Boorley Green, Southampton , SO32 2ZB		

SAP Rating	87 B	**DER**	14.54	**TER**	18.60
Environmental	89 B	**% DER<TER**	21.84		
CO_2 Emissions (t/year)	0.85	**DFEE**	47.36	**TFEE**	52.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.89		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.60	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.54	$kgCO_2/m^2$	Pass
	-4.06 (-21.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.56	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.36	$kWh/m^2/yr$	
	-5.2 (-9.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing West	1.03 m², No overhang 6.45 m², No overhang 4.54 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.47 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.023	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 660 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 660 - EPC	**Prop Type Ref**	
Property	15 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.36	**TER**	17.92
Environmental	91 B	**% DER<TER**	31.03		
CO_2 Emissions (t/year)	0.71	**DFEE**	43.73	**TFEE**	50.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.51		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 79 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.92 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.36 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.7 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing East: 6.11 m², No overhang
Windows facing South: 8.86 m², No overhang
Windows facing West: 5.58 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2018	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.4248	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4604	0.4514	0.4424	0.3972	0.3882	0.3430	0.3430	0.3340	0.3611	0.3882	0.4062	0.4243	(22b)
Effective ac	0.6060	0.6019	0.5978	0.5789	0.5753	0.5588	0.5588	0.5558	0.5652	0.5753	0.5825	0.5900	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6331	39.3639	39.1001	37.8608	37.6290	36.5496	36.5496	36.3497	36.9654	37.6290	38.0980	38.5884	(38)
Heat transfer coeff	104.4457	104.1765	103.9127	102.6735	102.4416	101.3622	101.3622	101.1624	101.7780	102.4416	102.9106	103.4010	(39)
Average = Sum(39)m / 12 =												102.6723	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3228	1.3194	1.3160	1.3003	1.2974	1.2837	1.2837	1.2812	1.2890	1.2974	1.3033	1.3095	(40)
HLP (average)												1.3003	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345	(61)
Total heat required for water heating calculated for each month													
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190	(64)
								Total per year (kWh/year) = Sum(64)m =				1589.7261	(64)
Heat gains from water heating, kWh/month													
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3683	17.2027	13.9902	10.5915	7.9173	6.6841	7.2224	9.3879	12.6005	15.9992	18.6734	19.9066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	370.4720	368.4266	355.1020	333.5866	311.7351	290.6484	276.9237	282.8295	293.8544	315.5805	340.5601	359.3008	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	19.6403	0.7200	0.7000	0.7700	41.9133	(76)
South	8.8600	46.7521	0.7200	0.7000	0.7700	144.6766	(78)
West	5.8600	19.6403	0.7200	0.7000	0.7700	38.2777	(80)

Solar gains	224.8676	393.8136	560.1669	717.9045	817.2306	814.7854	784.2682	711.1619	615.7543	441.7054	271.4799	190.9591	(83)
Total gains	595.3396	762.2402	915.2689	1051.4911	1128.9657	1105.4338	1061.1919	993.9914	909.6088	757.2859	612.0399	550.2599	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4994	52.6350	52.7687	53.4056	53.5264	54.0964	54.0964	54.2033	53.8754	53.5264	53.2825	53.0298	
alpha	4.5000	4.5090	4.5179	4.5604	4.5684	4.6064	4.6064	4.6136	4.5917	4.5684	4.5522	4.5353	
util living area													
	0.9948	0.9842	0.9559	0.8812	0.7447	0.5649	0.4157	0.4605	0.7019	0.9285	0.9879	0.9963	(86)
MIT	19.6716	19.9304	20.2705	20.6344	20.8702	20.9719	20.9944	20.9912	20.9260	20.5804	20.0444	19.6258	(87)
Th 2	19.8230	19.8257	19.8283	19.8406	19.8429	19.8536	19.8536	19.8556	19.8495	19.8429	19.8382	19.8334	(88)
util rest of house													
	0.9930	0.9791	0.9419	0.8461	0.6794	0.4729	0.3098	0.3498	0.6102	0.8986	0.9831	0.9950	(89)
MIT 2	18.0832	18.4592	18.9441	19.4445	19.7290	19.8371	19.8518	19.8525	19.7983	19.3910	18.6363	18.0237	(90)
Living area fraction									fLA = Living area / (4) =			0.1722	(91)
MIT	18.3568	18.7126	19.1726	19.6494	19.9256	20.0326	20.0486	20.0486	19.9926	19.5959	18.8789	18.2996	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3568	18.7126	19.1726	19.6494	19.9256	20.0326	20.0486	20.0486	19.9926	19.5959	18.8789	18.2996	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9724	0.9319	0.8394	0.6845	0.4878	0.3281	0.3689	0.6226	0.8907	0.9774	0.9925	(94)
Useful gains	589.2030	741.1790	852.9418	882.6570	772.7738	539.2761	348.1508	366.6911	566.3013	674.4810	598.2254	546.1147	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1468.1714	1438.9507	1316.8429	1103.6827	842.6433	550.6560	349.5610	369.1028	599.7336	921.5539	1212.1705	1457.9177	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	653.9525	468.9026	345.1424	159.1385	51.9829	0.0000	0.0000	0.0000	0.0000	183.8222	442.0405	678.3815	(98)
Space heating												2983.3631	(98)
Space heating per m2											(98) / (4) =	37.7832	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3211.3704	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	653.9525	468.9026	345.1424	159.1385	51.9829	0.0000	0.0000	0.0000	0.0000	183.8222	442.0405	678.3815	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	703.9316	504.7390	371.5204	171.3009	55.9558	0.0000	0.0000	0.0000	0.0000	197.8711	475.8240	730.2276	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2451	89.1343	88.9171	88.4339	87.6143	86.7000	86.7000	86.7000	86.7000	88.5184	89.0853	89.2790	(217)
Fuel for water heating, kWh/month													
	181.8281	159.5938	165.9681	146.7380	143.0557	126.1460	118.2761	133.7538	134.7658	152.1606	163.4318	176.4345	(219)
Water heating fuel used												1802.1521	(219)
Annual totals kWh/year													
Space heating fuel - main system												3211.3704	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4806.8193	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3211.3704	0.2160	693.6560	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1802.1521	0.2160	389.2649	(264)
Space and water heating			1082.9209	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0499	0.5190	177.5239	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			975.6419	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.3600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.3600	ZC1
Total Floor Area	TFA	78.9600	
Assumed number of occupants	N	2.4428	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3044	ZC2
CO2 emissions from cooking, equation (L16)		2.2496	ZC3
Total CO2 emissions		30.9140	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.9140	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800 (1b)	x	2.3900 (2b)	=	94.3572	(1b) - (3b)
First floor	39.4800 (1c)	x	2.6300 (2c)	=	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1514	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4014	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3412	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4350	0.4265	0.4179	0.3753	0.3668	0.3241	0.3241	0.3156	0.3412	0.3668	0.3838	0.4009	(22b)
Effective ac	0.5946	0.5909	0.5873	0.5704	0.5673	0.5525	0.5525	0.5498	0.5582	0.5673	0.5737	0.5803	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			17.5900	1.3258	23.3201			(27)
Ground floor			39.4800	0.1300	5.1324			(28a)
External Wall	89.1700	19.7100	69.4600	0.1800	12.5028			(29a)
Main Roof	39.4800		39.4800	0.1300	5.1324			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6317			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4689	(36)
Total fabric heat loss					(33) + (36) =		59.1005	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.8888	38.6485	38.4130	37.3068	37.0998	36.1364	36.1364	35.9580	36.5075	37.0998	37.5185	37.9562	(38)
Heat transfer coeff	97.9893	97.7490	97.5135	96.4073	96.2004	95.2369	95.2369	95.0585	95.6080	96.2004	96.6191	97.0568	(39)
Average = Sum(39)m / 12 =												96.4063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2410	1.2380	1.2350	1.2210	1.2183	1.2061	1.2061	1.2039	1.2108	1.2183	1.2236	1.2292	(40)
HLP (average)												1.2210	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4428	(42)
Average daily hot water use (litres/day)												92.2173	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.9919	47.9328	44.5675	44.1733	40.9293	42.2936	44.1733	44.5675	47.9328	48.2056	50.9589	(61)
Total heat required for water heating calculated for each month													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(64)
								Total per year (kWh/year) = Sum(64)m =				2002.6219	(64)
Heat gains from water heating, kWh/month													
	62.7581	54.9943	57.1255	50.4980	48.8065	42.8191	40.7698	45.6942	46.2065	52.8477	56.6582	61.1798	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3686	17.2030	13.9904	10.5917	7.9174	6.6842	7.2225	9.3881	12.6007	15.9995	18.6737	19.9069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	84.3522	81.8368	76.7816	70.1362	65.6001	59.4709	54.7981	61.4169	64.1757	71.0318	78.6919	82.2309	(72)
Total internal gains													
	383.6165	381.1899	367.2411	345.1026	322.6255	300.9145	287.1942	293.7241	305.3766	327.7257	353.3269	372.4478	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.2400	19.6403	0.6300	0.7000	0.7700	31.4522	(76)
South	7.5800	46.7521	0.6300	0.7000	0.7700	108.3033	(78)
West	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311	(80)

Solar gains	168.3866	294.9085	419.5060	537.6651	612.0758	610.2526	587.3927	532.6241	461.1460	330.7792	203.2931	142.9936	(83)
Total gains	552.0031	676.0984	786.7471	882.7677	934.7014	911.1671	874.5869	826.3482	766.5226	658.5049	556.6200	515.4413	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9585	56.0960	56.2315	56.8767	56.9991	57.5757	57.5757	57.6838	57.3522	56.9991	56.7521	56.4961	
alpha	4.7306	4.7397	4.7488	4.7918	4.7999	4.8384	4.8384	4.8456	4.8235	4.7999	4.7835	4.7664	
util living area													
	0.9961	0.9895	0.9716	0.9201	0.8090	0.6339	0.4719	0.5175	0.7608	0.9496	0.9913	0.9972	(86)
MIT	19.7287	19.9408	20.2392	20.5840	20.8373	20.9624	20.9926	20.9886	20.9100	20.5593	20.0713	19.6908	(87)
Th 2	19.8873	19.8898	19.8921	19.9033	19.9054	19.9151	19.9151	19.9169	19.9113	19.9054	19.9011	19.8967	(88)
util rest of house													
	0.9948	0.9861	0.9621	0.8937	0.7511	0.5407	0.3593	0.4015	0.6749	0.9272	0.9878	0.9962	(89)
MIT 2	18.2109	18.5205	18.9503	19.4358	19.7552	19.8918	19.9126	19.9126	19.8454	19.4156	18.7202	18.1623	(90)
Living area fraction									fLA = Living area / (4) =			0.1722	(91)
MIT	18.4724	18.7652	19.1723	19.6335	19.9415	20.0762	20.0986	20.0979	20.0288	19.6126	18.9529	18.4256	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4724	18.7652	19.1723	19.6335	19.9415	20.0762	20.0986	20.0979	20.0288	19.6126	18.9529	18.4256	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9811	0.9540	0.8860	0.7532	0.5553	0.3788	0.4215	0.6852	0.9194	0.9834	0.9943	(94)
Useful gains	547.7503	663.3182	750.5528	782.0885	704.0597	505.9396	331.2534	348.2872	525.2194	605.4577	547.4063	512.4827	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1388.7389	1355.3072	1235.7242	1034.7920	792.8395	521.5341	333.1950	351.5196	566.8406	867.0146	1145.2159	1380.6861	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	625.6955	465.0166	360.9675	181.9466	66.0521	0.0000	0.0000	0.0000	0.0000	194.5983	430.4229	645.9433	(98)
Space heating												2970.6430	(98)
Space heating per m2											(98) / (4) =	37.6221	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3180.5599	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	625.6955	465.0166	360.9675	181.9466	66.0521	0.0000	0.0000	0.0000	0.0000	194.5983	430.4229	645.9433	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	669.9096	497.8765	386.4749	194.8036	70.7196	0.0000	0.0000	0.0000	0.0000	208.3494	460.8383	691.5881	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	201.3900	176.5599	183.6991	162.9319	157.7468	138.9346	133.1099	148.3863	150.0251	170.8335	182.3614	196.6434	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7137	87.3756	86.7212	85.3296	83.0382	80.3000	80.3000	80.3000	80.3000	85.3797	87.1383	87.8221	(217)
Fuel for water heating, kWh/month													
	229.5993	202.0700	211.8273	190.9442	189.9690	173.0194	165.7658	184.7900	186.8308	200.0867	209.2780	223.9112	(219)
Water heating fuel used												2368.0917	(219)
Annual totals kWh/year													
Space heating fuel - main system												3180.5599	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0556	(232)
Total delivered energy for all uses												5965.7072	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3180.5599	0.2160	687.0009	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2368.0917	0.2160	511.5078	(264)
Space and water heating			1198.5087	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0556	0.5190	177.5269	(268)
Total CO2, kg/m2/year			1414.9606	(272)
Emissions per m2 for space and water heating			15.1787	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2483	(272b)
Emissions per m2 for pumps and fans			0.4930	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1787 * 1.00) + 2.2483 + 0.4930, rounded to 2 d.p.			17.9200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800 (1b)	x	2.3900 (2b)	=	94.3572	(1b) - (3b)
First floor	39.4800 (1c)	x	2.6300 (2c)	=	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1514	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3744	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3182	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4057	0.3978	0.3898	0.3500	0.3421	0.3023	0.3023	0.2943	0.3182	0.3421	0.3580	0.3739	(22b)
Effective ac	0.5823	0.5791	0.5760	0.5613	0.5585	0.5457	0.5457	0.5433	0.5506	0.5585	0.5641	0.5699	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4651	(36)
Total fabric heat loss					(33) + (36) =		64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.0843	37.8753	37.6704	36.7080	36.5280	35.6898	35.6898	35.5346	36.0126	36.5280	36.8922	37.2730	(38)
Heat transfer coeff	102.8969	102.6879	102.4830	101.5206	101.3406	100.5024	100.5024	100.3472	100.8252	101.3406	101.7048	102.0856	(39)
Average = Sum(39)m / 12 =												101.5198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3032	1.3005	1.2979	1.2857	1.2834	1.2728	1.2728	1.2709	1.2769	1.2834	1.2881	1.2929	(40)
HLP (average)												1.2857	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428	(42)
Average daily hot water use (litres/day)	92.2173	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9666	27.9582	28.8504	25.1524	24.1344	20.8261	19.2985	22.1453	22.4098	26.1164	28.5081	30.9579	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3683	17.2027	13.9902	10.5915	7.9173	6.6841	7.2224	9.3879	12.6005	15.9992	18.6734	19.9066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	42.9659	41.6045	38.7774	34.9339	32.4387	28.9252	25.9388	29.7651	31.1247	35.1027	39.5946	41.6101	(72)
Total internal gains													
	339.2298	337.9573	326.2366	306.9002	286.4639	267.3686	255.3347	259.0722	269.3253	288.7963	311.2292	328.8266	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	19.6403	0.7200	0.7000	0.7700	41.9133	(76)
South	8.8600	46.7521	0.7200	0.7000	0.7700	144.6766	(78)
West	5.8600	19.6403	0.7200	0.7000	0.7700	38.2777	(80)

Solar gains	224.8676	393.8136	560.1669	717.9045	817.2306	814.7854	784.2682	711.1619	615.7543	441.7054	271.4799	190.9591	(83)
Total gains	564.0974	731.7709	886.4035	1024.8048	1103.6945	1082.1540	1039.6029	970.2341	885.0796	730.5017	582.7091	519.7857	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.2896	53.3981	53.5048	54.0120	54.1080	54.5592	54.5592	54.6436	54.3845	54.1080	53.9142	53.7131	
alpha	4.5526	4.5599	4.5670	4.6008	4.6072	4.6373	4.6373	4.6429	4.6256	4.6072	4.5943	4.5809	
util living area													
	0.9958	0.9863	0.9596	0.8871	0.7513	0.5716	0.4207	0.4677	0.7116	0.9350	0.9899	0.9971	(86)
MIT	19.6616	19.9216	20.2641	20.6293	20.8685	20.9713	20.9943	20.9909	20.9234	20.5693	20.0290	19.6126	(87)
Th 2	19.8384	19.8404	19.8425	19.8520	19.8538	19.8622	19.8622	19.8637	19.8590	19.8538	19.8502	19.8464	(88)
util rest of house													
	0.9943	0.9818	0.9466	0.8532	0.6869	0.4795	0.3143	0.3563	0.6206	0.9072	0.9859	0.9961	(89)
MIT 2	18.6373	18.8961	19.2306	19.5764	19.7747	19.8506	19.8609	19.8615	19.8225	19.5344	19.0122	18.5950	(90)
Living area fraction									fLA = Living area / (4) =			0.1722	(91)
MIT	18.8137	19.0727	19.4086	19.7578	19.9631	20.0436	20.0562	20.0560	20.0121	19.7127	19.1873	18.7702	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8137	19.0727	19.4086	19.7578	19.9631	20.0436	20.0562	20.0560	20.0121	19.7127	19.1873	18.7702	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9779	0.9406	0.8500	0.6936	0.4948	0.3327	0.3755	0.6339	0.9030	0.9827	0.9947	(94)
Useful gains	559.9065	715.5924	833.7599	871.1095	765.4796	535.4057	345.9156	364.3670	561.0280	659.6223	572.6259	517.0399	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1493.4194	1455.3658	1322.9144	1102.2866	837.3835	547.0977	347.3520	366.8733	596.0927	923.4817	1229.3400	1487.4129	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	694.5336	497.1277	363.9309	166.4475	53.4965	0.0000	0.0000	0.0000	0.0000	196.3114	472.8341	721.9575	(98)
Space heating												3166.6393	(98)
Space heating per m2											(98) / (4) =	40.1043	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	944.7225	743.7177	762.6385	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9347	0.9668	0.9551	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	883.0381	719.0507	728.3584	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1355.8293	1304.2120	1224.6385	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	340.4097	435.3600	369.2323	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												1145.0020 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	85.1024	108.8400	92.3081	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												286.2505 (107)
Space cooling per m2												3.6253 (108)
Energy for space heating												40.1043 (99)
Energy for space cooling												3.6253 (108)
Total												43.7296 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800 (1b)	x	2.3900 (2b)	=	94.3572	(1b) - (3b)
First floor	39.4800 (1c)	x	2.6300 (2c)	=	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1514	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4014	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3412	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4350	0.4265	0.4179	0.3753	0.3668	0.3241	0.3241	0.3156	0.3412	0.3668	0.3838	0.4009	(22b)
Effective ac	0.5946	0.5909	0.5873	0.5704	0.5673	0.5525	0.5525	0.5498	0.5582	0.5673	0.5737	0.5803	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			17.5900	1.3258	23.3201			(27)
Ground floor			39.4800	0.1300	5.1324			(28a)
External Wall	89.1700	19.7100	69.4600	0.1800	12.5028			(29a)
Main Roof	39.4800		39.4800	0.1300	5.1324			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6317			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4689	(36)
Total fabric heat loss					(33) + (36) =		59.1005	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.8888	38.6485	38.4130	37.3068	37.0998	36.1364	36.1364	35.9580	36.5075	37.0998	37.5185	37.9562	(38)
Heat transfer coeff	97.9893	97.7490	97.5135	96.4073	96.2004	95.2369	95.2369	95.0585	95.6080	96.2004	96.6191	97.0568	(39)
Average = Sum(39)m / 12 =												96.4063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2410	1.2380	1.2350	1.2210	1.2183	1.2061	1.2061	1.2039	1.2108	1.2183	1.2236	1.2292	(40)
HLP (average)												1.2210	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4428	(42)
Average daily hot water use (litres/day)												92.2173	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.9666	27.9582	28.8504	25.1524	24.1344	20.8261	19.2985	22.1453	22.4098	26.1164	28.5081	30.9579	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	122.1416	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.3686	17.2030	13.9904	10.5917	7.9174	6.6842	7.2225	9.3881	12.6007	15.9995	18.6737	19.9069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.2532	219.5076	213.8266	201.7323	186.4655	172.1168	162.5311	160.2767	165.9577	178.0519	193.3188	207.6674	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	35.2142	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	42.9659	41.6045	38.7774	34.9339	32.4387	28.9252	25.9388	29.7651	31.1247	35.1027	39.5946	41.6101	(72)
Total internal gains													
	339.2302	337.9576	326.2369	306.9004	286.4640	267.3687	255.3348	259.0724	269.3255	288.7966	311.2295	328.8270	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.2400	19.6403	0.6300	0.7000	0.7700	31.4522	(76)
South	7.5800	46.7521	0.6300	0.7000	0.7700	108.3033	(78)
West	4.7700	19.6403	0.6300	0.7000	0.7700	28.6311	(80)

Solar gains	168.3866	294.9085	419.5060	537.6651	612.0758	610.2526	587.3927	532.6241	461.1460	330.7792	203.2931	142.9936	(83)
Total gains	507.6167	632.8661	745.7428	844.5655	898.5399	877.6213	842.7276	791.6965	730.4715	619.5757	514.5226	471.8205	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9585	56.0960	56.2315	56.8767	56.9991	57.5757	57.5757	57.6838	57.3522	56.9991	56.7521	56.4961	
alpha	4.7306	4.7397	4.7488	4.7918	4.7999	4.8384	4.8384	4.8456	4.8235	4.7999	4.7835	4.7664	
util living area													
	0.9973	0.9920	0.9768	0.9306	0.8258	0.6532	0.4886	0.5379	0.7835	0.9593	0.9937	0.9981	(86)
MIT	19.6777	19.8926	20.1970	20.5531	20.8207	20.9574	20.9914	20.9866	20.8972	20.5229	20.0238	19.6403	(87)
Th 2	19.8873	19.8898	19.8921	19.9033	19.9054	19.9151	19.9151	19.9169	19.9113	19.9054	19.9011	19.8967	(88)
util rest of house													
	0.9964	0.9893	0.9688	0.9067	0.7700	0.5590	0.3726	0.4185	0.6996	0.9403	0.9911	0.9974	(89)
MIT 2	18.6920	18.9074	19.2087	19.5568	19.7908	19.8968	19.9131	19.9134	19.8589	19.5381	19.0480	18.6622	(90)
Living area fraction									fLA = Living area / (4) =			0.1722	(91)
MIT	18.8618	19.0771	19.3790	19.7284	19.9682	20.0794	20.0988	20.0982	20.0377	19.7077	19.2161	18.8307	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8618	19.0771	19.3790	19.7284	19.9682	20.0794	20.0988	20.0982	20.0377	19.7077	19.2161	18.8307	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9951	0.9866	0.9640	0.9022	0.7736	0.5741	0.3927	0.4392	0.7105	0.9359	0.9889	0.9965	(94)
Useful gains	505.1484	624.3962	718.9095	761.9276	695.0940	503.8776	330.9433	347.6902	518.9751	579.8674	508.8221	470.1673	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1426.8987	1385.7968	1255.8719	1043.9407	795.4042	521.8441	333.2155	351.5485	567.6936	876.1681	1170.6464	1420.0075	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	685.7823	511.6612	399.5000	203.0494	74.6308	0.0000	0.0000	0.0000	0.0000	220.4478	476.5135	706.6811	(98)
Space heating												3278.2661	(98)
Space heating per m2											(98) / (4) =	41.5181	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	895.2271	704.7532	722.4447	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9061	0.9511	0.9359	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	811.1913	670.2592	676.1328	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1116.7652	1074.0981	1015.9583	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	220.0132	300.4562	252.8302	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												773.2997	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   55.0033   75.1140   63.2076    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        193.3249 (107)
Space cooling per m2                                                                                                   2.4484 (108)
Energy for space heating                                                                                              41.5181 (99)
Energy for space cooling                                                                                               2.4484 (108)
Total                                                                                                                 43.9665 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   50.6 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2018	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.4248	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3792	0.3521	0.3611	0.3430	0.3430	0.3340	0.3250	0.3160	0.3069	0.3340	0.3160	0.3340	(22b)
Effective ac	0.5719	0.5620	0.5652	0.5588	0.5588	0.5558	0.5528	0.5499	0.5471	0.5558	0.5499	0.5558	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.4024	36.7548	36.9654	36.5496	36.5496	36.3497	36.1552	35.9660	35.7821	36.3497	35.9660	36.3497	(38)
Heat transfer coeff	102.2151	101.5675	101.7780	101.3622	101.3622	101.1624	100.9678	100.7786	100.5947	101.1624	100.7786	101.1624	(39)
Average = Sum(39)m / 12 =												101.2410	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2945	1.2863	1.2890	1.2837	1.2837	1.2812	1.2787	1.2763	1.2740	1.2812	1.2763	1.2812	(40)
HLP (average)												1.2822	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345 (61)
Total heat required for water heating calculated for each month												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (64)
								Total per year (kWh/year) = Sum(64)m =				1589.7261 (64)
RHI water heating demand												1590 (64)
Heat gains from water heating, kWh/month												
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4207	43.0068	34.9755	26.4787	19.7931	16.7102	18.0560	23.4698	31.5012	39.9980	46.6835	49.7665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.2585	327.6233	319.1442	301.0930	278.3067	256.8908	242.5837	239.2189	247.6980	265.7492	288.5355	309.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	547.8437	543.6604	522.7189	490.1485	456.7662	426.7625	409.1239	417.1676	435.8095	468.5905	505.1009	532.7586	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	25.1925	0.7200	0.7000	0.7700	53.7622	(76)
South	8.8600	56.7559	0.7200	0.7000	0.7700	175.6338	(78)
West	5.5800	25.1925	0.7200	0.7000	0.7700	49.0987	(80)

Solar gains	278.4947	415.1114	595.9284	770.9906	837.3697	908.7068	867.0414	802.9076	692.6099	502.4524	335.1150	232.5013	(83)
Total gains	826.3384	958.7717	1118.6473	1261.1391	1294.1359	1335.4693	1276.1653	1220.0752	1128.4194	971.0429	840.2159	765.2599	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6451	53.9871	53.8754	54.0964	54.0964	54.2033	54.3077	54.4097	54.5092	54.2033	54.4097	54.2033	
alpha	4.5763	4.5991	4.5917	4.6064	4.6064	4.6136	4.6205	4.6273	4.6339	4.6136	4.6273	4.6136	
util living area													
	0.9783	0.9592	0.9046	0.7878	0.6277	0.4266	0.3076	0.3210	0.5439	0.8219	0.9512	0.9831	(86)
MIT	20.0297	20.2167	20.5209	20.8002	20.9428	20.9920	20.9986	20.9984	20.9768	20.7990	20.3943	19.9937	(87)
Th 2	19.8451	19.8516	19.8495	19.8536	19.8536	19.8556	19.8575	19.8594	19.8613	19.8556	19.8594	19.8556	(88)
util rest of house													
	0.9715	0.9473	0.8788	0.7390	0.5558	0.3434	0.2180	0.2277	0.4532	0.7661	0.9343	0.9777	(89)
MIT 2	18.6148	18.8832	19.2978	19.6538	19.8093	19.8518	19.8572	19.8590	19.8480	19.6660	19.1439	18.5716	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9637	0.9376	0.8699	0.7389	0.5657	0.3576	0.2335	0.2438	0.4681	0.7664	0.9249	0.9709	(94)
Useful gains	796.3505	898.9664	973.0730	931.8156	732.1045	477.5807	297.9628	297.4979	528.2311	744.2445	777.1448	743.0017	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1426.7681	1402.9358	1273.0864	1049.2236	760.6740	480.3383	298.2395	297.8281	537.4203	855.9489	1154.8450	1397.7171	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	469.0307	338.6674	223.2100	84.5337	21.2557	0.0000	0.0000	0.0000	0.0000	83.1080	271.9442	487.1083	(98)
Space heating												1978.8579	(98)
RHI space heating demand												1979	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2018	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.4248	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4604	0.4514	0.4424	0.3972	0.3882	0.3430	0.3430	0.3340	0.3611	0.3882	0.4062	0.4243	(22b)
Effective ac	0.6060	0.6019	0.5978	0.5789	0.5753	0.5588	0.5588	0.5558	0.5652	0.5753	0.5825	0.5900	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6331	39.3639	39.1001	37.8608	37.6290	36.5496	36.5496	36.3497	36.9654	37.6290	38.0980	38.5884	(38)
Heat transfer coeff	104.4457	104.1765	103.9127	102.6735	102.4416	101.3622	101.3622	101.1624	101.7780	102.4416	102.9106	103.4010	(39)
Average = Sum(39)m / 12 =												102.6723	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3228	1.3194	1.3160	1.3003	1.2974	1.2837	1.2837	1.2812	1.2890	1.2974	1.3033	1.3095	(40)
HLP (average)												1.3003	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345 (61)
Total heat required for water heating calculated for each month												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (64)
								Total per year (kWh/year) = Sum(64)m =				1589.7261 (64)
Heat gains from water heating, kWh/month												
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4207	43.0068	34.9755	26.4787	19.7931	16.7102	18.0560	23.4698	31.5012	39.9980	46.6835	49.7665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.2585	327.6233	319.1442	301.0930	278.3067	256.8908	242.5837	239.2189	247.6980	265.7492	288.5355	309.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	547.8437	543.6604	522.7189	490.1485	456.7662	426.7625	409.1239	417.1676	435.8095	468.5905	505.1009	532.7586	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	19.6403	0.7200	0.7000	0.7700	41.9133	(76)
South	8.6000	46.7521	0.7200	0.7000	0.7700	144.6766	(78)
West	5.5800	19.6403	0.7200	0.7000	0.7700	38.2777	(80)

Solar gains	224.8676	393.8136	560.1669	717.9045	817.2306	814.7854	784.2682	711.1619	615.7543	441.7054	271.4799	190.9591	(83)
Total gains	772.7113	937.4739	1082.8858	1208.0530	1273.9968	1241.5479	1193.3921	1128.3295	1051.5638	910.2959	776.5807	723.7177	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4994	52.6350	52.7687	53.4056	53.5264	54.0964	54.0964	54.2033	53.8754	53.5264	53.2825	53.0298	
alpha	4.5000	4.5090	4.5179	4.5604	4.5684	4.6064	4.6064	4.6136	4.5917	4.5684	4.5522	4.5353	
util living area													
	0.9856	0.9666	0.9246	0.8314	0.6854	0.5096	0.3712	0.4083	0.6290	0.8784	0.9707	0.9889	(86)
MIT	19.8668	20.1103	20.4163	20.7246	20.9080	20.9814	20.9965	20.9946	20.9527	20.6922	20.2170	19.8194	(87)
Th 2	19.8230	19.8257	19.8283	19.8406	19.8429	19.8536	19.8536	19.8556	19.8495	19.8429	19.8382	19.8334	(88)
util rest of house													
	0.9810	0.9568	0.9034	0.7891	0.6187	0.4239	0.2758	0.3089	0.5391	0.8362	0.9602	0.9854	(89)
MIT 2	18.3651	18.7138	19.1406	19.5523	19.7649	19.8430	19.8525	19.8538	19.8184	19.5279	18.8804	18.3041	(90)
Living area fraction									fLA = Living area / (4) =			0.1722	(91)
MIT	18.6237	18.9543	19.3603	19.7542	19.9618	20.0391	20.0496	20.0503	20.0138	19.7284	19.1106	18.5651	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6237	18.9543	19.3603	19.7542	19.9618	20.0391	20.0496	20.0503	20.0138	19.7284	19.1106	18.5651	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9746	0.9473	0.8932	0.7856	0.6260	0.4381	0.2923	0.3260	0.5526	0.8313	0.9515	0.9800	(94)
Useful gains	753.0835	888.0640	967.2268	949.0280	797.4837	543.9590	348.7892	367.8300	581.1165	756.7078	738.9279	709.2144	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1496.0520	1464.1331	1336.3490	1114.4374	846.3517	551.3211	349.6554	369.2688	601.8918	935.1281	1236.0172	1485.3650	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	552.7686	387.1185	274.6270	119.0947	36.3578	0.0000	0.0000	0.0000	0.0000	132.7447	357.9043	577.4560	(98)
Space heating												2438.0716	(98)
Space heating per m2											(98) / (4) =	30.8773	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2624.4043	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	552.7686	387.1185	274.6270	119.0947	36.3578	0.0000	0.0000	0.0000	0.0000	132.7447	357.9043	577.4560	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	595.0146	416.7045	295.6157	128.1967	39.1365	0.0000	0.0000	0.0000	0.0000	142.8899	385.2576	621.5888	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1532	89.0171	88.7550	88.2025	87.3995	86.7000	86.7000	86.7000	86.7000	88.2594	88.9507	89.1944	(217)
Fuel for water heating, kWh/month													
	182.0155	159.8038	166.2712	147.1230	143.4071	126.1460	118.2761	133.7538	134.7658	152.6072	163.6793	176.6018	(219)
Water heating fuel used												1804.4506	(219)
Annual totals kWh/year													
Space heating fuel - main system												2624.4043	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4222.1516	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2624.4043	3.4800	91.3293	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1804.4506	3.4800	62.7949	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	342.0499	13.1900	45.1164	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			246.8600	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8364	(257)
SAP value		88.3321	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2624.4043	0.2160	566.8713	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1804.4506	0.2160	389.7613	(264)
Space and water heating			956.6327	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0499	0.5190	177.5239	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			849.3537	(272)
CO2 emissions per m2			10.7600	(273)
EI value			90.8185	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8798 = 3.956, stars = 4
Water heating environmental impact	0.216 / 0.8798 = 0.2455, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2018	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.4248	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3792	0.3521	0.3611	0.3430	0.3430	0.3340	0.3250	0.3160	0.3069	0.3340	0.3160	0.3340	(22b)
Effective ac	0.5719	0.5620	0.5652	0.5588	0.5588	0.5558	0.5528	0.5499	0.5471	0.5558	0.5499	0.5558	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.4024	36.7548	36.9654	36.5496	36.5496	36.3497	36.1552	35.9660	35.7821	36.3497	35.9660	36.3497	(38)
Heat transfer coeff	102.2151	101.5675	101.7780	101.3622	101.3622	101.1624	100.9678	100.7786	100.5947	101.1624	100.7786	101.1624	(39)
Average = Sum(39)m / 12 =												101.2410	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2945	1.2863	1.2890	1.2837	1.2837	1.2812	1.2787	1.2763	1.2740	1.2812	1.2763	1.2812	(40)
HLP (average)												1.2822	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345 (61)
Total heat required for water heating calculated for each month												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (64)
								Total per year (kWh/year) = Sum(64)m =				1589.7261 (64)
Heat gains from water heating, kWh/month												
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4207	43.0068	34.9755	26.4787	19.7931	16.7102	18.0560	23.4698	31.5012	39.9980	46.6835	49.7665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.2585	327.6233	319.1442	301.0930	278.3067	256.8908	242.5837	239.2189	247.6980	265.7492	288.5355	309.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	547.8437	543.6604	522.7189	490.1485	456.7662	426.7625	409.1239	417.1676	435.8095	468.5905	505.1009	532.7586	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	25.1925	0.7200	0.7000	0.7700	53.7622	(76)
South	8.6000	56.7559	0.7200	0.7000	0.7700	175.6338	(78)
West	5.5800	25.1925	0.7200	0.7000	0.7700	49.0987	(80)

Solar gains	278.4947	415.1114	595.9284	770.9906	837.3697	908.7068	867.0414	802.9076	692.6099	502.4524	335.1150	232.5013	(83)
Total gains	826.3384	958.7717	1118.6473	1261.1391	1294.1359	1335.4693	1276.1653	1220.0752	1128.4194	971.0429	840.2159	765.2599	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6451	53.9871	53.8754	54.0964	54.0964	54.2033	54.3077	54.4097	54.5092	54.2033	54.4097	54.2033	
alpha	4.5763	4.5991	4.5917	4.6064	4.6064	4.6136	4.6205	4.6273	4.6339	4.6136	4.6273	4.6136	
util living area													
	0.9783	0.9592	0.9046	0.7878	0.6277	0.4266	0.3076	0.3210	0.5439	0.8219	0.9512	0.9831	(86)
MIT	20.0297	20.2167	20.5209	20.8002	20.9428	20.9920	20.9986	20.9984	20.9768	20.7990	20.3943	19.9937	(87)
Th 2	19.8451	19.8516	19.8495	19.8536	19.8536	19.8556	19.8575	19.8594	19.8613	19.8556	19.8594	19.8556	(88)
util rest of house													
	0.9715	0.9473	0.8788	0.7390	0.5558	0.3434	0.2180	0.2277	0.4532	0.7661	0.9343	0.9777	(89)
MIT 2	18.6148	18.8832	19.2978	19.6538	19.8093	19.8518	19.8572	19.8590	19.8480	19.6660	19.1439	18.5716	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9637	0.9376	0.8699	0.7389	0.5657	0.3576	0.2335	0.2438	0.4681	0.7664	0.9249	0.9709	(94)
Useful gains	796.3505	898.9664	973.0730	931.8156	732.1045	477.5807	297.9628	297.4979	528.2311	744.2445	777.1448	743.0017	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1426.7681	1402.9358	1273.0864	1049.2236	760.6740	480.3383	298.2395	297.8281	537.4203	855.9489	1154.8450	1397.7171	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	469.0307	338.6674	223.2100	84.5337	21.2557	0.0000	0.0000	0.0000	0.0000	83.1080	271.9442	487.1083	(98)
Space heating												1978.8579	(98)
Space heating per m2											(98) / (4) =	25.0615	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2130.0947	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	469.0307	338.6674	223.2100	84.5337	21.2557	0.0000	0.0000	0.0000	0.0000	83.1080	271.9442	487.1083	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	504.8770	364.5505	240.2691	90.9943	22.8802	0.0000	0.0000	0.0000	0.0000	89.4597	292.7278	524.3361	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0551	88.9291	88.5985	87.9347	87.1498	86.7000	86.7000	86.7000	86.7000	87.8938	88.7577	89.0964	(217)
Fuel for water heating, kWh/month													
	182.2161	159.9620	166.5648	147.5711	143.8181	126.1460	118.2761	133.7538	134.7658	153.2419	164.0351	176.7961	(219)
Water heating fuel used												1807.1467	(219)
Annual totals kWh/year													
Space heating fuel - main system												2130.0947	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3661.3530	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2130.0947	7.3800	157.2010	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1807.1467	7.3800	133.3674	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	342.0499	28.6600	98.0315	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			318.4988	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2130.0947	0.2160	460.1004	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1467	0.2160	390.3437	(264)
Space and water heating			850.4441	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	342.0499	0.5190	177.5239	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			707.2581	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2130.0947	1.2200	2598.7155	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1807.1467	1.2200	2204.7189	(264)
Space and water heating			4803.4344	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	342.0499	3.0700	1050.0933	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3956.4573	(272)
Primary energy kWh/m2/year			50.1071	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 58	-185 kg (26.2%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£58	2.34 kg/m²	B 90	A 93
Total Savings	£58	2.34 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£120	£134	-£14
Mains gas	£398	£325	£72
Space heating	£286	£286	£0
Water heating	£133	£76	£58
Lighting	£98	£98	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£319	£260	£58
Total cost of uses	£318	£261	£58
Delivered energy	46 kWh/m²	35 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	50 kWh/m²	37 kWh/m²	13 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.2018	(8)
Pressure test			Yes	
Measured/design AP50			4.4600	
Infiltration rate			0.4248	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4604	0.4514	0.4424	0.3972	0.3882	0.3430	0.3430	0.3340	0.3611	0.3882	0.4062	0.4243	(22b)
Effective ac	0.6060	0.6019	0.5978	0.5789	0.5753	0.5588	0.5588	0.5558	0.5652	0.5753	0.5825	0.5900	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.6331	39.3639	39.1001	37.8608	37.6290	36.5496	36.5496	36.3497	36.9654	37.6290	38.0980	38.5884	(38)
Heat transfer coeff	104.4457	104.1765	103.9127	102.6735	102.4416	101.3622	101.3622	101.1624	101.7780	102.4416	102.9106	103.4010	(39)
Average = Sum(39)m / 12 =												102.6723	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3228	1.3194	1.3160	1.3003	1.2974	1.2837	1.2837	1.2812	1.2890	1.2974	1.3033	1.3095	(40)
HLP (average)												1.3003	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345 (61)
Total heat required for water heating calculated for each month												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1079.5246 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	1813.6014 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2500 (H8)
Utilisation factor	0.5507 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	92.2173 (H14)
Volume ratio Veff/V	0.8133 (H15)
Solar storage volume factor	0.9587 (H16)
Solar input	-841.8739 (H17)

Solar input	-24.4127	-40.7377	-69.3810	-92.9842	-114.8742	-112.9396	-111.4471	-97.3719	-76.2617	-52.0778	-28.9569	-20.4292 (63)
								Solar input (sum of months) = Sum(63)m =				-841.8739 (63)
Output from w/h												
	137.8601	101.5151	78.1929	36.7820	10.4630	0.0000	0.0000	18.5927	40.5802	82.6124	116.6368	137.0898 (64)
								Total per year (kWh/year) = Sum(64)m =				760.3249 (64)
Heat gains from water heating, kWh/month												
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4207	43.0068	34.9755	26.4787	19.7931	16.7102	18.0560	23.4698	31.5012	39.9980	46.6835	49.7665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.2585	327.6233	319.1442	301.0930	278.3067	256.8908	242.5837	239.2189	247.6980	265.7492	288.5355	309.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	547.8437	543.6604	522.7189	490.1485	456.7662	426.7625	409.1239	417.1676	435.8095	468.5905	505.1009	532.7586	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	19.6403	0.7200	0.7000	0.7700	41.9133	(76)
South	8.8600	46.7521	0.7200	0.7000	0.7700	144.6766	(78)
West	5.8600	19.6403	0.7200	0.7000	0.7700	38.2777	(80)

Solar gains	224.8676	393.8136	560.1669	717.9045	817.2306	814.7854	784.2682	711.1619	615.7543	441.7054	271.4799	190.9591 (83)
Total gains	772.7113	937.4739	1082.8858	1208.0530	1273.9968	1241.5479	1193.3921	1128.3295	1051.5638	910.2959	776.5807	723.7177 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.4994	52.6350	52.7687	53.4056	53.5264	54.0964	54.0964	54.2033	53.8754	53.5264	53.2825	53.0298	
alpha	4.5000	4.5090	4.5179	4.5604	4.5684	4.6064	4.6064	4.6136	4.5917	4.5684	4.5522	4.5353	
util living area													
	0.9856	0.9666	0.9246	0.8314	0.6854	0.5096	0.3712	0.4083	0.6290	0.8784	0.9707	0.9889	(86)
MIT	19.8668	20.1103	20.4163	20.7246	20.9080	20.9814	20.9965	20.9946	20.9527	20.6922	20.2170	19.8194	(87)
Th 2	19.8230	19.8257	19.8283	19.8406	19.8429	19.8536	19.8536	19.8556	19.8495	19.8429	19.8382	19.8334	(88)
util rest of house													
	0.9810	0.9568	0.9034	0.7891	0.6187	0.4239	0.2758	0.3089	0.5391	0.8362	0.9602	0.9854	(89)
MIT 2	18.3651	18.7138	19.1406	19.5523	19.7649	19.8430	19.8525	19.8538	19.8184	19.5279	18.8804	18.3041	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	18.6237	18.9543	19.3603	19.7542	19.9618	20.0391	20.0496	20.0503	20.0138	19.7284	19.1106	18.5651	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6237	18.9543	19.3603	19.7542	19.9618	20.0391	20.0496	20.0503	20.0138	19.7284	19.1106	18.5651	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9746	0.9473	0.8932	0.7856	0.6260	0.4381	0.2923	0.3260	0.5526	0.8313	0.9515	0.9800	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	753.0835	888.0640	967.2268	949.0280	797.4837	543.9590	348.7892	367.8300	581.1165	756.7078	738.9279	709.2144	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1496.0520	1464.1331	1336.3490	1114.4374	846.3517	551.3211	349.6554	369.2688	601.8918	935.1281	1236.0172	1485.3650	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	552.7686	387.1185	274.6270	119.0947	36.3578	0.0000	0.0000	0.0000	0.0000	132.7447	357.9043	577.4560	(98)
Space heating												2438.0716	(98)
Space heating per m2											(98) / (4) =	30.8773	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2624.4043	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	552.7686	387.1185	274.6270	119.0947	36.3578	0.0000	0.0000	0.0000	0.0000	132.7447	357.9043	577.4560	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	595.0146	416.7045	295.6157	128.1967	39.1365	0.0000	0.0000	0.0000	0.0000	142.8899	385.2576	621.5888	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	137.8601	101.5151	78.1929	36.7820	10.4630	0.0000	0.0000	18.5927	40.5802	82.6124	116.6368	137.0898	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2425	89.2159	89.1706	89.1238	89.1646	86.7000	86.7000	86.7000	86.7000	88.6449	89.0918	89.2679	(217)
Fuel for water heating, kWh/month	154.4780	113.7858	87.6891	41.2706	11.7345	0.0000	0.0000	21.4448	46.8053	93.1947	130.9176	153.5712	(219)
Water heating fuel used												854.8919	(219)
Annual totals kWh/year													
Space heating fuel - main system												2624.4043	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												3322.5929	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2624.4043	3.4800	91.3293	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	854.8919	3.4800	29.7502	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	342.0499	13.1900	45.1164	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			220.4103	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7468	(257)
SAP value		89.5823	
SAP rating (Section 12)		90	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2624.4043	0.2160	566.8713	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	854.8919	0.2160	184.6566	(264)
Space and water heating			751.5280	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	342.0499	0.5190	177.5239 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			670.1990 (272)
CO2 emissions per m2			8.4900 (273)
EI value			92.7552
EI rating			93 (274)
EI band			A

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.4800	(1b)	x 2.3900	(2b) =	94.3572	(1b) - (3b)
First floor	39.4800	(1c)	x 2.6300	(2c) =	103.8324	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.9600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	198.1896	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2018	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.4248	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3611	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3792	0.3521	0.3611	0.3430	0.3430	0.3340	0.3250	0.3160	0.3069	0.3340	0.3160	0.3340	(22b)
Effective ac	0.5719	0.5620	0.5652	0.5588	0.5588	0.5558	0.5528	0.5499	0.5471	0.5558	0.5499	0.5558	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			20.5500	1.2357	25.3945			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			39.4800	0.1900	7.5012			(28a)
External Wall	89.1700	22.6700	66.5000	0.2700	17.9550			(29a)
Main Roof	39.4800		39.4800	0.1600	6.3168			(30)
Total net area of external elements Aum(A, m2)			168.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.3475			(33)
Party Wall			42.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4651	(36)
Total fabric heat loss (33) + (36) =	64.8126	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.4024	36.7548	36.9654	36.5496	36.5496	36.3497	36.1552	35.9660	35.7821	36.3497	35.9660	36.3497	(38)
Heat transfer coeff	102.2151	101.5675	101.7780	101.3622	101.3622	101.1624	100.9678	100.7786	100.5947	101.1624	100.7786	101.1624	(39)
Average = Sum(39)m / 12 =												101.2410	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2945	1.2863	1.2890	1.2837	1.2837	1.2812	1.2787	1.2763	1.2740	1.2812	1.2763	1.2812	(40)
HLP (average)												1.2822	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4428 (42)
Average daily hot water use (litres/day)	92.2173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4390	97.7503	94.0616	90.3729	86.6842	82.9955	82.9955	86.6842	90.3729	94.0616	97.7503	101.4390	(44)
Energy conte	150.4311	131.5680	135.7664	118.3644	113.5735	98.0053	90.8163	104.2130	105.4577	122.9007	134.1558	145.6845	(45)
Energy content (annual)										Total = Sum(45)m =		1450.9365	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5647	19.7352	20.3650	17.7547	17.0360	14.7008	13.6224	15.6320	15.8186	18.4351	20.1234	21.8527	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8417	10.6848	11.8076	11.4018	11.7637	11.3633	11.7291	11.7515	11.3843	11.7894	11.4380	11.8345 (61)
Total heat required for water heating calculated for each month												
	162.2727	142.2528	147.5739	129.7662	125.3372	109.3686	102.5454	115.9645	116.8419	134.6901	145.5938	157.5190 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3989 (H8)
Utilisation factor												0.5107 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2173 (H14)
Volume ratio Veff/V												0.8133 (H15)
Solar storage volume factor												0.9587 (H16)
Solar input												-873.8359 (H17)
Solar input	-28.5066	-40.5346	-69.6693	-94.0000	-110.4087	-117.9339	-115.4537	-103.3346	-80.9038	-55.9341	-33.7158	-23.4408 (63)
								Solar input (sum of months) = Sum(63)m =				-873.8359 (63)
Output from w/h												
	133.7661	101.7181	77.9047	35.7662	14.9285	0.0000	0.0000	12.6300	35.9381	78.7560	111.8779	134.0782 (64)
								Total per year (kWh/year) = Sum(64)m =				737.3638 (64)
Heat gains from water heating, kWh/month												
	52.9787	46.4176	48.0942	42.2066	40.7041	35.4276	33.1287	37.5887	37.9107	43.8118	47.4663	51.3987 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	146.5699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.4207	43.0068	34.9755	26.4787	19.7931	16.7102	18.0560	23.4698	31.5012	39.9980	46.6835	49.7665	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.2585	327.6233	319.1442	301.0930	278.3067	256.8908	242.5837	239.2189	247.6980	265.7492	288.5355	309.9514	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	52.0998	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	-97.7133	(71)
Water heating gains (Table 5)													
	71.2080	69.0737	64.6428	58.6203	54.7098	49.2050	44.5278	50.5225	52.6538	58.8869	65.9254	69.0843	(72)
Total internal gains													
	547.8437	543.6604	522.7189	490.1485	456.7662	426.7625	409.1239	417.1676	435.8095	468.5905	505.1009	532.7586	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.1100	25.1925	0.7200	0.7000	0.7700	53.7622	(76)
South	8.8600	56.7559	0.7200	0.7000	0.7700	175.6338	(78)
West	5.5800	25.1925	0.7200	0.7000	0.7700	49.0987	(80)

Solar gains	278.4947	415.1114	595.9284	770.9906	837.3697	908.7068	867.0414	802.9076	692.6099	502.4524	335.1150	232.5013	(83)
Total gains	826.3384	958.7717	1118.6473	1261.1391	1294.1359	1335.4693	1276.1653	1220.0752	1128.4194	971.0429	840.2159	765.2599	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6451	53.9871	53.8754	54.0964	54.0964	54.2033	54.3077	54.4097	54.5092	54.2033	54.4097	54.2033	
alpha	4.5763	4.5991	4.5917	4.6064	4.6064	4.6136	4.6205	4.6273	4.6339	4.6136	4.6273	4.6136	
util living area													
	0.9783	0.9592	0.9046	0.7878	0.6277	0.4266	0.3076	0.3210	0.5439	0.8219	0.9512	0.9831	(86)
MIT	20.0297	20.2167	20.5209	20.8002	20.9428	20.9920	20.9986	20.9984	20.9768	20.7990	20.3943	19.9937	(87)
Th 2	19.8451	19.8516	19.8495	19.8536	19.8536	19.8556	19.8575	19.8594	19.8613	19.8556	19.8594	19.8556	(88)
util rest of house													
	0.9715	0.9473	0.8788	0.7390	0.5558	0.3434	0.2180	0.2277	0.4532	0.7661	0.9343	0.9777	(89)
MIT 2	18.6148	18.8832	19.2978	19.6538	19.8093	19.8518	19.8572	19.8590	19.8480	19.6660	19.1439	18.5716	(90)
Living area fraction										fLA = Living area / (4) =		0.1722	(91)
MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8585	19.1128	19.5085	19.8512	20.0045	20.0482	20.0538	20.0553	20.0424	19.8611	19.3592	18.8166	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9637	0.9376	0.8699	0.7389	0.5657	0.3576	0.2335	0.2438	0.4681	0.7664	0.9249	0.9709	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	796.3505	898.9664	973.0730	931.8156	732.1045	477.5807	297.9628	297.4979	528.2311	744.2445	777.1448	743.0017	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1426.7681	1402.9358	1273.0864	1049.2236	760.6740	480.3383	298.2395	297.8281	537.4203	855.9489	1154.8450	1397.7171	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	469.0307	338.6674	223.2100	84.5337	21.2557	0.0000	0.0000	0.0000	0.0000	83.1080	271.9442	487.1083	(98)
Space heating												1978.8579	(98)
Space heating per m2											(98) / (4) =	25.0615	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2130.0947	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.0307	338.6674	223.2100	84.5337	21.2557	0.0000	0.0000	0.0000	0.0000	83.1080	271.9442	487.1083	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	504.8770	364.5505	240.2691	90.9943	22.8802	0.0000	0.0000	0.0000	0.0000	89.4597	292.7278	524.3361	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	133.7661	101.7181	77.9047	35.7662	14.9285	0.0000	0.0000	12.6300	35.9381	78.7560	111.8779	134.0782	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1697	89.1401	89.0497	88.9242	88.5516	86.7000	86.7000	86.7000	86.7000	88.3140	88.9431	89.1895	(217)
Fuel for water heating, kWh/month	150.0130	114.1105	87.4845	40.2210	16.8585	0.0000	0.0000	14.5674	41.4511	89.1772	125.7859	150.3297	(219)
Water heating fuel used												829.9988	(219)
Annual totals kWh/year													
Space heating fuel - main system												2130.0947	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												342.0499	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												2734.2052	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2130.0947	7.3800	157.2010	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	829.9988	7.3800	61.2539	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	342.0499	28.6600	98.0315	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			260.7153	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2130.0947	0.2160	460.1004	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.9988	0.2160	179.2797	(264)
Space and water heating			639.3802	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	342.0499	0.5190	177.5239	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			522.1442	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2130.0947	1.2200	2598.7155	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	829.9988	1.2200	1012.5985	(264)
Space and water heating			3611.3140	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	342.0499	3.0700	1050.0933	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			2917.8369	(272)
Primary energy kWh/m2/year			36.9534	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	523.22	(P1)
Transmission heat loss coefficient	64.81	(37)
Summer heat loss coefficient	588.03	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	6.1100	125.2818	0.7200	0.7000	0.8865	307.8087
South	8.8600	118.5567	0.7200	0.7000	0.8865	422.3879
West	5.5800	125.2818	0.7200	0.7000	0.8865	281.1085
total:						1011.3051

	Jun	Jul	Aug	
Solar gains	1077	1011	933	(P3)
Internal gains	424	406	414	
Total summer gains	1501	1417	1348	(P5)
Summer gain/loss ratio	2.55	2.41	2.29	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.20	19.96	19.84	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 660 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 660 - EPC	**Prop Type Ref**	
Property	15 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.36	**TER**	17.92
Environmental	91 B	**% DER<TER**	31.03		
CO_2 Emissions (t/year)	0.71	**DFEE**	43.73	**TFEE**	50.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.51		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.92	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.36	$kgCO_2/m^2$	Pass
	-5.56 (-31.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.56	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.73	$kWh/m^2/yr$	
	-6.9 (-13.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Potterton ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing East Windows facing South Windows facing West	6.11 m², No overhang 8.86 m², No overhang 5.58 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.027	W/m²K	
Photovoltaic array	0.73	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 661 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 661 - EPC	**Prop Type Ref**	
Property	17 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	13.28	**TER**	17.61
Environmental	89 B	**% DER<TER**	24.58		
CO_2 Emissions (t/year)	0.98	**DFEE**	47.17	**TFEE**	53.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.61 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.28 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.58 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.64 m², No overhang
Windows facing South: 7.41 m², No overhang
Windows facing West: 3.28 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.021 W/m²K
Air permeability 3.6 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3263	0.3199	0.3135	0.2815	0.2751	0.2431	0.2431	0.2367	0.2559	0.2751	0.2879	0.3007	(22b)
Effective ac	0.5532	0.5512	0.5491	0.5396	0.5378	0.5296	0.5296	0.5280	0.5327	0.5378	0.5414	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8623	44.6946	44.5303	43.7585	43.6141	42.9419	42.9419	42.8175	43.2009	43.6141	43.9062	44.2116	(38)
Heat transfer coeff	119.9304	119.7628	119.5985	118.8267	118.6823	118.0101	118.0101	117.8857	118.2691	118.6823	118.9744	119.2798	(39)
Average = Sum(39)m / 12 =												118.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2233	1.2216	1.2138	1.2123	1.2054	1.2054	1.2041	1.2081	1.2123	1.2153	1.2184	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200	(61)
Total heat required for water heating calculated for each month													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922	(64)
Heat gains from water heating, kWh/month													
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	418.5545	416.3349	401.1816	376.6357	351.5150	327.4582	311.9259	318.2829	330.9758	355.7475	384.2161	405.7578	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)
West	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(80)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	590.4284	712.7408	818.2378	915.6546	977.7481	959.6317	917.0093	856.3180	789.7557	686.2632	590.7002	552.4697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6879	56.7673	56.8453	57.2145	57.2841	57.6104	57.6104	57.6712	57.4843	57.2841	57.1435	56.9972	
alpha	4.7792	4.7845	4.7897	4.8143	4.8189	4.8407	4.8407	4.8447	4.8323	4.8189	4.8096	4.7998	
util living area													
	0.9979	0.9946	0.9853	0.9554	0.8742	0.7172	0.5500	0.6060	0.8418	0.9729	0.9954	0.9985	(86)
MIT	19.6622	19.8457	20.1213	20.4661	20.7638	20.9364	20.9859	20.9778	20.8564	20.4625	19.9896	19.6240	(87)
Th 2	19.9000	19.9014	19.9027	19.9090	19.9102	19.9157	19.9157	19.9167	19.9136	19.9102	19.9078	19.9053	(88)
util rest of house													
	0.9972	0.9927	0.9800	0.9384	0.8267	0.6221	0.4227	0.4766	0.7666	0.9593	0.9936	0.9980	(89)
MIT 2	18.1229	18.3914	18.7917	19.2855	19.6795	19.8736	19.9106	19.9077	19.7993	19.2897	18.6069	18.0707	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.4197	18.6719	19.0481	19.5132	19.8886	20.0785	20.1179	20.1141	20.0032	19.5159	18.8735	18.3703	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4197	18.6719	19.0481	19.5132	19.8886	20.0785	20.1179	20.1141	20.0032	19.5159	18.8735	18.3703	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9897	0.9743	0.9305	0.8256	0.6376	0.4473	0.5014	0.7738	0.9526	0.9908	0.9969	(94)
Useful gains	587.9220	705.3754	797.2431	852.0555	807.2564	611.8913	410.2026	429.3700	611.1220	653.7130	585.2945	550.7315	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1693.3856	1649.3572	1500.7392	1261.1297	971.8401	646.5209	415.1534	437.8357	698.1650	1058.1554	1400.7504	1690.2296	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	822.4649	634.3557	523.4011	294.5334	122.4503	0.0000	0.0000	0.0000	0.0000	300.9052	587.1282	847.7866	(98)
Space heating												4133.0255	(98)
Space heating per m2											(98) / (4) =	42.2168	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4448.8972	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	822.4649	634.3557	523.4011	294.5334	122.4503	0.0000	0.0000	0.0000	0.0000	300.9052	587.1282	847.7866	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	885.3228	682.8372	563.4026	317.0435	131.8087	0.0000	0.0000	0.0000	0.0000	323.9022	632.0002	912.5798	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3271	89.2645	89.1400	88.8527	88.2025	86.7000	86.7000	86.7000	86.7000	88.8415	89.2118	89.3549	(217)
Fuel for water heating, kWh/month													
	193.6328	169.8428	176.3906	155.5226	151.2577	134.1795	125.7167	142.2981	143.4146	161.4474	173.8927	187.8739	(219)
Water heating fuel used												1915.4694	(219)
Annual totals kWh/year													
Space heating fuel - main system												4448.8972	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6219.8596	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4448.8972	0.2160	960.9618	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.4694	0.2160	413.7414	(264)
Space and water heating			1374.7032	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1299.7040	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.2800	ZC1
Total Floor Area	TFA	97.9000	
Assumed number of occupants	N	2.7192	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3070	ZC2
CO2 emissions from cooking, equation (L16)		1.8821	ZC3
Total CO2 emissions		30.4692	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.4692	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.3300	1.3258	24.3011			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	122.4300	20.4500	101.9800	0.1800	18.3564			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9285			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.3129	(36)
Total fabric heat loss (33) + (36) =	69.2414	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	116.3797	116.1237	115.8727	114.6941	114.4735	113.4469	113.4469	113.2568	113.8424	114.4735	114.9197	115.3861	(39)
Average = Sum(39)m / 12 =												114.6930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1888	1.1861	1.1836	1.1715	1.1693	1.1588	1.1588	1.1569	1.1628	1.1693	1.1738	1.1786	(40)
HLP (average)												1.1715	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7398	47.3176	43.8427	45.3041	47.3176	47.7398	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.6558	(64)
Heat gains from water heating, kWh/month													
	66.3184	58.3671	61.0953	54.0925	52.2806	45.8670	43.6719	48.9467	49.4956	56.5130	60.1107	64.6278	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	89.1377	86.8558	82.1174	75.1285	70.2696	63.7042	58.6987	65.7886	68.7439	75.9583	83.4871	86.8654	(72)
Total internal gains													
	431.7034	429.4865	414.3385	389.2549	363.4647	338.7396	323.2123	330.2373	343.6021	368.9113	397.3714	418.9093	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.6300	0.7000	0.7700	24.8277	(74)
South	7.4100	46.7521	0.6300	0.7000	0.7700	105.8744	(78)
West	3.2800	19.6403	0.6300	0.7000	0.7700	19.6876	(80)

Solar gains	150.3897	259.3551	364.9242	471.6416	547.9540	553.1518	529.4480	470.7807	401.4324	289.2013	180.6736	128.3730	(83)
Total gains	582.0931	688.8416	779.2627	860.8966	911.4186	891.8914	852.6603	801.0180	745.0345	658.1126	578.0450	547.2822	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4175	58.5463	58.6731	59.2761	59.3902	59.9277	59.9277	60.0283	59.7195	59.3902	59.1597	58.9206	
alpha	4.8945	4.9031	4.9115	4.9517	4.9593	4.9952	4.9952	5.0019	4.9813	4.9593	4.9440	4.9280	
util living area													
	0.9981	0.9953	0.9876	0.9621	0.8897	0.7376	0.5680	0.6218	0.8540	0.9756	0.9958	0.9986	(86)
MIT	19.7020	19.8716	20.1318	20.4653	20.7575	20.9347	20.9858	20.9780	20.8572	20.4757	20.0241	19.6716	(87)
Th 2	19.9290	19.9311	19.9332	19.9428	19.9446	19.9531	19.9531	19.9547	19.9498	19.9446	19.9410	19.9371	(88)
util rest of house													
	0.9974	0.9936	0.9830	0.9474	0.8464	0.6455	0.4417	0.4945	0.7829	0.9634	0.9941	0.9981	(89)
MIT 2	18.2013	18.4501	18.8292	19.3117	19.7033	19.9088	19.9478	19.9455	19.8339	19.3346	18.6804	18.1625	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.4907	18.7242	19.0804	19.5342	19.9066	20.1067	20.1480	20.1446	20.0313	19.5547	18.9395	18.4536	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4907	18.7242	19.0804	19.5342	19.9066	20.1067	20.1480	20.1446	20.0313	19.5547	18.9395	18.4536	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9909	0.9780	0.9401	0.8445	0.6602	0.4661	0.5189	0.7894	0.9572	0.9916	0.9970	(94)
Useful gains	579.7995	682.5894	762.1041	809.2861	769.7283	588.8680	397.4520	415.6265	588.0995	629.9392	573.1874	545.6671	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1651.5141	1605.3196	1457.7268	1219.6760	939.4364	624.7135	402.5075	424.1061	675.2305	1025.0733	1360.5955	1644.6631	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	797.3556	620.0747	517.5433	295.4807	126.2628	0.0000	0.0000	0.0000	0.0000	293.9798	566.9338	817.6530	(98)
Space heating												4035.2839	(98)
Space heating per m2											(98) / (4) =	41.2184	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4320.4324	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	797.3556	620.0747	517.5433	295.4807	126.2628	0.0000	0.0000	0.0000	0.0000	293.9798	566.9338	817.6530	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	853.6998	663.8915	554.1149	316.3605	135.1850	0.0000	0.0000	0.0000	0.0000	314.7536	606.9955	875.4315	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0725	87.8405	87.3768	86.3662	84.3293	80.3000	80.3000	80.3000	80.3000	86.2437	87.6015	88.1598	(217)
Fuel for water heating, kWh/month													
	240.8220	212.8410	224.7613	202.0808	200.3756	185.3351	177.5652	197.9436	200.1296	211.7348	220.3390	234.8161	(219)
Water heating fuel used												2508.7441	(219)
Annual totals kWh/year													
Space heating fuel - main system												4320.4324	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Total delivered energy for all uses												7308.4226	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4320.4324	0.2160	933.2134	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2508.7441	0.2160	541.8887	(264)
Space and water heating			1475.1021	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Total CO2, kg/m2/year			1723.8309	(272)
Emissions per m2 for space and water heating			15.0674	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1430	(272b)
Emissions per m2 for pumps and fans			0.3976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0674 * 1.00) + 2.1430 + 0.3976, rounded to 2 d.p.			17.6100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3263	0.3199	0.3135	0.2815	0.2751	0.2431	0.2431	0.2367	0.2559	0.2751	0.2879	0.3007	(22b)
Effective ac	0.5532	0.5512	0.5491	0.5396	0.5378	0.5296	0.5296	0.5280	0.5327	0.5378	0.5414	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8623	44.6946	44.5303	43.7585	43.6141	42.9419	42.9419	42.8175	43.2009	43.6141	43.9062	44.2116	(38)
Heat transfer coeff	119.9304	119.7628	119.5985	118.8267	118.6823	118.0101	118.0101	117.8857	118.2691	118.6823	118.9744	119.2798	(39)
Average = Sum(39)m / 12 =												118.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2233	1.2216	1.2138	1.2123	1.2054	1.2054	1.2041	1.2081	1.2123	1.2153	1.2184	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.2420	29.9483	30.9040	26.9428	25.8523	22.3085	20.6721	23.7216	24.0049	27.9754	30.5373	33.1616	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	46.0242	44.5659	41.5376	37.4206	34.7477	30.9841	27.7851	31.8839	33.3401	37.6013	42.4130	44.5720	(72)
Total internal gains													
	385.5900	384.1965	370.7587	348.5470	324.9427	303.0195	289.2987	293.3326	305.1984	327.5543	353.2973	373.6159	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)
West	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(80)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	557.4639	680.6024	787.8149	887.5660	951.1758	935.1930	894.3821	831.3677	763.9783	658.0701	559.7814	520.3278	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6879	56.7673	56.8453	57.2145	57.2841	57.6104	57.6104	57.6712	57.4843	57.2841	57.1435	56.9972	
alpha	4.7792	4.7845	4.7897	4.8143	4.8189	4.8407	4.8407	4.8447	4.8323	4.8189	4.8096	4.7998	
util living area													
	0.9984	0.9956	0.9874	0.9601	0.8835	0.7301	0.5623	0.6211	0.8547	0.9769	0.9964	0.9989	(86)
MIT	19.6313	19.8161	20.0944	20.4446	20.7502	20.9312	20.9845	20.9754	20.8452	20.4390	19.9610	19.5937	(87)
Th 2	19.9000	19.9014	19.9027	19.9090	19.9102	19.9157	19.9157	19.9167	19.9136	19.9102	19.9078	19.9053	(88)
util rest of house													
	0.9978	0.9940	0.9828	0.9445	0.8380	0.6354	0.4330	0.4899	0.7822	0.9650	0.9949	0.9985	(89)
MIT 2	18.6559	18.8410	19.1180	19.4634	19.7420	19.8842	19.9118	19.9098	19.8281	19.4644	18.9912	18.6226	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8440	19.0291	19.3063	19.6527	19.9364	20.0861	20.1187	20.1153	20.0243	19.6524	19.1782	18.8099	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8440	19.0291	19.3063	19.6527	19.9364	20.0861	20.1187	20.1153	20.0243	19.6524	19.1782	18.8099	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9923	0.9795	0.9399	0.8393	0.6516	0.4581	0.5154	0.7908	0.9613	0.9934	0.9979	(94)
Useful gains	555.8347	675.3638	771.6275	834.2504	798.2819	609.3920	409.7552	428.4646	604.1811	632.5729	556.0977	519.2236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1744.2664	1692.1388	1531.6149	1277.7038	977.5155	647.4203	415.2399	437.9788	700.6559	1074.3586	1436.9950	1742.6633	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	884.1932	683.2728	565.4306	319.2864	133.3498	0.0000	0.0000	0.0000	0.0000	328.6886	634.2460	910.2391	(98)
Space heating												4458.7066	(98)
Space heating per m2											(98) / (4) =	45.5435	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1109.2953	873.2750	895.9310	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8587	0.9200	0.8950	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	952.6002	803.4055	801.8179	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1197.0822	1147.1561	1075.3683	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	176.0271	255.7505	203.5215	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                635.2990 (104)
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   44.0068   63.9376   50.8804    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                158.8248 (107)
Space cooling per m2                                                                                           1.6223 (108)
Energy for space heating                                                                                      45.5435 (99)
Energy for space cooling                                                                                       1.6223 (108)
Total                                                                                                         47.1658 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                      47.2 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.3300	1.3258	24.3011			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	122.4300	20.4500	101.9800	0.1800	18.3564			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9285			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.3129	(36)
Total fabric heat loss (33) + (36) =	69.2414	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	116.3797	116.1237	115.8727	114.6941	114.4735	113.4469	113.4469	113.2568	113.8424	114.4735	114.9197	115.3861	(39)
Average = Sum(39)m / 12 =												114.6930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1888	1.1861	1.1836	1.1715	1.1693	1.1588	1.1588	1.1569	1.1628	1.1693	1.1738	1.1786	(40)
HLP (average)												1.1715	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.2420	29.9483	30.9040	26.9428	25.8523	22.3085	20.6721	23.7216	24.0049	27.9754	30.5373	33.1616	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	46.0242	44.5659	41.5376	37.4206	34.7477	30.9841	27.7851	31.8839	33.3401	37.6013	42.4130	44.5720	(72)
Total internal gains													
	385.5900	384.1965	370.7587	348.5470	324.9427	303.0195	289.2987	293.3326	305.1984	327.5543	353.2973	373.6159	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.6300	0.7000	0.7700	24.8277	(74)
South	7.4100	46.7521	0.6300	0.7000	0.7700	105.8744	(78)
West	3.2800	19.6403	0.6300	0.7000	0.7700	19.6876	(80)

Solar gains	150.3897	259.3551	364.9242	471.6416	547.9540	553.1518	529.4480	470.7807	401.4324	289.2013	180.6736	128.3730	(83)
Total gains	535.9797	643.5517	735.6829	820.1886	872.8967	856.1714	818.7467	764.1133	706.6308	616.7556	533.9709	501.9888	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4175	58.5463	58.6731	59.2761	59.3902	59.9277	59.9277	60.0283	59.7195	59.3902	59.1597	58.9206	
alpha	4.8945	4.9031	4.9115	4.9517	4.9593	4.9952	4.9952	5.0019	4.9813	4.9593	4.9440	4.9280	
util living area													
	0.9987	0.9965	0.9902	0.9684	0.9030	0.7579	0.5885	0.6463	0.8736	0.9812	0.9970	0.9990	(86)
MIT	19.6585	19.8294	20.0926	20.4328	20.7358	20.9261	20.9834	20.9740	20.8390	20.4404	19.9828	19.6286	(87)
Th 2	19.9290	19.9311	19.9332	19.9428	19.9446	19.9531	19.9531	19.9547	19.9498	19.9446	19.9410	19.9371	(88)
util rest of house													
	0.9982	0.9952	0.9865	0.9557	0.8629	0.6668	0.4592	0.5165	0.8072	0.9713	0.9958	0.9987	(89)
MIT 2	18.7060	18.8780	19.1411	19.4816	19.7625	19.9182	19.9488	19.9471	19.8584	19.4947	19.0394	18.6827	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.8897	19.0615	19.3246	19.6650	19.9502	20.1126	20.1483	20.1451	20.0475	19.6771	19.2213	18.8651	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8897	19.0615	19.3246	19.6650	19.9502	20.1126	20.1483	20.1451	20.0475	19.6771	19.2213	18.8651	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9939	0.9838	0.9515	0.8632	0.6821	0.4844	0.5417	0.8145	0.9680	0.9946	0.9982	(94)
Useful gains	534.6799	639.5987	723.7396	780.3709	753.4775	583.9827	396.5635	413.9284	575.5732	597.0100	531.0853	501.1028	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1697.9446	1644.4851	1486.0171	1234.6842	944.4305	625.3887	402.5475	424.1628	677.0766	1039.0889	1392.9748	1692.1490	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	865.4689	675.2837	567.1345	327.1056	142.0690	0.0000	0.0000	0.0000	0.0000	328.9067	620.5604	886.1383	(98)
Space heating												4412.6672	(98)
Space heating per m2											(98) / (4) =	45.0732	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1066.4012	839.5073	860.7519	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8476	0.9135	0.8881	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	903.8315	766.8888	764.4356	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1104.7192	1058.7511	996.7593	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	144.6391	217.1456	172.8488	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												534.6335	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.1598	54.2864	43.2122	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												133.6584 (107)
Space cooling per m2												1.3653 (108)
Energy for space heating												45.0732 (99)
Energy for space cooling												1.3653 (108)
Total												46.4385 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2687	0.2495	0.2559	0.2431	0.2431	0.2367	0.2303	0.2239	0.2175	0.2367	0.2239	0.2367	(22b)
Effective ac	0.5361	0.5311	0.5327	0.5296	0.5296	0.5280	0.5265	0.5251	0.5237	0.5280	0.5251	0.5280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss	(33) + (36) = 75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4731	43.0697	43.2009	42.9419	42.9419	42.8175	42.6963	42.5785	42.4639	42.8175	42.5785	42.8175	(38)
Heat transfer coeff	118.5413	118.1379	118.2691	118.0101	118.0101	117.8857	117.7645	117.6467	117.5321	117.8857	117.6467	117.8857	(39)
Average = Sum(39)m / 12 =												117.9346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2108	1.2067	1.2081	1.2054	1.2054	1.2041	1.2029	1.2017	1.2005	1.2041	1.2017	1.2041	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
RHI water heating demand												1693 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)
West	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(80)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3523	57.5481	57.4843	57.6104	57.6104	57.6712	57.7306	57.7884	57.8447	57.6712	57.7884	57.6712	
alpha	4.8235	4.8365	4.8323	4.8407	4.8407	4.8447	4.8487	4.8526	4.8563	4.8447	4.8526	4.8447	
util living area													
	0.9895	0.9821	0.9583	0.8930	0.7622	0.5474	0.4011	0.4200	0.6813	0.9067	0.9769	0.9917	(86)
MIT	19.9721	20.1048	20.3715	20.6757	20.8894	20.9821	20.9968	20.9961	20.9504	20.7052	20.3025	19.9453	(87)
Th 2	19.9113	19.9146	19.9136	19.9157	19.9157	19.9167	19.9177	19.9186	19.9196	19.9167	19.9186	19.9167	(88)
util rest of house													
	0.9861	0.9764	0.9448	0.8593	0.6943	0.4506	0.2914	0.3056	0.5850	0.8686	0.9679	0.9889	(89)
MIT 2	18.5811	18.7744	19.1522	19.5653	19.8219	19.9074	19.9168	19.9176	19.8881	19.6145	19.0639	18.5466	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9366	0.8544	0.7019	0.4688	0.3127	0.3278	0.6015	0.8647	0.9611	0.9849	(94)
Useful gains	818.3146	900.7632	971.0799	971.6616	816.5756	559.3332	355.3665	354.8670	607.5688	783.2583	794.2820	770.5559	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1653.5748	1622.1447	1465.0360	1213.0773	888.3500	567.5791	356.2498	355.9506	633.8465	993.1650	1341.5009	1628.7457	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	621.4335	484.7683	367.5033	173.8193	53.4001	0.0000	0.0000	0.0000	0.0000	156.1706	393.9976	638.4932	(98)
Space heating												2889.5860	(98)
RHI space heating demand												2890	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3263	0.3199	0.3135	0.2815	0.2751	0.2431	0.2431	0.2367	0.2559	0.2751	0.2879	0.3007	(22b)
Effective ac	0.5532	0.5512	0.5491	0.5396	0.5378	0.5296	0.5296	0.5280	0.5327	0.5378	0.5414	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8623	44.6946	44.5303	43.7585	43.6141	42.9419	42.9419	42.8175	43.2009	43.6141	43.9062	44.2116	(38)
Heat transfer coeff	119.9304	119.7628	119.5985	118.8267	118.6823	118.0101	118.0101	117.8857	118.2691	118.6823	118.9744	119.2798	(39)
Average = Sum(39)m / 12 =												118.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2233	1.2216	1.2138	1.2123	1.2054	1.2054	1.2041	1.2081	1.2123	1.2153	1.2184	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)
West	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(80)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	793.9507	913.7166	1010.2615	1094.7193	1143.3192	1114.7902	1067.6264	1009.4816	951.8713	861.3379	779.2684	751.4504	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6879	56.7673	56.8453	57.2145	57.2841	57.6104	57.6104	57.6712	57.4843	57.2841	57.1435	56.9972	
alpha	4.7792	4.7845	4.7897	4.8143	4.8189	4.8407	4.8407	4.8447	4.8323	4.8189	4.8096	4.7998	
util living area													
	0.9927	0.9850	0.9672	0.9192	0.8132	0.6405	0.4786	0.5246	0.7592	0.9391	0.9856	0.9943	(86)
MIT	19.8505	20.0267	20.2831	20.5908	20.8350	20.9608	20.9922	20.9879	20.9114	20.5965	20.1604	19.8093	(87)
Th 2	19.9000	19.9014	19.9027	19.9090	19.9102	19.9157	19.9157	19.9167	19.9136	19.9102	19.9078	19.9053	(88)
util rest of house													
	0.9904	0.9803	0.9565	0.8927	0.7560	0.5469	0.3647	0.4074	0.6733	0.9132	0.9802	0.9925	(89)
MIT 2	18.3966	18.6522	19.0197	19.4494	19.7573	19.8912	19.9130	19.9121	19.8487	19.4679	18.8525	18.3406	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.6770	18.9173	19.2634	19.6695	19.9652	20.0975	20.1211	20.1196	20.0536	19.6856	19.1048	18.6238	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6770	18.9173	19.2634	19.6695	19.9652	20.0975	20.1211	20.1196	20.0536	19.6856	19.1048	18.6238	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9744	0.9484	0.8857	0.7592	0.5635	0.3867	0.4300	0.6855	0.9066	0.9746	0.9893	(94)
Useful gains	783.3068	890.3480	958.1732	969.6324	868.0443	628.1543	412.8809	434.0860	652.5419	780.8613	759.4678	743.4440	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1724.2406	1678.7508	1526.4790	1279.7065	980.9273	648.7609	415.5260	438.4848	704.1311	1078.2965	1428.2594	1720.4723	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	700.0548	529.8067	422.8195	223.2533	83.9850	0.0000	0.0000	0.0000	0.0000	221.2918	481.5300	726.9091	(98)
Space heating												3389.6502	(98)
Space heating per m2											(98) / (4) =	34.6236	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3648.7085	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	700.0548	529.8067	422.8195	223.2533	83.9850	0.0000	0.0000	0.0000	0.0000	221.2918	481.5300	726.9091	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	753.5574	570.2979	455.1341	240.3158	90.4036	0.0000	0.0000	0.0000	0.0000	238.2043	518.3315	782.4640	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2474	89.1678	89.0095	88.6491	87.9088	86.7000	86.7000	86.7000	86.7000	88.6138	89.0987	89.2818	(217)
Fuel for water heating, kWh/month													
	193.8058	170.0270	176.6491	155.8799	151.7631	134.1795	125.7167	142.2981	143.4146	161.8624	174.1135	188.0278	(219)
Water heating fuel used												1917.7375	(219)
Annual totals kWh/year													
Space heating fuel - main system												3648.7085	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5421.9390	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3648.7085	3.4800	126.9751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1917.7375	3.4800	66.7373	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	404.2461	13.1900	53.3201	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			294.6518	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8660	(257)
SAP value		87.9191	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3648.7085	0.2160	788.1210	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.7375	0.2160	414.2313	(264)
Space and water heating			1202.3523	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1127.3532	(272)
CO2 emissions per m2			11.5200	(273)
EI value			89.4286	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2687	0.2495	0.2559	0.2431	0.2431	0.2367	0.2303	0.2239	0.2175	0.2367	0.2239	0.2367	(22b)
Effective ac	0.5361	0.5311	0.5327	0.5296	0.5296	0.5280	0.5265	0.5251	0.5237	0.5280	0.5251	0.5280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4731	43.0697	43.2009	42.9419	42.9419	42.8175	42.6963	42.5785	42.4639	42.8175	42.5785	42.8175	(38)
Heat transfer coeff	118.5413	118.1379	118.2691	118.0101	118.0101	117.8857	117.7645	117.6467	117.5321	117.8857	117.6467	117.8857	(39)
Average = Sum(39)m / 12 =												117.9346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2108	1.2067	1.2081	1.2054	1.2054	1.2041	1.2029	1.2017	1.2005	1.2041	1.2017	1.2041	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)
West	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(80)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3523	57.5481	57.4843	57.6104	57.6104	57.6712	57.7306	57.7884	57.8447	57.6712	57.7884	57.6712	
alpha	4.8235	4.8365	4.8323	4.8407	4.8407	4.8447	4.8487	4.8526	4.8563	4.8447	4.8526	4.8447	
util living area													
	0.9895	0.9821	0.9583	0.8930	0.7622	0.5474	0.4011	0.4200	0.6813	0.9067	0.9769	0.9917	(86)
MIT	19.9721	20.1048	20.3715	20.6757	20.8894	20.9821	20.9968	20.9961	20.9504	20.7052	20.3025	19.9453	(87)
Th 2	19.9113	19.9146	19.9136	19.9157	19.9157	19.9167	19.9177	19.9186	19.9196	19.9167	19.9186	19.9167	(88)
util rest of house													
	0.9861	0.9764	0.9448	0.8593	0.6943	0.4506	0.2914	0.3056	0.5850	0.8686	0.9679	0.9889	(89)
MIT 2	18.5811	18.7744	19.1522	19.5653	19.8219	19.9074	19.9168	19.9176	19.8881	19.6145	19.0639	18.5466	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9366	0.8544	0.7019	0.4688	0.3127	0.3278	0.6015	0.8647	0.9611	0.9849	(94)
Useful gains	818.3146	900.7632	971.0799	971.6616	816.5756	559.3332	355.3665	354.8670	607.5688	783.2583	794.2820	770.5559	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1653.5748	1622.1447	1465.0360	1213.0773	888.3500	567.5791	356.2498	355.9506	633.8465	993.1650	1341.5009	1628.7457	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	621.4335	484.7683	367.5033	173.8193	53.4001	0.0000	0.0000	0.0000	0.0000	156.1706	393.9976	638.4932	(98)
Space heating												2889.5860	(98)
Space heating per m2											(98) / (4) =	29.5157	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3110.4262	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	621.4335	484.7683	367.5033	173.8193	53.4001	0.0000	0.0000	0.0000	0.0000	156.1706	393.9976	638.4932	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	668.9274	521.8173	395.5902	187.1037	57.4813	0.0000	0.0000	0.0000	0.0000	168.1061	424.1094	687.2908	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1833	89.1164	88.9166	88.4541	87.5912	86.7000	86.7000	86.7000	86.7000	88.3391	88.9723	89.2145	(217)
Fuel for water heating, kWh/month													
	193.9450	170.1250	176.8336	156.2235	152.3134	134.1795	125.7167	142.2981	143.4146	162.3657	174.3609	188.1695	(219)
Water heating fuel used												1919.9457	(219)
Annual totals kWh/year													
Space heating fuel - main system												3110.4262	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4816.6798	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3110.4262	7.3800	229.5495	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1919.9457	7.3800	141.6920	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	404.2461	28.6600	115.8569	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			416.9973	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3110.4262	0.2160	671.8521	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1919.9457	0.2160	414.7083	(264)
Space and water heating			1086.5603	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			975.6541	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3110.4262	1.2200	3794.7200	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1919.9457	1.2200	2342.3337	(264)
Space and water heating			6137.0537	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	404.2461	3.0700	1241.0356	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5481.0189	(272)
Primary energy kWh/m2/year			55.9859	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 61	-193 kg (19.8%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£61	1.97 kg/m²	B 89	B 91
Total Savings	£61	1.97 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£137	£152	-£14
Mains gas	£478	£403	£75
Space heating	£358	£358	£0
Water heating	£142	£81	£61
Lighting	£116	£116	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£416	£356	£61
Total cost of uses	£417	£356	£61
Delivered energy	49 kWh/m²	39 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	45 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500	(1b)	x 2.3900	(2b) =	116.9905	(1b) - (3b)
First floor	48.9500	(1c)	x 2.6300	(2c) =	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3263	0.3199	0.3135	0.2815	0.2751	0.2431	0.2431	0.2367	0.2559	0.2751	0.2879	0.3007	(22b)
Effective ac	0.5532	0.5512	0.5491	0.5396	0.5378	0.5296	0.5296	0.5280	0.5327	0.5378	0.5414	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8623	44.6946	44.5303	43.7585	43.6141	42.9419	42.9419	42.8175	43.2009	43.6141	43.9062	44.2116	(38)
Heat transfer coeff	119.9304	119.7628	119.5985	118.8267	118.6823	118.0101	118.0101	117.8857	118.2691	118.6823	118.9744	119.2798	(39)
Average = Sum(39)m / 12 =												118.8260	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2250	1.2233	1.2216	1.2138	1.2123	1.2054	1.2054	1.2041	1.2081	1.2123	1.2153	1.2184	(40)
HLP (average)												1.2137	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200	(61)
Total heat required for water heating calculated for each month													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1669	(H8)
Utilisation factor												0.5756	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.7814	(H14)
Volume ratio Veff/V												0.7593	(H15)
Solar storage volume factor												0.9449	(H16)
Solar input												-867.2757	(H17)
Solar input	-25.1493	-41.9669	-71.4744	-95.7898	-118.3402	-116.3473	-114.8097	-100.3098	-78.5627	-53.6491	-29.8307	-21.0456	(63)
								Solar input (sum of months) = Sum(63)m =				-867.2757	(63)
Output from w/h													
	147.8173	109.6424	85.7600	42.3962	15.0729	0.0000	0.0000	23.0626	45.7778	89.7833	125.3022	146.8288	(64)
								Total per year (kWh/year) = Sum(64)m =				831.4436	(64)
Heat gains from water heating, kWh/month													
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)
West	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(80)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	793.9507	913.7166	1010.2615	1094.7193	1143.3192	1114.7902	1067.6264	1009.4816	951.8713	861.3379	779.2684	751.4504	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.6879	56.7673	56.8453	57.2145	57.2841	57.6104	57.6104	57.6712	57.4843	57.2841	57.1435	56.9972	
alpha	4.7792	4.7845	4.7897	4.8143	4.8189	4.8407	4.8407	4.8447	4.8323	4.8189	4.8096	4.7998	
util living area													
	0.9927	0.9850	0.9672	0.9192	0.8132	0.6405	0.4786	0.5246	0.7592	0.9391	0.9856	0.9943	(86)
MIT	19.8505	20.0267	20.2831	20.5908	20.8350	20.9608	20.9922	20.9879	20.9114	20.5965	20.1604	19.8093	(87)
Th 2	19.9000	19.9014	19.9027	19.9090	19.9102	19.9157	19.9157	19.9167	19.9136	19.9102	19.9078	19.9053	(88)
util rest of house													
	0.9904	0.9803	0.9565	0.8927	0.7560	0.5469	0.3647	0.4074	0.6733	0.9132	0.9802	0.9925	(89)
MIT 2	18.3966	18.6522	19.0197	19.4494	19.7573	19.8912	19.9130	19.9121	19.8487	19.4679	18.8525	18.3406	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.6770	18.9173	19.2634	19.6695	19.9652	20.0975	20.1211	20.1196	20.0536	19.6856	19.1048	18.6238	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6770	18.9173	19.2634	19.6695	19.9652	20.0975	20.1211	20.1196	20.0536	19.6856	19.1048	18.6238	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9744	0.9484	0.8857	0.7592	0.5635	0.3867	0.4300	0.6855	0.9066	0.9746	0.9893	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	783.3068	890.3480	958.1732	969.6324	868.0443	628.1543	412.8809	434.0860	652.5419	780.8613	759.4678	743.4440	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1724.2406	1678.7508	1526.4790	1279.7065	980.9273	648.7609	415.5260	438.4848	704.1311	1078.2965	1428.2594	1720.4723	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	700.0548	529.8067	422.8195	223.2533	83.9850	0.0000	0.0000	0.0000	0.0000	221.2918	481.5300	726.9091	(98)
Space heating												3389.6502	(98)
Space heating per m2											(98) / (4) =	34.6236	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3648.7085 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	700.0548	529.8067	422.8195	223.2533	83.9850	0.0000	0.0000	0.0000	0.0000	221.2918	481.5300	726.9091	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	753.5574	570.2979	455.1341	240.3158	90.4036	0.0000	0.0000	0.0000	0.0000	238.2043	518.3315	782.4640	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.8173	109.6424	85.7600	42.3962	15.0729	0.0000	0.0000	23.0626	45.7778	89.7833	125.3022	146.8288	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3252	89.3346	89.3439	89.3735	89.3979	86.7000	86.7000	86.7000	86.7000	88.9524	89.2200	89.3458	(217)
Fuel for water heating, kWh/month	165.4822	122.7322	95.9887	47.4371	16.8605	0.0000	0.0000	26.6005	52.8002	100.9341	140.4418	164.3376	(219)
Water heating fuel used												933.6148	(219)
Annual totals kWh/year													
Space heating fuel - main system												3648.7085	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4487.8163	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3648.7085	3.4800	126.9751	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	933.6148	3.4800	32.4898	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	404.2461	13.1900	53.3201	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			266.9994	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7847 (257)
SAP value		89.0528
SAP rating (Section 12)		89 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3648.7085	0.2160	788.1210	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	933.6148	0.2160	201.6608	(264)
Space and water heating			989.7818	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	404.2461	0.5190	209.8037 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			940.7327 (272)
CO2 emissions per m2			9.6100 (273)
EI value			91.1786
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500	(1b)	x 2.3900	(2b) =	116.9905	(1b) - (3b)
First floor	48.9500	(1c)	x 2.6300	(2c) =	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.5800	
Infiltration rate		0.3011	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2559	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2687	0.2495	0.2559	0.2431	0.2431	0.2367	0.2303	0.2239	0.2175	0.2367	0.2239	0.2367	(22b)
Effective ac	0.5361	0.5311	0.5327	0.5296	0.5296	0.5280	0.5265	0.5251	0.5237	0.5280	0.5251	0.5280	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss	(33) + (36) = 75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4731	43.0697	43.2009	42.9419	42.9419	42.8175	42.6963	42.5785	42.4639	42.8175	42.5785	42.8175	(38)
Heat transfer coeff	118.5413	118.1379	118.2691	118.0101	118.0101	117.8857	117.7645	117.6467	117.5321	117.8857	117.6467	117.8857	(39)
Average = Sum(39)m / 12 =												117.9346	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2108	1.2067	1.2081	1.2054	1.2054	1.2041	1.2029	1.2017	1.2005	1.2041	1.2017	1.2041	(40)
HLP (average)												1.2046	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3059 (H8)
Utilisation factor												0.5350 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.7814 (H14)
Volume ratio Veff/V												0.7593 (H15)
Solar storage volume factor												0.9449 (H16)
Solar input												-902.2341 (H17)
Solar input	-29.4331	-41.8519	-71.9334	-97.0548	-113.9968	-121.7665	-119.2058	-106.6928	-83.5331	-57.7519	-34.8116	-24.2025 (63)
								Solar input (sum of months) = Sum(63)m =				-902.2341 (63)
Output from w/h												
	143.5335	109.7573	85.3011	41.1312	19.4164	0.0000	0.0000	16.6797	40.8074	85.6805	120.3213	143.6719 (64)
								Total per year (kWh/year) = Sum(64)m =				806.3004 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)
West	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(80)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.3523	57.5481	57.4843	57.6104	57.6104	57.6712	57.7306	57.7884	57.8447	57.6712	57.7884	57.6712	
alpha	4.8235	4.8365	4.8323	4.8407	4.8407	4.8447	4.8487	4.8526	4.8563	4.8447	4.8526	4.8447	
util living area													
	0.9895	0.9821	0.9583	0.8930	0.7622	0.5474	0.4011	0.4200	0.6813	0.9067	0.9769	0.9917	(86)
MIT	19.9721	20.1048	20.3715	20.6757	20.8894	20.9821	20.9968	20.9961	20.9504	20.7052	20.3025	19.9453	(87)
Th 2	19.9113	19.9146	19.9136	19.9157	19.9157	19.9167	19.9177	19.9186	19.9196	19.9167	19.9186	19.9167	(88)
util rest of house													
	0.9861	0.9764	0.9448	0.8593	0.6943	0.4506	0.2914	0.3056	0.5850	0.8686	0.9679	0.9889	(89)
MIT 2	18.5811	18.7744	19.1522	19.5653	19.8219	19.9074	19.9168	19.9176	19.8881	19.6145	19.0639	18.5466	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8494	19.0309	19.3873	19.7794	20.0277	20.1147	20.1251	20.1256	20.0930	19.8248	19.3028	18.8163	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9366	0.8544	0.7019	0.4688	0.3127	0.3278	0.6015	0.8647	0.9611	0.9849	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	818.3146	900.7632	971.0799	971.6616	816.5756	559.3332	355.3665	354.8670	607.5688	783.2583	794.2820	770.5559	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1653.5748	1622.1447	1465.0360	1213.0773	888.3500	567.5791	356.2498	355.9506	633.8465	993.1650	1341.5009	1628.7457	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	621.4335	484.7683	367.5033	173.8193	53.4001	0.0000	0.0000	0.0000	0.0000	156.1706	393.9976	638.4932	(98)
Space heating												2889.5860	(98)
Space heating per m2											(98) / (4) =	29.5157	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3110.4262	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	621.4335	484.7683	367.5033	173.8193	53.4001	0.0000	0.0000	0.0000	0.0000	156.1706	393.9976	638.4932	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	668.9274	521.8173	395.5902	187.1037	57.4813	0.0000	0.0000	0.0000	0.0000	168.1061	424.1094	687.2908	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.5335	109.7573	85.3011	41.1312	19.4164	0.0000	0.0000	16.6797	40.8074	85.6805	120.3213	143.6719	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2817	89.2916	89.2792	89.2695	89.0239	86.7000	86.7000	86.7000	86.7000	88.7397	89.1304	89.2946	(217)
Fuel for water heating, kWh/month	160.7648	122.9201	95.5441	46.0753	21.8103	0.0000	0.0000	19.2384	47.0674	96.5526	134.9947	160.8965	(219)
Water heating fuel used												905.8643	(219)

Annual totals kWh/year		
Space heating fuel - main system	3110.4262	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	50.0000	(230g)
Total electricity for the above, kWh/year	125.0000	(231)
Electricity for lighting (calculated in Appendix L)	404.2461	(232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =	-692.9382	-692.9382	(233)
Total delivered energy for all uses		3852.5984	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3110.4262	7.3800	229.5495	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	905.8643	7.3800	66.8528	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	404.2461	28.6600	115.8569	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			356.4881	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3110.4262	0.2160	671.8521	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.8643	0.2160	195.6667	(264)
Space and water heating			867.5188	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			782.5626	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3110.4262	1.2200	3794.7200	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.8643	1.2200	1105.1545	(264)
Space and water heating			4899.8745	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	404.2461	3.0700	1241.0356	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4397.3397	(272)
Primary energy kWh/m2/year			44.9166	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	648.72	(P1)
Transmission heat loss coefficient	75.07	(37)
Summer heat loss coefficient	723.79	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.6400	87.1704	0.7200	0.7000	0.8865	267.8024
South	7.4100	118.5567	0.7200	0.7000	0.8865	353.2612
West	3.2800	125.2818	0.7200	0.7000	0.8865	165.2394
total:						786.3030

	Jun	Jul	Aug	
Solar gains	843	786	711	(P3)
Internal gains	480	460	468	
Total summer gains	1322	1246	1179	(P5)
Summer gain/loss ratio	1.83	1.72	1.63	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.48	19.27	19.18	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 661 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 661 - EPC	**Prop Type Ref**	
Property	17 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	13.28	**TER**	17.61
Environmental	89 B	**% DER<TER**	24.58		
CO_2 Emissions (t/year)	0.98	**DFEE**	47.17	**TFEE**	53.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.68		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.61	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.28	$kgCO_2/m^2$	Pass
	-4.33 (-24.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.40	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.17	$kWh/m^2/yr$	
	-6.2 (-11.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.58 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	7.64 m², No overhang 7.41 m², No overhang 3.28 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.58 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Air permeability	3.6	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 662 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 662 - EPC	**Prop Type Ref**	
Property	19 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	13.33	**TER**	17.61
Environmental	89 B	**% DER<TER**	24.30		
CO_2 Emissions (t/year)	0.98	**DFEE**	47.43	**TFEE**	53.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.61 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.33 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.4 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.95 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.64 m², No overhang
Windows facing East: 3.28 m², No overhang
Windows facing South: 7.41 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.021 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3464	0.3396	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192	(22b)
Effective ac	0.5600	0.5577	0.5554	0.5446	0.5426	0.5333	0.5333	0.5316	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4091	45.2202	45.0351	44.1655	44.0028	43.2455	43.2455	43.1053	43.5372	44.0028	44.3320	44.6760	(38)
Heat transfer coeff	120.4773	120.2884	120.1033	119.2337	119.0710	118.3137	118.3137	118.1735	118.6054	119.0710	119.4002	119.7442	(39)
Average = Sum(39)m / 12 =												119.2329	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2287	1.2268	1.2179	1.2163	1.2085	1.2085	1.2071	1.2115	1.2163	1.2196	1.2231	(40)
HLP (average)												1.2179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200	(61)
Total heat required for water heating calculated for each month													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922	(64)
Heat gains from water heating, kWh/month													
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	418.5545	416.3349	401.1816	376.6357	351.5150	327.4582	311.9259	318.2829	330.9758	355.7475	384.2161	405.7578	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	590.4284	712.7408	818.2378	915.6546	977.7481	959.6317	917.0093	856.3180	789.7557	686.2632	590.7002	552.4697	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4307	56.5193	56.6064	57.0192	57.0971	57.4626	57.4626	57.5308	57.3213	57.0971	56.9397	56.7761	
alpha	4.7620	4.7680	4.7738	4.8013	4.8065	4.8308	4.8308	4.8354	4.8214	4.8065	4.7960	4.7851	
util living area													
	0.9979	0.9946	0.9854	0.9556	0.8750	0.7183	0.5512	0.6071	0.8426	0.9730	0.9954	0.9985	(86)
MIT	19.6549	19.8389	20.1152	20.4621	20.7613	20.9355	20.9856	20.9775	20.8549	20.4591	19.9848	19.6178	(87)
Th 2	19.8956	19.8971	19.8986	19.9057	19.9070	19.9132	19.9132	19.9143	19.9108	19.9070	19.9043	19.9015	(88)
util rest of house													
	0.9972	0.9927	0.9801	0.9387	0.8276	0.6231	0.4234	0.4773	0.7674	0.9594	0.9936	0.9980	(89)
MIT 2	18.1091	18.3784	18.7801	19.2774	19.6737	19.8705	19.9080	19.9052	19.7953	19.2826	18.5974	18.0590	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.4072	18.6600	19.0376	19.5058	19.8834	20.0759	20.1158	20.1120	19.9997	19.5095	18.8650	18.3596	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4072	18.6600	19.0376	19.5058	19.8834	20.0759	20.1158	20.1120	19.9997	19.5095	18.8650	18.3596	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9897	0.9744	0.9308	0.8264	0.6385	0.4481	0.5022	0.7746	0.9527	0.9908	0.9968	(94)
Useful gains	587.9156	705.3776	797.2996	852.3008	807.9711	612.7722	410.9308	430.0607	611.7257	653.8110	585.2939	550.7262	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1699.6013	1655.1721	1505.8010	1264.5740	974.4082	647.8742	415.9707	438.6597	699.7318	1060.8648	1404.7425	1695.5356	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	827.0942	638.2619	527.1251	296.8367	123.8292	0.0000	0.0000	0.0000	0.0000	302.8481	590.0030	851.7382	(98)
Space heating												4157.7364	(98)
Space heating per m2											(98) / (4) =	42.4692	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4475.4966	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	827.0942	638.2619	527.1251	296.8367	123.8292	0.0000	0.0000	0.0000	0.0000	302.8481	590.0030	851.7382	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	890.3059	687.0419	567.4113	319.5228	133.2931	0.0000	0.0000	0.0000	0.0000	325.9936	635.0947	916.8333	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3298	89.2676	89.1441	88.8582	88.2115	86.7000	86.7000	86.7000	86.7000	88.8461	89.2145	89.3570	(217)
Fuel for water heating, kWh/month													
	193.6271	169.8368	176.3824	155.5130	151.2424	134.1795	125.7167	142.2981	143.4146	161.4392	173.8876	187.8695	(219)
Water heating fuel used												1915.4069	(219)
Annual totals kWh/year													
Space heating fuel - main system												4475.4966	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6246.3965	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4475.4966	0.2160	966.7073	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.4069	0.2160	413.7279	(264)
Space and water heating			1380.4352	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1305.4360	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.3300	ZC1
Total Floor Area	TFA	97.9000	
Assumed number of occupants	N	2.7192	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3070	ZC2
CO2 emissions from cooking, equation (L16)		1.8821	ZC3
Total CO2 emissions		30.5192	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.5192	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.3300	1.3258	24.3011			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	122.4300	20.4500	101.9800	0.1800	18.3564			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9285			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.3129	(36)
Total fabric heat loss (33) + (36) =	69.2414	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	116.3797	116.1237	115.8727	114.6941	114.4735	113.4469	113.4469	113.2568	113.8424	114.4735	114.9197	115.3861	(39)
Average = Sum(39)m / 12 =												114.6930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1888	1.1861	1.1836	1.1715	1.1693	1.1588	1.1588	1.1569	1.1628	1.1693	1.1738	1.1786	(40)
HLP (average)												1.1715	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7398	47.3176	43.8427	45.3041	47.3176	47.7398	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
								Total per year (kWh/year) = Sum(64)m =				2132.6558	(64)
Heat gains from water heating, kWh/month													
	66.3184	58.3671	61.0953	54.0925	52.2806	45.8670	43.6719	48.9467	49.4956	56.5130	60.1107	64.6278	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	89.1377	86.8558	82.1174	75.1285	70.2696	63.7042	58.6987	65.7886	68.7439	75.9583	83.4871	86.8654	(72)
Total internal gains													
	431.7034	429.4865	414.3385	389.2549	363.4647	338.7396	323.2123	330.2373	343.6021	368.9113	397.3714	418.9093	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.6300	0.7000	0.7700	24.8277	(74)
East	3.2800	19.6403	0.6300	0.7000	0.7700	19.6876	(76)
South	7.4100	46.7521	0.6300	0.7000	0.7700	105.8744	(78)

Solar gains	150.3897	259.3551	364.9242	471.6416	547.9540	553.1518	529.4480	470.7807	401.4324	289.2013	180.6736	128.3730	(83)
Total gains	582.0931	688.8416	779.2627	860.8966	911.4186	891.8914	852.6603	801.0180	745.0345	658.1126	578.0450	547.2822	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4175	58.5463	58.6731	59.2761	59.3902	59.9277	59.9277	60.0283	59.7195	59.3902	59.1597	58.9206	
alpha	4.8945	4.9031	4.9115	4.9517	4.9593	4.9952	4.9952	5.0019	4.9813	4.9593	4.9440	4.9280	
util living area													
	0.9981	0.9953	0.9876	0.9621	0.8897	0.7376	0.5680	0.6218	0.8540	0.9756	0.9958	0.9986	(86)
MIT	19.7020	19.8716	20.1318	20.4653	20.7575	20.9347	20.9858	20.9780	20.8572	20.4757	20.0241	19.6716	(87)
Th 2	19.9290	19.9311	19.9332	19.9428	19.9446	19.9531	19.9531	19.9547	19.9498	19.9446	19.9410	19.9371	(88)
util rest of house													
	0.9974	0.9936	0.9830	0.9474	0.8464	0.6455	0.4417	0.4945	0.7829	0.9634	0.9941	0.9981	(89)
MIT 2	18.2013	18.4501	18.8292	19.3117	19.7033	19.9088	19.9478	19.9455	19.8339	19.3346	18.6804	18.1625	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.4907	18.7242	19.0804	19.5342	19.9066	20.1067	20.1480	20.1446	20.0313	19.5547	18.9395	18.4536	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4907	18.7242	19.0804	19.5342	19.9066	20.1067	20.1480	20.1446	20.0313	19.5547	18.9395	18.4536	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9909	0.9780	0.9401	0.8445	0.6602	0.4661	0.5189	0.7894	0.9572	0.9916	0.9970	(94)
Useful gains	579.7995	682.5894	762.1041	809.2861	769.7283	588.8680	397.4520	415.6265	588.0995	629.9392	573.1874	545.6671	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1651.5141	1605.3196	1457.7268	1219.6760	939.4364	624.7135	402.5075	424.1061	675.2305	1025.0733	1360.5955	1644.6631	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	797.3556	620.0747	517.5433	295.4807	126.2628	0.0000	0.0000	0.0000	0.0000	293.9798	566.9338	817.6530	(98)
Space heating												4035.2839	(98)
Space heating per m2											(98) / (4) =	41.2184	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4320.4324	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	797.3556	620.0747	517.5433	295.4807	126.2628	0.0000	0.0000	0.0000	0.0000	293.9798	566.9338	817.6530	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	853.6998	663.8915	554.1149	316.3605	135.1850	0.0000	0.0000	0.0000	0.0000	314.7536	606.9955	875.4315	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	212.0979	186.9605	196.3893	174.5296	168.9754	148.8241	142.5848	158.9487	160.7041	182.6079	193.0202	207.0134	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.0725	87.8405	87.3768	86.3662	84.3293	80.3000	80.3000	80.3000	80.3000	86.2437	87.6015	88.1598	(217)
Fuel for water heating, kWh/month													
	240.8220	212.8410	224.7613	202.0808	200.3756	185.3351	177.5652	197.9436	200.1296	211.7348	220.3390	234.8161	(219)
Water heating fuel used												2508.7441	(219)
Annual totals kWh/year													
Space heating fuel - main system												4320.4324	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Total delivered energy for all uses												7308.4226	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4320.4324	0.2160	933.2134	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2508.7441	0.2160	541.8887	(264)
Space and water heating			1475.1021	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Total CO2, kg/m2/year			1723.8309	(272)
Emissions per m2 for space and water heating			15.0674	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1430	(272b)
Emissions per m2 for pumps and fans			0.3976	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0674 * 1.00) + 2.1430 + 0.3976, rounded to 2 d.p.			17.6100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3464	0.3396	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192	(22b)
Effective ac	0.5600	0.5577	0.5554	0.5446	0.5426	0.5333	0.5333	0.5316	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4091	45.2202	45.0351	44.1655	44.0028	43.2455	43.2455	43.1053	43.5372	44.0028	44.3320	44.6760	(38)
Heat transfer coeff	120.4773	120.2884	120.1033	119.2337	119.0710	118.3137	118.3137	118.1735	118.6054	119.0710	119.4002	119.7442	(39)
Average = Sum(39)m / 12 =												119.2329	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2287	1.2268	1.2179	1.2163	1.2085	1.2085	1.2071	1.2115	1.2163	1.2196	1.2231	(40)
HLP (average)												1.2179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.2420	29.9483	30.9040	26.9428	25.8523	22.3085	20.6721	23.7216	24.0049	27.9754	30.5373	33.1616	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	46.0242	44.5659	41.5376	37.4206	34.7477	30.9841	27.7851	31.8839	33.3401	37.6013	42.4130	44.5720	(72)
Total internal gains													
	385.5900	384.1965	370.7587	348.5470	324.9427	303.0195	289.2987	293.3326	305.1984	327.5543	353.2973	373.6159	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	557.4639	680.6024	787.8149	887.5660	951.1758	935.1930	894.3821	831.3677	763.9783	658.0701	559.7814	520.3278	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4307	56.5193	56.6064	57.0192	57.0971	57.4626	57.4626	57.5308	57.3213	57.0971	56.9397	56.7761	
alpha	4.7620	4.7680	4.7738	4.8013	4.8065	4.8308	4.8308	4.8354	4.8214	4.8065	4.7960	4.7851	
util living area													
	0.9984	0.9956	0.9875	0.9603	0.8842	0.7312	0.5635	0.6222	0.8554	0.9770	0.9964	0.9989	(86)
MIT	19.6240	19.8092	20.0884	20.4405	20.7475	20.9303	20.9842	20.9750	20.8436	20.4356	19.9562	19.5876	(87)
Th 2	19.8956	19.8971	19.8986	19.9057	19.9070	19.9132	19.9132	19.9143	19.9108	19.9070	19.9043	19.9015	(88)
util rest of house													
	0.9978	0.9940	0.9829	0.9448	0.8388	0.6363	0.4337	0.4907	0.7830	0.9651	0.9949	0.9985	(89)
MIT 2	18.6451	18.8308	19.1087	19.4568	19.7370	19.8813	19.9093	19.9073	19.8245	19.4586	18.9836	18.6134	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.8339	19.0195	19.2977	19.6465	19.9319	20.0836	20.1166	20.1132	20.0210	19.6470	19.1712	18.8013	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8339	19.0195	19.2977	19.6465	19.9319	20.0836	20.1166	20.1132	20.0210	19.6470	19.1712	18.8013	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9923	0.9795	0.9402	0.8400	0.6525	0.4590	0.5162	0.7916	0.9614	0.9934	0.9979	(94)
Useful gains	555.8298	675.3645	771.6724	834.4677	798.9567	610.2522	410.4773	429.1447	604.7481	632.6522	556.0965	519.2198	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1751.0044	1698.4137	1537.0410	1281.3490	980.1753	648.7896	416.0591	438.8058	702.2628	1077.2390	1441.3017	1748.4195	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	889.2099	687.4890	569.4343	321.7546	134.8267	0.0000	0.0000	0.0000	0.0000	330.7726	637.3477	914.5246	(98)
Space heating												4485.3594	(98)
Space heating per m2											(98) / (4) =	45.8157	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1112.1488	875.5214	898.1183	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8575	0.9191	0.8939	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	953.6582	804.6676	802.8561	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1197.0822	1147.1561	1075.3683	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	175.2653	254.8115	202.7491	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											632.8258	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	43.8163	63.7029	50.6873	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											158.2065	(107)
Space cooling per m2											1.6160	(108)
Energy for space heating											45.8157	(99)
Energy for space cooling											1.6160	(108)
Total											47.4317	(109)
Dwelling Fabric Energy Efficiency (DFEE)											47.4	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4032	0.3953	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5781	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			18.3300	1.3258	24.3011			(27)
Ground floor			48.9500	0.1300	6.3635			(28a)
External Wall	122.4300	20.4500	101.9800	0.1800	18.3564			(29a)
Main Roof	48.9500		48.9500	0.1300	6.3635			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9285			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.3129	(36)
Total fabric heat loss (33) + (36) =	69.2414	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.1383	46.8823	46.6313	45.4527	45.2321	44.2055	44.2055	44.0154	44.6010	45.2321	45.6783	46.1447	(38)
Heat transfer coeff	116.3797	116.1237	115.8727	114.6941	114.4735	113.4469	113.4469	113.2568	113.8424	114.4735	114.9197	115.3861	(39)
Average = Sum(39)m / 12 =												114.6930	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1888	1.1861	1.1836	1.1715	1.1693	1.1588	1.1588	1.1569	1.1628	1.1693	1.1738	1.1786	(40)
HLP (average)												1.1715	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	34.2420	29.9483	30.9040	26.9428	25.8523	22.3085	20.6721	23.7216	24.0049	27.9754	30.5373	33.1616	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	135.9608	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.8901	20.3308	16.5341	12.5174	9.3569	7.8995	8.5357	11.0950	14.8917	18.9084	22.0689	23.5263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.8874	255.5116	248.8988	234.8208	217.0499	200.3477	189.1897	186.5655	193.1783	207.2563	225.0272	241.7294	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	36.5961	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	46.0242	44.5659	41.5376	37.4206	34.7477	30.9841	27.7851	31.8839	33.3401	37.6013	42.4130	44.5720	(72)
Total internal gains													
	385.5900	384.1965	370.7587	348.5470	324.9427	303.0195	289.2987	293.3326	305.1984	327.5543	353.2973	373.6159	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.6300	0.7000	0.7700	24.8277	(74)
East	3.2800	19.6403	0.6300	0.7000	0.7700	19.6876	(76)
South	7.4100	46.7521	0.6300	0.7000	0.7700	105.8744	(78)

Solar gains	150.3897	259.3551	364.9242	471.6416	547.9540	553.1518	529.4480	470.7807	401.4324	289.2013	180.6736	128.3730	(83)
Total gains	535.9797	643.5517	735.6829	820.1886	872.8967	856.1714	818.7467	764.1133	706.6308	616.7556	533.9709	501.9888	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.4175	58.5463	58.6731	59.2761	59.3902	59.9277	59.9277	60.0283	59.7195	59.3902	59.1597	58.9206	
alpha	4.8945	4.9031	4.9115	4.9517	4.9593	4.9952	4.9952	5.0019	4.9813	4.9593	4.9440	4.9280	
util living area													
	0.9987	0.9965	0.9902	0.9684	0.9030	0.7579	0.5885	0.6463	0.8736	0.9812	0.9970	0.9990	(86)
MIT	19.6585	19.8294	20.0926	20.4328	20.7358	20.9261	20.9834	20.9740	20.8390	20.4404	19.9828	19.6286	(87)
Th 2	19.9290	19.9311	19.9332	19.9428	19.9446	19.9531	19.9531	19.9547	19.9498	19.9446	19.9410	19.9371	(88)
util rest of house													
	0.9982	0.9952	0.9865	0.9557	0.8629	0.6668	0.4592	0.5165	0.8072	0.9713	0.9958	0.9987	(89)
MIT 2	18.7060	18.8780	19.1411	19.4816	19.7625	19.9182	19.9488	19.9471	19.8584	19.4947	19.0394	18.6827	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8897	19.0615	19.3246	19.6650	19.9502	20.1126	20.1483	20.1451	20.0475	19.6771	19.2213	18.8651	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8897	19.0615	19.3246	19.6650	19.9502	20.1126	20.1483	20.1451	20.0475	19.6771	19.2213	18.8651	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9939	0.9838	0.9515	0.8632	0.6821	0.4844	0.5417	0.8145	0.9680	0.9946	0.9982	(94)
Useful gains	534.6799	639.5987	723.7396	780.3709	753.4775	583.9827	396.5635	413.9284	575.5732	597.0100	531.0853	501.1028	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1697.9446	1644.4851	1486.0171	1234.6842	944.4305	625.3887	402.5475	424.1628	677.0766	1039.0889	1392.9748	1692.1490	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	865.4689	675.2837	567.1345	327.1056	142.0690	0.0000	0.0000	0.0000	0.0000	328.9067	620.5604	886.1383	(98)
Space heating												4412.6672	(98)
Space heating per m2											(98) / (4) =	45.0732	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1066.4012	839.5073	860.7519	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8476	0.9135	0.8881	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	903.8315	766.8888	764.4356	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1104.7192	1058.7511	996.7593	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	144.6391	217.1456	172.8488	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												534.6335	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.1598	54.2864	43.2122	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												133.6584 (107)
Space cooling per m2												1.3653 (108)
Energy for space heating												45.0732 (99)
Energy for space cooling												1.3653 (108)
Total												46.4385 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2852	0.2649	0.2716	0.2581	0.2581	0.2513	0.2445	0.2377	0.2309	0.2513	0.2377	0.2513	(22b)
Effective ac	0.5407	0.5351	0.5369	0.5333	0.5333	0.5316	0.5299	0.5282	0.5267	0.5316	0.5282	0.5316	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8439	43.3895	43.5372	43.2455	43.2455	43.1053	42.9688	42.8360	42.7070	43.1053	42.8360	43.1053	(38)
Heat transfer coeff	118.9121	118.4577	118.6054	118.3137	118.3137	118.1735	118.0370	117.9042	117.7752	118.1735	117.9042	118.1735	(39)
Average = Sum(39)m / 12 =												118.2286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2146	1.2100	1.2115	1.2085	1.2085	1.2071	1.2057	1.2043	1.2030	1.2071	1.2043	1.2071	(40)
HLP (average)												1.2076	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
RHI water heating demand												1693 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
East	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(76)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1734	57.3927	57.3213	57.4626	57.4626	57.5308	57.5973	57.6622	57.7253	57.5308	57.6622	57.5308	
alpha	4.8116	4.8262	4.8214	4.8308	4.8308	4.8354	4.8398	4.8441	4.8484	4.8354	4.8441	4.8354	
util living area													
	0.9896	0.9822	0.9585	0.8935	0.7632	0.5485	0.4020	0.4209	0.6823	0.9072	0.9769	0.9917	(86)
MIT	19.9671	20.1006	20.3676	20.6731	20.8881	20.9818	20.9967	20.9960	20.9498	20.7031	20.2997	19.9415	(87)
Th 2	19.9083	19.9120	19.9108	19.9132	19.9132	19.9143	19.9155	19.9165	19.9176	19.9143	19.9165	19.9143	(88)
util rest of house													
	0.9861	0.9764	0.9451	0.8599	0.6952	0.4514	0.2919	0.3061	0.5857	0.8691	0.9680	0.9889	(89)
MIT 2	18.5718	18.7665	19.1446	19.5599	19.8182	19.9049	19.9146	19.9155	19.8858	19.6099	19.0584	18.5394	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9368	0.8549	0.7028	0.4697	0.3132	0.3283	0.6022	0.8651	0.9612	0.9849	(94)
Useful gains	818.3381	900.8217	971.2915	972.2270	817.6030	560.3310	355.9584	355.4229	608.3336	783.6422	794.3450	770.5664	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1657.7414	1625.6834	1468.3937	1215.6256	890.2588	568.7190	356.8591	356.5263	634.9209	995.1031	1343.8443	1631.9499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	624.5161	487.1070	369.8441	175.2470	54.0559	0.0000	0.0000	0.0000	0.0000	157.3269	395.6395	640.8693	(98)
Space heating												2904.6058	(98)
RHI space heating demand												2905	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3464	0.3396	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192	(22b)
Effective ac	0.5600	0.5577	0.5554	0.5446	0.5426	0.5333	0.5333	0.5316	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4091	45.2202	45.0351	44.1655	44.0028	43.2455	43.2455	43.1053	43.5372	44.0028	44.3320	44.6760	(38)
Heat transfer coeff	120.4773	120.2884	120.1033	119.2337	119.0710	118.3137	118.3137	118.1735	118.6054	119.0710	119.4002	119.7442	(39)
Average = Sum(39)m / 12 =												119.2329	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2287	1.2268	1.2179	1.2163	1.2085	1.2085	1.2071	1.2115	1.2163	1.2196	1.2231	(40)
HLP (average)												1.2179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	793.9507	913.7166	1010.2615	1094.7193	1143.3192	1114.7902	1067.6264	1009.4816	951.8713	861.3379	779.2684	751.4504	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4307	56.5193	56.6064	57.0192	57.0971	57.4626	57.4626	57.5308	57.3213	57.0971	56.9397	56.7761	
alpha	4.7620	4.7680	4.7738	4.8013	4.8065	4.8308	4.8308	4.8354	4.8214	4.8065	4.7960	4.7851	
util living area													
	0.9927	0.9851	0.9674	0.9197	0.8143	0.6417	0.4797	0.5257	0.7603	0.9395	0.9857	0.9944	(86)
MIT	19.8430	20.0197	20.2770	20.5870	20.8328	20.9602	20.9920	20.9877	20.9102	20.5932	20.1554	19.8029	(87)
Th 2	19.8956	19.8971	19.8986	19.9057	19.9070	19.9132	19.9132	19.9143	19.9108	19.9070	19.9043	19.9015	(88)
util rest of house													
	0.9904	0.9803	0.9567	0.8933	0.7571	0.5479	0.3653	0.4081	0.6743	0.9137	0.9802	0.9925	(89)
MIT 2	18.3827	18.6391	19.0081	19.4416	19.7521	19.8884	19.9105	19.9097	19.8451	19.4611	18.8430	18.3287	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.6643	18.9053	19.2528	19.6625	19.9605	20.0951	20.1190	20.1176	20.0505	19.6794	19.0961	18.6130	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6643	18.9053	19.2528	19.6625	19.9605	20.0951	20.1190	20.1176	20.0505	19.6794	19.0961	18.6130	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9745	0.9487	0.8862	0.7602	0.5644	0.3875	0.4308	0.6865	0.9069	0.9746	0.9893	(94)
Useful gains	783.3187	890.4148	958.3963	970.1823	869.1612	629.2137	413.6523	434.8422	653.4613	781.1778	759.5129	743.4473	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1730.5693	1684.6770	1531.6541	1283.2540	983.5843	650.1437	416.3499	439.3189	705.7594	1081.0957	1432.3360	1725.8718	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	704.7544	533.7442	426.5038	225.4116	85.1308	0.0000	0.0000	0.0000	0.0000	223.1389	484.4326	730.9239	(98)
Space heating												3414.0402	(98)
Space heating per m2											(98) / (4) =	34.8727	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3674.9625	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	704.7544	533.7442	426.5038	225.4116	85.1308	0.0000	0.0000	0.0000	0.0000	223.1389	484.4326	730.9239	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	758.6162	574.5363	459.0999	242.6390	91.6370	0.0000	0.0000	0.0000	0.0000	240.1926	521.4560	786.7856	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2508	89.1719	89.0150	88.6564	87.9190	86.7000	86.7000	86.7000	86.7000	88.6202	89.1023	89.2845	(217)
Fuel for water heating, kWh/month													
	193.7983	170.0190	176.6381	155.8670	151.7455	134.1795	125.7167	142.2981	143.4146	161.8507	174.1065	188.0220	(219)
Water heating fuel used												1917.6559	(219)
Annual totals kWh/year													
Space heating fuel - main system												3674.9625	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5448.1115	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3674.9625	3.4800	127.8887	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1917.6559	3.4800	66.7344	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	404.2461	13.1900	53.3201	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			295.5626	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8687	(257)
SAP value		87.8817	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3674.9625	0.2160	793.7919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.6559	0.2160	414.2137	(264)
Space and water heating			1208.0056	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1133.0064	(272)
CO2 emissions per m2			11.5700	(273)
EI value			89.3756	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500 (1b)	x	2.3900 (2b)	=	116.9905	(1b) - (3b)
First floor	48.9500 (1c)	x	2.6300 (2c)	=	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2852	0.2649	0.2716	0.2581	0.2581	0.2513	0.2445	0.2377	0.2309	0.2513	0.2377	0.2513	(22b)
Effective ac	0.5407	0.5351	0.5369	0.5333	0.5333	0.5316	0.5299	0.5282	0.5267	0.5316	0.5282	0.5316	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8439	43.3895	43.5372	43.2455	43.2455	43.1053	42.9688	42.8360	42.7070	43.1053	42.8360	43.1053	(38)
Heat transfer coeff	118.9121	118.4577	118.6054	118.3137	118.3137	118.1735	118.0370	117.9042	117.7752	118.1735	117.9042	118.1735	(39)
Average = Sum(39)m / 12 =												118.2286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2146	1.2100	1.2115	1.2085	1.2085	1.2071	1.2057	1.2043	1.2030	1.2071	1.2043	1.2071	(40)
HLP (average)												1.2076	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (64)
								Total per year (kWh/year) = Sum(64)m =				1692.8922 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
East	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(76)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1734	57.3927	57.3213	57.4626	57.4626	57.5308	57.5973	57.6622	57.7253	57.5308	57.6622	57.5308	
alpha	4.8116	4.8262	4.8214	4.8308	4.8308	4.8354	4.8398	4.8441	4.8484	4.8354	4.8441	4.8354	
util living area													
	0.9896	0.9822	0.9585	0.8935	0.7632	0.5485	0.4020	0.4209	0.6823	0.9072	0.9769	0.9917	(86)
MIT	19.9671	20.1006	20.3676	20.6731	20.8881	20.9818	20.9967	20.9960	20.9498	20.7031	20.2997	19.9415	(87)
Th 2	19.9083	19.9120	19.9108	19.9132	19.9132	19.9143	19.9155	19.9165	19.9176	19.9143	19.9165	19.9143	(88)
util rest of house													
	0.9861	0.9764	0.9451	0.8599	0.6952	0.4514	0.2919	0.3061	0.5857	0.8691	0.9680	0.9889	(89)
MIT 2	18.5718	18.7665	19.1446	19.5599	19.8182	19.9049	19.9146	19.9155	19.8858	19.6099	19.0584	18.5394	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9368	0.8549	0.7028	0.4697	0.3132	0.3283	0.6022	0.8651	0.9612	0.9849	(94)
Useful gains	818.3381	900.8217	971.2915	972.2270	817.6030	560.3310	355.9584	355.4229	608.3336	783.6422	794.3450	770.5664	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1657.7414	1625.6834	1468.3937	1215.6256	890.2588	568.7190	356.8591	356.5263	634.9209	995.1031	1343.8443	1631.9499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	624.5161	487.1070	369.8441	175.2470	54.0559	0.0000	0.0000	0.0000	0.0000	157.3269	395.6395	640.8693	(98)
Space heating												2904.6058	(98)
Space heating per m2											(98) / (4) =	29.6691	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3126.5940	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	624.5161	487.1070	369.8441	175.2470	54.0559	0.0000	0.0000	0.0000	0.0000	157.3269	395.6395	640.8693	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	672.2455	524.3348	398.1099	188.6405	58.1872	0.0000	0.0000	0.0000	0.0000	169.3508	425.8768	689.8486	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1860	89.1192	88.9209	88.4605	87.5991	86.7000	86.7000	86.7000	86.7000	88.3450	88.9750	89.2165	(217)
Fuel for water heating, kWh/month													
	193.9391	170.1196	176.8250	156.2121	152.2997	134.1795	125.7167	142.2981	143.4146	162.3549	174.3555	188.1653	(219)
Water heating fuel used												1919.8801	(219)
Annual totals kWh/year													
Space heating fuel - main system												3126.5940	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4832.7820	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3126.5940	7.3800	230.7426	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1919.8801	7.3800	141.6872	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	404.2461	28.6600	115.8569	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			418.1856	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3126.5940	0.2160	675.3443	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1919.8801	0.2160	414.6941	(264)
Space and water heating			1090.0384	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			979.1322	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3126.5940	1.2200	3814.4446	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1919.8801	1.2200	2342.2538	(264)
Space and water heating			6156.6984	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	404.2461	3.0700	1241.0356	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5500.6636	(272)
Primary energy kWh/m2/year			56.1866	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 61	-193 kg (19.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£61	1.97 kg/m²	B 89	B 91
Total Savings	£61	1.97 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£137	£152	-£14
Mains gas	£479	£405	£75
Space heating	£359	£359	£0
Water heating	£142	£81	£61
Lighting	£116	£116	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£417	£358	£61
Total cost of uses	£418	£357	£61
Delivered energy	49 kWh/m²	40 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	45 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500	(1b)	x 2.3900	(2b) =	116.9905	(1b) - (3b)
First floor	48.9500	(1c)	x 2.6300	(2c) =	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3464	0.3396	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192	(22b)
Effective ac	0.5600	0.5577	0.5554	0.5446	0.5426	0.5333	0.5333	0.5316	0.5369	0.5426	0.5467	0.5509	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss (33) + (36) =	75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	45.4091	45.2202	45.0351	44.1655	44.0028	43.2455	43.2455	43.1053	43.5372	44.0028	44.3320	44.6760	(38)
Heat transfer coeff	120.4773	120.2884	120.1033	119.2337	119.0710	118.3137	118.3137	118.1735	118.6054	119.0710	119.4002	119.7442	(39)
Average = Sum(39)m / 12 =												119.2329	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2306	1.2287	1.2268	1.2179	1.2163	1.2085	1.2085	1.2071	1.2115	1.2163	1.2196	1.2231	(40)
HLP (average)												1.2179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200	(61)
Total heat required for water heating calculated for each month													
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1669	(H8)
Utilisation factor												0.5756	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.7814	(H14)
Volume ratio Veff/V												0.7593	(H15)
Solar storage volume factor												0.9449	(H16)
Solar input												-867.2757	(H17)
Solar input	-25.1493	-41.9669	-71.4744	-95.7898	-118.3402	-116.3473	-114.8097	-100.3098	-78.5627	-53.6491	-29.8307	-21.0456	(63)
								Solar input (sum of months) = Sum(63)m =				-867.2757	(63)
Output from w/h													
	147.8173	109.6424	85.7600	42.3962	15.0729	0.0000	0.0000	23.0626	45.7778	89.7833	125.3022	146.8288	(64)
								Total per year (kWh/year) = Sum(64)m =				831.4436	(64)
Heat gains from water heating, kWh/month													
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	10.6334	0.7200	0.7000	0.7700	28.3745	(74)
East	3.2800	19.6403	0.7200	0.7000	0.7700	22.5001	(76)
South	7.4100	46.7521	0.7200	0.7000	0.7700	120.9993	(78)

Solar gains	171.8739	296.4059	417.0562	539.0190	626.2331	632.1735	605.0834	538.0351	458.7799	330.5158	206.4841	146.7119	(83)
Total gains	793.9507	913.7166	1010.2615	1094.7193	1143.3192	1114.7902	1067.6264	1009.4816	951.8713	861.3379	779.2684	751.4504	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.4307	56.5193	56.6064	57.0192	57.0971	57.4626	57.4626	57.5308	57.3213	57.0971	56.9397	56.7761	
alpha	4.7620	4.7680	4.7738	4.8013	4.8065	4.8308	4.8308	4.8354	4.8214	4.8065	4.7960	4.7851	
util living area													
	0.9927	0.9851	0.9674	0.9197	0.8143	0.6417	0.4797	0.5257	0.7603	0.9395	0.9857	0.9944	(86)
MIT	19.8430	20.0197	20.2770	20.5870	20.8328	20.9602	20.9920	20.9877	20.9102	20.5932	20.1554	19.8029	(87)
Th 2	19.8956	19.8971	19.8986	19.9057	19.9070	19.9132	19.9132	19.9143	19.9108	19.9070	19.9043	19.9015	(88)
util rest of house													
	0.9904	0.9803	0.9567	0.8933	0.7571	0.5479	0.3653	0.4081	0.6743	0.9137	0.9802	0.9925	(89)
MIT 2	18.3827	18.6391	19.0081	19.4416	19.7521	19.8884	19.9105	19.9097	19.8451	19.4611	18.8430	18.3287	(90)
Living area fraction									fLA = Living area / (4) =			0.1928	(91)
MIT	18.6643	18.9053	19.2528	19.6625	19.9605	20.0951	20.1190	20.1176	20.0505	19.6794	19.0961	18.6130	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6643	18.9053	19.2528	19.6625	19.9605	20.0951	20.1190	20.1176	20.0505	19.6794	19.0961	18.6130	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9745	0.9487	0.8862	0.7602	0.5644	0.3875	0.4308	0.6865	0.9069	0.9746	0.9893	(94)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	783.3187	890.4148	958.3963	970.1823	869.1612	629.2137	413.6523	434.8422	653.4613	781.1778	759.5129	743.4473	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1730.5693	1684.6770	1531.6541	1283.2540	983.5843	650.1437	416.3499	439.3189	705.7594	1081.0957	1432.3360	1725.8718	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	704.7544	533.7442	426.5038	225.4116	85.1308	0.0000	0.0000	0.0000	0.0000	223.1389	484.4326	730.9239	(98)
Space heating												3414.0402	(98)
Space heating per m2											(98) / (4) =	34.8727	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3674.9625	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	704.7544	533.7442	426.5038	225.4116	85.1308	0.0000	0.0000	0.0000	0.0000	223.1389	484.4326	730.9239	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	758.6162	574.5363	459.0999	242.6390	91.6370	0.0000	0.0000	0.0000	0.0000	240.1926	521.4560	786.7856	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.8173	109.6424	85.7600	42.3962	15.0729	0.0000	0.0000	23.0626	45.7778	89.7833	125.3022	146.8288	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3284	89.3381	89.3479	89.3778	89.4036	86.7000	86.7000	86.7000	86.7000	88.9579	89.2233	89.3484	(217)
Fuel for water heating, kWh/month	165.4764	122.7275	95.9844	47.4349	16.8594	0.0000	0.0000	26.6005	52.8002	100.9278	140.4367	164.3330	(219)
Water heating fuel used												933.5807	(219)
Annual totals kWh/year													
Space heating fuel - main system												3674.9625	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4514.0362	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3674.9625	3.4800	127.8887	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	933.5807	3.4800	32.4886	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	404.2461	13.1900	53.3201	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			267.9118	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7874	(257)
SAP value		89.0154	
SAP rating (Section 12)		89	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3674.9625	0.2160	793.7919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	933.5807	0.2160	201.6534	(264)
Space and water heating			995.4453	(265)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	404.2461	0.5190	209.8037 (268)
Energy saving/generation technologies			
PV Unit	-623.7532	0.5190	-323.7279 (269)
Total kg/year			946.3962 (272)
CO2 emissions per m2			9.6700 (273)
EI value			91.1255
EI rating			91 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.9500	(1b)	x 2.3900	(2b) =	116.9905	(1b) - (3b)
First floor	48.9500	(1c)	x 2.6300	(2c) =	128.7385	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.9000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	245.7290	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Measured/design AP50		3.9500	
Infiltration rate		0.3196	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2716	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2852	0.2649	0.2716	0.2581	0.2581	0.2513	0.2445	0.2377	0.2309	0.2513	0.2377	0.2513	(22b)
Effective ac	0.5407	0.5351	0.5369	0.5333	0.5333	0.5316	0.5299	0.5282	0.5267	0.5316	0.5282	0.5316	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			18.3300	1.2357	22.6511			(27)
Opening Type 3			2.1200	1.5000	3.1800			(26a)
Ground floor			48.9500	0.1900	9.3005			(28a)
External Wall	122.4300	20.4500	101.9800	0.2700	27.5346			(29a)
Main Roof	48.9500		48.9500	0.1600	7.8320			(30)
Total net area of external elements Aum(A, m2)			220.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.4982			(33)
Party Wall			25.3000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.5700	(36)
Total fabric heat loss	(33) + (36) = 75.0682	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8439	43.3895	43.5372	43.2455	43.2455	43.1053	42.9688	42.8360	42.7070	43.1053	42.8360	43.1053	(38)
Heat transfer coeff	118.9121	118.4577	118.6054	118.3137	118.3137	118.1735	118.0370	117.9042	117.7752	118.1735	117.9042	118.1735	(39)
Average = Sum(39)m / 12 =												118.2286	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2146	1.2100	1.2115	1.2085	1.2085	1.2071	1.2057	1.2043	1.2030	1.2071	1.2043	1.2071	(40)
HLP (average)												1.2076	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7192 (42)
Average daily hot water use (litres/day)	98.7814 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6595	104.7083	100.7570	96.8058	92.8545	88.9033	88.9033	92.8545	96.8058	100.7570	104.7083	108.6595	(44)
Energy conte	161.1389	140.9332	145.4304	126.7897	121.6578	104.9814	97.2807	111.6310	112.9643	131.6490	143.7051	156.0545	(45)
Energy content (annual)										Total = Sum(45)m =		1554.2159	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1708	21.1400	21.8146	19.0185	18.2487	15.7472	14.5921	16.7447	16.9446	19.7473	21.5558	23.4082	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8276	10.6761	11.8041	11.3963	11.7554	11.3522	11.7157	11.7414	11.3762	11.7834	11.4278	11.8200 (61)
Total heat required for water heating calculated for each month												
	172.9666	151.6093	157.2345	138.1860	133.4132	116.3336	108.9964	123.3725	124.3405	143.4324	155.1329	167.8745 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3059 (H8)
Utilisation factor												0.5350 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.7814 (H14)
Volume ratio Veff/V												0.7593 (H15)
Solar storage volume factor												0.9449 (H16)
Solar input												-902.2341 (H17)
Solar input	-29.4331	-41.8519	-71.9334	-97.0548	-113.9968	-121.7665	-119.2058	-106.6928	-83.5331	-57.7519	-34.8116	-24.2025 (63)
								Solar input (sum of months) = Sum(63)m =				-902.2341 (63)
Output from w/h												
	143.5335	109.7573	85.3011	41.1312	19.4164	0.0000	0.0000	16.6797	40.8074	85.6805	120.3213	143.6719 (64)
								Total per year (kWh/year) = Sum(64)m =				806.3004 (64)
Heat gains from water heating, kWh/month												
	56.5356	49.5293	51.3066	45.0067	43.3901	37.7444	35.2748	40.0527	40.4047	46.7191	50.6389	54.8431 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	163.1530	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	57.2252	50.8269	41.3352	31.2934	23.3922	19.7487	21.3392	27.7374	37.2291	47.2709	55.1722	58.8157	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.4439	381.3606	371.4907	350.4788	323.9550	299.0264	282.3726	278.4559	288.3259	309.3378	335.8615	360.7901	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	54.0345	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	-108.7687	(71)
Water heating gains (Table 5)													
	75.9887	73.7043	68.9605	62.5093	58.3200	52.4227	47.4123	53.8342	56.1176	62.7945	70.3318	73.7139	(72)
Total internal gains													
	622.0767	617.3107	593.2053	555.7003	517.0861	482.6167	462.5429	471.4465	493.0914	530.8221	572.7843	604.7385	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6400	13.4839	0.7200	0.7000	0.7700	35.9809	(74)
East	3.2800	25.1925	0.7200	0.7000	0.7700	28.8609	(76)
South	7.4100	56.7559	0.7200	0.7000	0.7700	146.8902	(78)

Solar gains	211.7320	311.2568	443.6556	581.5655	646.2411	710.4018	673.9327	611.0534	517.0152	374.9998	253.6185	177.6308	(83)
Total gains	833.8087	928.5675	1036.8609	1137.2658	1163.3272	1193.0185	1136.4756	1082.4999	1010.1067	905.8218	826.4029	782.3693	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1734	57.3927	57.3213	57.4626	57.4626	57.5308	57.5973	57.6622	57.7253	57.5308	57.6622	57.5308	
alpha	4.8116	4.8262	4.8214	4.8308	4.8308	4.8354	4.8398	4.8441	4.8484	4.8354	4.8441	4.8354	
util living area													
	0.9896	0.9822	0.9585	0.8935	0.7632	0.5485	0.4020	0.4209	0.6823	0.9072	0.9769	0.9917	(86)
MIT	19.9671	20.1006	20.3676	20.6731	20.8881	20.9818	20.9967	20.9960	20.9498	20.7031	20.2997	19.9415	(87)
Th 2	19.9083	19.9120	19.9108	19.9132	19.9132	19.9143	19.9155	19.9165	19.9176	19.9143	19.9165	19.9143	(88)
util rest of house													
	0.9861	0.9764	0.9451	0.8599	0.6952	0.4514	0.2919	0.3061	0.5857	0.8691	0.9680	0.9889	(89)
MIT 2	18.5718	18.7665	19.1446	19.5599	19.8182	19.9049	19.9146	19.9155	19.8858	19.6099	19.0584	18.5394	(90)
Living area fraction										fLA = Living area / (4) =		0.1928	(91)
MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8409	19.0237	19.3805	19.7746	20.0246	20.1126	20.1233	20.1239	20.0910	19.8207	19.2978	18.8098	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9701	0.9368	0.8549	0.7028	0.4697	0.3132	0.3283	0.6022	0.8651	0.9612	0.9849	(94)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	818.3381	900.8217	971.2915	972.2270	817.6030	560.3310	355.9584	355.4229	608.3336	783.6422	794.3450	770.5664	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1657.7414	1625.6834	1468.3937	1215.6256	890.2588	568.7190	356.8591	356.5263	634.9209	995.1031	1343.8443	1631.9499	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	624.5161	487.1070	369.8441	175.2470	54.0559	0.0000	0.0000	0.0000	0.0000	157.3269	395.6395	640.8693	(98)
Space heating												2904.6058	(98)
Space heating per m2											(98) / (4) =	29.6691	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3126.5940	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	624.5161	487.1070	369.8441	175.2470	54.0559	0.0000	0.0000	0.0000	0.0000	157.3269	395.6395	640.8693	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	672.2455	524.3348	398.1099	188.6405	58.1872	0.0000	0.0000	0.0000	0.0000	169.3508	425.8768	689.8486	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	143.5335	109.7573	85.3011	41.1312	19.4164	0.0000	0.0000	16.6797	40.8074	85.6805	120.3213	143.6719	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2842	89.2939	89.2824	89.2737	89.0316	86.7000	86.7000	86.7000	86.7000	88.7451	89.1328	89.2964	(217)
Fuel for water heating, kWh/month													
	160.7604	122.9169	95.5407	46.0732	21.8084	0.0000	0.0000	19.2384	47.0674	96.5467	134.9910	160.8933	(219)
Water heating fuel used												905.8363	(219)
Annual totals kWh/year													
Space heating fuel - main system												3126.5940	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												404.2461	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												3868.7382	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3126.5940	7.3800	230.7426	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	905.8363	7.3800	66.8507	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	404.2461	28.6600	115.8569	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			357.6792	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3126.5940	0.2160	675.3443	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.8363	0.2160	195.6606	(264)
Space and water heating			871.0049	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	404.2461	0.5190	209.8037	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			786.0487	(272)

13a. Primary energy - Individual heating systems including micro-CHP

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3126.5940	1.2200	3814.4446	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.8363	1.2200	1105.1203	(264)
Space and water heating			4919.5650	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	404.2461	3.0700	1241.0356	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4417.0302	(272)
Primary energy kWh/m2/year			45.1178	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	648.72	(P1)
Transmission heat loss coefficient	75.07	(37)
Summer heat loss coefficient	723.79	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.6400	87.1704	0.7200	0.7000	0.8865	267.8024
East	3.2800	125.2818	0.7200	0.7000	0.8865	165.2394
South	7.4100	118.5567	0.7200	0.7000	0.8865	353.2612
total:						786.3030

	Jun	Jul	Aug	
Solar gains	843	786	711	(P3)
Internal gains	480	460	468	
Total summer gains	1322	1246	1179	(P5)
Summer gain/loss ratio	1.83	1.72	1.63	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.48	19.27	19.18	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 662 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 662 - EPC	**Prop Type Ref**	
Property	19 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	13.33	**TER**	17.61
Environmental	89 B	**% DER<TER**	24.30		
CO_2 Emissions (t/year)	0.98	**DFEE**	47.43	**TFEE**	53.40
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.18		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.61	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.33	$kgCO_2/m^2$	Pass
	-4.28 (-24.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.40	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.43	$kWh/m^2/yr$	
	-6.0 (-11.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	7.64 m², No overhang 3.28 m², No overhang 7.41 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.95 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.021	W/m²K
Air permeability	4.0	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 663 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 663 - EPC	**Prop Type Ref**	
Property	1 Kittiwake Place, Borley Green, Southampton, SO32 2ZB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.94
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.07	**DFEE**	56.29	**TFEE**	60.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.48		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Detached House, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.94 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.39 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.26 m², No overhang
Windows facing East: 2.38 m², No overhang
Windows facing South: 4.62 m², No overhang
Windows facing West: 9.23 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Thermal bridging y-value 0.022 W/m²K
Photovoltaic array 1.10 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200 (1b)	x	2.3900 (2b)	=	119.7868	(1b) - (3b)
First floor	48.0900 (1c)	x	2.6300 (2c)	=	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030	(8)
Pressure test		Yes	
Measured/design AP50		5.3900	
Infiltration rate		0.4725	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5121	0.5021	0.4920	0.4418	0.4318	0.3816	0.3816	0.3715	0.4017	0.4318	0.4519	0.4719	(22b)
Effective ac	0.6311	0.6260	0.6210	0.5976	0.5932	0.5728	0.5728	0.5690	0.5807	0.5932	0.6021	0.6114	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2898	50.8760	50.4704	48.5653	48.2089	46.5496	46.5496	46.2423	47.1887	48.2089	48.9300	49.6838	(38)
Heat transfer coeff	144.1739	143.7601	143.3545	141.4494	141.0929	139.4336	139.4336	139.1264	140.0728	141.0929	141.8140	142.5679	(39)
Average = Sum(39)m / 12 =												141.4477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4680	1.4638	1.4597	1.4403	1.4366	1.4197	1.4197	1.4166	1.4263	1.4366	1.4440	1.4517	(40)
HLP (average)												1.4403	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202	(61)
Total heat required for water heating calculated for each month													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(64)
								Total per year (kWh/year) = Sum(64)m =				1694.0565	(64)
Heat gains from water heating, kWh/month													
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5909	20.0650	16.3180	12.3538	9.2346	7.7962	8.4241	10.9500	14.6970	18.6612	21.7804	23.2188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	253.4011	256.0306	249.4043	235.2977	217.4907	200.7546	189.5739	186.9444	193.5707	207.6773	225.4843	242.2203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	418.8695	416.6870	401.5663	377.0395	351.9209	327.8448	312.2778	318.6009	331.2593	356.0119	384.4810	406.0401	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	10.6334	0.7200	0.7000	0.7700	34.3911	(74)
East	2.3800	19.6403	0.7200	0.7000	0.7700	16.3263	(76)
South	4.6200	46.7521	0.7200	0.7000	0.7700	75.4408	(78)
West	9.2300	19.6403	0.7200	0.7000	0.7700	63.3159	(80)

Solar gains	189.4742	345.0730	525.6396	731.4649	885.6065	906.5324	862.7556	744.7947	597.0897	396.3644	231.1535	159.3519	(83)
Total gains	608.3437	761.7600	927.2059	1108.5044	1237.5274	1234.3772	1175.0334	1063.3956	928.3490	752.3763	615.6345	565.3919	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3049	47.4411	47.5753	48.2161	48.3379	48.9132	48.9132	49.0212	48.6900	48.3379	48.0921	47.8378	
alpha	4.1537	4.1627	4.1717	4.2144	4.2225	4.2609	4.2609	4.2681	4.2460	4.2225	4.2061	4.1892	
util living area													
	0.9975	0.9934	0.9806	0.9370	0.8314	0.6615	0.5059	0.5724	0.8253	0.9701	0.9948	0.9982	(86)
MIT	19.3722	19.5909	19.9414	20.3888	20.7426	20.9309	20.9827	20.9714	20.8176	20.3297	19.7667	19.3405	(87)
Th 2	19.7116	19.7148	19.7179	19.7326	19.7354	19.7482	19.7482	19.7506	19.7433	19.7354	19.7298	19.7239	(88)
util rest of house													
	0.9967	0.9911	0.9734	0.9133	0.7715	0.5559	0.3700	0.4310	0.7393	0.9544	0.9926	0.9975	(89)
MIT 2	17.5726	17.8933	18.4023	19.0410	19.4972	19.7060	19.7427	19.7401	19.6044	18.9755	18.1611	17.5344	(90)
Living area fraction										fLA = Living area / (4) =		0.2097	(91)
MIT	17.9499	18.2492	18.7250	19.3236	19.7583	19.9628	20.0026	19.9983	19.8588	19.2594	18.4977	17.9130	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9499	18.2492	18.7250	19.3236	19.7583	19.9628	20.0026	19.9983	19.8588	19.2594	18.4977	17.9130	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9947	0.9870	0.9656	0.9036	0.7728	0.5754	0.3987	0.4606	0.7486	0.9461	0.9893	0.9961	(94)
Useful gains	605.1318	751.8637	895.3513	1001.6874	956.3542	710.2368	468.4565	489.7762	694.9969	711.8366	609.0171	563.1653	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1967.9562	1919.0800	1752.5079	1474.4111	1136.9669	747.7518	474.4416	500.6142	806.6481	1221.7770	1616.3527	1955.0348	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1013.9413	784.3694	637.7245	340.3611	134.3759	0.0000	0.0000	0.0000	0.0000	379.3957	725.2817	1035.5509	(98)
Space heating												5051.0004	(98)
Space heating per m2											(98) / (4) =	51.4306	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5437.0295	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1013.9413	784.3694	637.7245	340.3611	134.3759	0.0000	0.0000	0.0000	0.0000	379.3957	725.2817	1035.5509	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	1091.4331	844.3158	686.4634	366.3736	144.6458	0.0000	0.0000	0.0000	0.0000	408.3915	780.7122	1114.6942	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4188	89.3654	89.2481	88.9515	88.2762	86.7000	86.7000	86.7000	86.7000	88.9984	89.3188	89.4392	(217)
Fuel for water heating, kWh/month	193.5693	169.7690	176.2988	155.4567	151.2348	134.2702	125.8008	142.3946	143.5123	161.2736	173.8050	187.8273	(219)
Water heating fuel used												1915.2126	(219)
Annual totals kWh/year													
Space heating fuel - main system												5437.0295	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												7075.5380	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5437.0295	0.2160	1174.3984	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1915.2126	0.2160	413.6859	(264)
Space and water heating			1588.0843	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.9622	0.5190	207.0614	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total CO2, kg/year			1444.4748	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.7100	ZC1
Total Floor Area	TFA	98.2100	
Assumed number of occupants	N	2.7223	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.2897	ZC2
CO2 emissions from cooking, equation (L16)		1.8770	ZC3
Total CO2 emissions		31.8767	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.8767	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1218	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3718	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4030	0.3951	0.3872	0.3477	0.3398	0.3002	0.3002	0.2923	0.3160	0.3398	0.3556	0.3714	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.3200	1.3258	26.9394			(27)
Ground floor			50.1200	0.1300	6.5156			(28a)
External Wall	146.1800	24.5600	121.6200	0.1800	21.8916			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	2.0300		2.0300	0.1300	0.2639			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9502			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0599	(36)
Total fabric heat loss (33) + (36) =	80.0101	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2314	46.9752	46.7241	45.5445	45.3238	44.2965	44.2965	44.1062	44.6922	45.3238	45.7703	46.2370	(38)
Heat transfer coeff	127.2415	126.9853	126.7342	125.5546	125.3339	124.3065	124.3065	124.1163	124.7023	125.3339	125.7804	126.2471	(39)
Average = Sum(39)m / 12 =												125.5535	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2956	1.2930	1.2904	1.2784	1.2762	1.2657	1.2657	1.2638	1.2698	1.2762	1.2807	1.2855	(40)
HLP (average)												1.2784	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.7755	47.3530	43.8755	45.3380	47.3530	47.7755	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	212.2183	187.0659	196.4980	174.6600	169.1017	148.9354	142.6914	159.0675	160.8242	182.7063	193.1276	207.1300 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	212.2183	187.0659	196.4980	174.6600	169.1017	148.9354	142.6914	159.0675	160.8242	182.7063	193.1276	207.1300 (64)
								Total per year (kWh/year) = Sum(64)m =				2134.0265 (64)
Heat gains from water heating, kWh/month												
	66.3585	58.4022	61.1315	54.1330	52.3197	45.9013	43.7045	48.9833	49.5326	56.5457	60.1464	64.6666 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.6783	20.1427	16.3811	12.4016	9.2703	7.8264	8.4567	10.9923	14.7539	18.7335	21.8647	23.3086	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	253.4011	256.0306	249.4043	235.2977	217.4907	200.7546	189.5739	186.9444	193.5707	207.6773	225.4843	242.2203	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	89.1915	86.9080	82.1660	75.1847	70.3222	63.7518	58.7426	65.8378	68.7952	76.0023	83.5367	86.9175	(72)
Total internal gains													
	432.1058	429.9161	414.7863	389.7189	363.9181	339.1677	323.6081	330.6094	343.9547	369.2479	397.7206	419.2814	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.3800	10.6334	0.6300	0.7000	0.7700	23.9828	(74)
East	1.9000	19.6403	0.6300	0.7000	0.7700	11.4044	(76)
South	3.6900	46.7521	0.6300	0.7000	0.7700	52.7229	(78)
West	7.3500	19.6403	0.6300	0.7000	0.7700	44.1171	(80)

Solar gains	132.2271	240.7906	366.7386	510.2770	617.7612	632.3410	601.8119	519.5575	416.5661	276.5672	161.3092	111.2088	(83)
Total gains	564.3329	670.7067	781.5249	899.9959	981.6793	971.5088	925.4200	850.1669	760.5208	645.8151	559.0298	530.4902	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6000	53.7081	53.8145	54.3201	54.4158	54.8655	54.8655	54.9496	54.6914	54.4158	54.2226	54.0221	
alpha	4.5733	4.5805	4.5876	4.6213	4.6277	4.6577	4.6577	4.6633	4.6461	4.6277	4.6148	4.6015	
util living area													
	0.9983	0.9959	0.9885	0.9617	0.8850	0.7325	0.5690	0.6331	0.8696	0.9801	0.9965	0.9987	(86)
MIT	19.5453	19.7171	20.0069	20.3892	20.7225	20.9214	20.9809	20.9693	20.8137	20.3732	19.8873	19.5151	(87)
Th 2	19.8443	19.8463	19.8483	19.8578	19.8595	19.8678	19.8678	19.8693	19.8646	19.8595	19.8560	19.8522	(88)
util rest of house													
	0.9977	0.9945	0.9842	0.9464	0.8387	0.6348	0.4336	0.4958	0.7989	0.9694	0.9950	0.9983	(89)
MIT 2	17.9138	18.1660	18.5885	19.1406	19.5866	19.8156	19.8610	19.8568	19.7121	19.1278	18.4219	17.8751	(90)
Living area fraction										fLA = Living area / (4) =		0.2097	(91)
MIT	18.2559	18.4912	18.8859	19.4024	19.8248	20.0474	20.0958	20.0901	19.9431	19.3889	18.7292	18.2189	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2559	18.4912	18.8859	19.4024	19.8248	20.0474	20.0958	20.0901	19.9431	19.3889	18.7292	18.2189	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9919	0.9791	0.9385	0.8370	0.6518	0.4621	0.5244	0.8048	0.9632	0.9927	0.9973	(94)
Useful gains	562.2943	665.2759	765.1879	844.6208	821.6939	633.2632	427.6352	445.8260	612.0850	622.0610	554.9323	529.0358	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1775.7656	1725.8805	1569.7128	1318.6203	1018.3082	677.1479	434.5472	457.9977	728.6434	1101.5455	1462.7193	1769.8461	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	902.8226	712.7263	598.5665	341.2796	146.2810	0.0000	0.0000	0.0000	0.0000	356.7365	653.6066	923.1629	(98)
Space heating												4635.1820	(98)
Space heating per m2											(98) / (4) =	47.1966	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4962.7216	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	902.8226	712.7263	598.5665	341.2796	146.2810	0.0000	0.0000	0.0000	0.0000	356.7365	653.6066	923.1629	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	966.6195	763.0902	640.8635	365.3957	156.6178	0.0000	0.0000	0.0000	0.0000	381.9448	699.7930	988.3971	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	212.2183	187.0659	196.4980	174.6600	169.1017	148.9354	142.6914	159.0675	160.8242	182.7063	193.1276	207.1300	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.2865	88.0964	87.6746	86.7080	84.6886	80.3000	80.3000	80.3000	80.3000	86.7063	87.8789	88.3633	(217)
Fuel for water heating, kWh/month	240.3745	212.3424	224.1220	201.4347	199.6747	185.4737	177.6979	198.0915	200.2792	210.7186	219.7656	234.4073	(219)
Water heating fuel used												2504.3822	(219)
Annual totals kWh/year													
Space heating fuel - main system												4962.7216	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												400.5067	(232)
Total delivered energy for all uses												7942.6105	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4962.7216	0.2160	1071.9479	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2504.3822	0.2160	540.9466	(264)
Space and water heating			1612.8944	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	400.5067	0.5190	207.8630	(268)
Total CO2, kg/m2/year			1859.6824	(272)
Emissions per m2 for space and water heating			16.4229	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1165	(272b)
Emissions per m2 for pumps and fans			0.3963	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4229 * 1.00) + 2.1165 + 0.3963, rounded to 2 d.p.			18.9400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							3 * 10	=	30.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1218	(8)
Pressure test			Yes	
Measured/design AP50			5.3900	
Infiltration rate			0.3913	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3326	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4241	0.4158	0.4075	0.3659	0.3576	0.3160	0.3160	0.3077	0.3326	0.3576	0.3742	0.3908	(22b)
Effective ac	0.5899	0.5864	0.5830	0.5669	0.5639	0.5499	0.5499	0.5473	0.5553	0.5639	0.5700	0.5764	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.9416	47.6579	47.3797	46.0732	45.8287	44.6908	44.6908	44.4800	45.1291	45.8287	46.3232	46.8402	(38)
Heat transfer coeff	140.8257	140.5419	140.2637	138.9572	138.7128	137.5748	137.5748	137.3641	138.0131	138.7128	139.2073	139.7243	(39)
Average = Sum(39)m / 12 =												138.9560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4339	1.4310	1.4282	1.4149	1.4124	1.4008	1.4008	1.3987	1.4053	1.4124	1.4174	1.4227	(40)
HLP (average)												1.4149	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2676	29.9707	30.9271	26.9630	25.8716	22.3252	20.6876	23.7393	24.0229	27.9963	30.5602	33.1864 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5909	20.0650	16.3180	12.3538	9.2346	7.7962	8.4241	10.9500	14.6970	18.6612	21.7804	23.2188 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	253.4011	256.0306	249.4043	235.2977	217.4907	200.7546	189.5739	186.9444	193.5707	207.6773	225.4843	242.2203 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930 (71)

Water heating gains (Table 5)

	46.0586	44.5992	41.5686	37.4486	34.7737	31.0073	27.8059	31.9077	33.3651	37.6295	42.4447	44.6053 (72)

Total internal gains

	385.8855	384.5297	371.1258	348.9349	325.3339	303.3930	289.6388	293.6370	305.4677	327.8028	353.5442	373.8793 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	10.6334	0.7200	0.7000	0.7700	34.3911	(74)
East	2.3800	19.6403	0.7200	0.7000	0.7700	16.3263	(76)
South	4.6200	46.7521	0.7200	0.7000	0.7700	75.4408	(78)
West	9.2300	19.6403	0.7200	0.7000	0.7700	63.3159	(80)

Solar gains	189.4742	345.0730	525.6396	731.4649	885.6065	906.5324	862.7556	744.7947	597.0897	396.3644	231.1535	159.3519 (83)
Total gains	575.3597	729.6027	896.7654	1080.3998	1210.9404	1209.9254	1152.3945	1038.4317	902.5574	724.1672	584.6977	533.2312 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4296	48.5274	48.6237	49.0809	49.1673	49.5740	49.5740	49.6501	49.4166	49.1673	48.9927	48.8114	
alpha	4.2286	4.2352	4.2416	4.2721	4.2778	4.3049	4.3049	4.3100	4.2944	4.2778	4.2662	4.2541	
util living area	0.9980	0.9944	0.9824	0.9402	0.8352	0.6658	0.5091	0.5783	0.8322	0.9732	0.9958	0.9986	(86)
MIT	19.3837	19.6016	19.9507	20.3928	20.7457	20.9315	20.9830	20.9714	20.8162	20.3266	19.7665	19.3466	(87)
Th 2	19.7374	19.7396	19.7418	19.7519	19.7538	19.7627	19.7627	19.7643	19.7593	19.7538	19.7500	19.7460	(88)
util rest of house	0.9973	0.9924	0.9759	0.9176	0.7765	0.5610	0.3740	0.4374	0.7483	0.9590	0.9939	0.9981	(89)
MIT 2	18.2825	18.5010	18.8478	19.2806	19.5924	19.7339	19.7589	19.7571	19.6627	19.2288	18.6742	18.2519	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.5134	18.7317	19.0791	19.5138	19.8342	19.9850	20.0156	20.0117	19.9046	19.4589	18.9032	18.4814	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5134	18.7317	19.0791	19.5138	19.8342	19.9850	20.0156	20.0117	19.9046	19.4589	18.9032	18.4814	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9901	0.9713	0.9122	0.7808	0.5813	0.4026	0.4672	0.7599	0.9544	0.9921	0.9973	(94)
Useful gains	573.2518	722.3775	871.0351	985.5659	945.5477	703.2944	463.9936	485.1605	685.8282	691.1747	580.0905	531.8050	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2001.6052	1943.9381	1764.3860	1474.8626	1128.3191	740.8400	469.8962	496.1127	801.1061	1228.8493	1643.0859	1995.4630	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1062.6949	820.8888	664.6531	352.2937	135.9819	0.0000	0.0000	0.0000	0.0000	400.0299	765.3567	1088.9616	(98)
Space heating												5290.8606	(98)
Space heating per m2											(98) / (4) =	53.8729	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1293.2033	1018.0536	1043.9670	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8703	0.9231	0.8926	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1125.5279	939.7259	931.8616	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1518.2177	1448.7308	1317.3462	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	282.7367	378.6996	286.8005	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												948.2369 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	70.6842	94.6749	71.7001	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												237.0592 (107)
Space cooling per m2												2.4138 (108)
Energy for space heating												53.8729 (99)
Energy for space cooling												2.4138 (108)
Total												56.2867 (109)
Dwelling Fabric Energy Efficiency (DFEE)												56.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1218	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3718	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3160	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4030	0.3951	0.3872	0.3477	0.3398	0.3002	0.3002	0.2923	0.3160	0.3398	0.3556	0.3714	(22b)
Effective ac	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			20.3200	1.3258	26.9394			(27)
Ground floor			50.1200	0.1300	6.5156			(28a)
External Wall	146.1800	24.5600	121.6200	0.1800	21.8916			(29a)
Main Roof	48.0900		48.0900	0.1300	6.2517			(30)
Bay Roof	2.0300		2.0300	0.1300	0.2639			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9502			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.0599	(36)
Total fabric heat loss (33) + (36) =	80.0101	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.2314	46.9752	46.7241	45.5445	45.3238	44.2965	44.2965	44.1062	44.6922	45.3238	45.7703	46.2370	(38)
Heat transfer coeff	127.2415	126.9853	126.7342	125.5546	125.3339	124.3065	124.3065	124.1163	124.7023	125.3339	125.7804	126.2471	(39)
Average = Sum(39)m / 12 =												125.5535	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2956	1.2930	1.2904	1.2784	1.2762	1.2657	1.2657	1.2638	1.2698	1.2762	1.2807	1.2855	(40)
HLP (average)												1.2784	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	34.2676	29.9707	30.9271	26.9630	25.8716	22.3252	20.6876	23.7393	24.0229	27.9963	30.5602	33.1864 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	136.1163	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.6783	20.1427	16.3811	12.4016	9.2703	7.8264	8.4567	10.9923	14.7539	18.7335	21.8647	23.3086 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	253.4011	256.0306	249.4043	235.2977	217.4907	200.7546	189.5739	186.9444	193.5707	207.6773	225.4843	242.2203 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116	36.6116 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930 (71)

Water heating gains (Table 5)

	46.0586	44.5992	41.5686	37.4486	34.7737	31.0073	27.8059	31.9077	33.3651	37.6295	42.4447	44.6053 (72)

Total internal gains

	385.9729	384.6074	371.1890	348.9828	325.3696	303.4232	289.6714	293.6793	305.5246	327.8751	353.6286	373.9692 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.3800	10.6334	0.6300	0.7000	0.7700	23.9828	(74)
East	1.9000	19.6403	0.6300	0.7000	0.7700	11.4044	(76)
South	3.6900	46.7521	0.6300	0.7000	0.7700	52.7229	(78)
West	7.3500	19.6403	0.6300	0.7000	0.7700	44.1171	(80)

Solar gains	132.2271	240.7906	366.7386	510.2770	617.7612	632.3410	601.8119	519.5575	416.5661	276.5672	161.3092	111.2088 (83)
Total gains	518.2001	625.3980	737.9275	859.2598	943.1308	935.7642	891.4833	813.2368	722.0906	604.4423	514.9377	485.1780 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.6000	53.7081	53.8145	54.3201	54.4158	54.8655	54.8655	54.9496	54.6914	54.4158	54.2226	54.0221	
alpha	4.5733	4.5805	4.5876	4.6213	4.6277	4.6577	4.6577	4.6633	4.6461	4.6277	4.6148	4.6015	
util living area	0.9988	0.9969	0.9908	0.9675	0.8971	0.7506	0.5875	0.6556	0.8867	0.9845	0.9975	0.9991	(86)
MIT	19.5026	19.6756	19.9683	20.3572	20.7013	20.9128	20.9783	20.9646	20.7939	20.3378	19.8467	19.4730	(87)
Th 2	19.8443	19.8463	19.8483	19.8578	19.8595	19.8678	19.8678	19.8693	19.8646	19.8595	19.8560	19.8522	(88)
util rest of house	0.9984	0.9958	0.9873	0.9541	0.8539	0.6538	0.4492	0.5163	0.8210	0.9760	0.9964	0.9988	(89)
MIT 2	18.4837	18.6579	18.9503	19.3383	19.6564	19.8275	19.8624	19.8593	19.7467	19.3261	18.8366	18.4603	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.6973	18.8712	19.1637	19.5519	19.8755	20.0551	20.0963	20.0910	19.9662	19.5382	19.0484	18.6727	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6973	18.8712	19.1637	19.5519	19.8755	20.0551	20.0963	20.0910	19.9662	19.5382	19.0484	18.6727	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9945	0.9845	0.9495	0.8546	0.6715	0.4786	0.5457	0.8282	0.9727	0.9953	0.9984	(94)
Useful gains	517.0455	621.9745	726.4933	815.8883	806.0071	628.4075	426.6373	443.7904	598.0281	587.9165	512.5170	484.3795	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1831.9375	1774.1427	1604.9273	1337.3931	1024.6618	678.0988	434.6187	458.1123	731.5341	1120.2631	1502.8706	1827.1305	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	978.2796	774.2570	653.5549	375.4835	162.6791	0.0000	0.0000	0.0000	0.0000	396.0659	713.0546	999.0067	(98)
Space heating												5052.3814	(98)
Space heating per m2											(98) / (4) =	51.4447	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1168.4815	919.8684	943.2838	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8333	0.8998	0.8659	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	973.6923	827.7372	816.7851	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1197.8098	1143.8131	1054.1879	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	161.3646	235.1605	176.6277	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												573.1527 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	40.3411	58.7901	44.1569	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.2882 (107)
Space cooling per m2												1.4590 (108)
Energy for space heating												51.4447 (99)
Energy for space cooling												1.4590 (108)
Total												52.9037 (109)
Target Fabric Energy Efficiency (TFEE)												60.8 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030	(8)
Pressure test		Yes	
Measured/design AP50		5.3900	
Infiltration rate		0.4725	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4217	0.3916	0.4017	0.3816	0.3816	0.3715	0.3615	0.3514	0.3414	0.3715	0.3514	0.3715	(22b)
Effective ac	0.5889	0.5767	0.5807	0.5728	0.5728	0.5690	0.5653	0.5618	0.5583	0.5690	0.5618	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.8606	46.8651	47.1887	46.5496	46.5496	46.2423	45.9432	45.6523	45.3696	46.2423	45.6523	46.2423	(38)
Heat transfer coeff	140.7447	139.7491	140.0728	139.4336	139.4336	139.1264	138.8273	138.5364	138.2537	139.1264	138.5364	139.1264	(39)
Average = Sum(39)m / 12 =												139.2472	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4331	1.4230	1.4263	1.4197	1.4197	1.4166	1.4136	1.4106	1.4077	1.4166	1.4106	1.4166	(40)
HLP (average)												1.4179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202 (61)
Total heat required for water heating calculated for each month												
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913 (64)
								Total per year (kWh/year) = Sum(64)m =				1694.0565 (64)
RHI water heating demand												1694 (64)
Heat gains from water heating, kWh/month												
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.4772	50.1626	40.7949	30.8844	23.0864	19.4906	21.0602	27.3749	36.7425	46.6531	54.4510	58.0469	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	378.2106	382.1352	372.2452	351.1906	324.6130	299.6338	282.9462	279.0215	288.9115	309.9661	336.5437	361.5229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	622.2332	617.5571	593.5521	556.1310	517.5630	483.0862	462.9541	471.7708	493.3135	530.9605	572.8790	604.8387	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	13.4839	0.7200	0.7000	0.7700	43.6104	(74)
East	2.3800	25.1925	0.7200	0.7000	0.7700	20.9417	(76)
South	4.6200	56.7559	0.7200	0.7000	0.7700	91.5833	(78)
West	9.2300	25.1925	0.7200	0.7000	0.7700	81.2152	(80)

Solar gains	237.3507	368.9552	568.9527	799.6018	921.7327	1025.3202	968.0167	855.3503	683.7403	457.9583	288.8505	196.0785 (83)
Total gains	859.5839	986.5123	1162.5048	1355.7327	1439.2956	1508.4064	1430.9708	1327.1211	1177.0538	988.9188	861.7295	800.9172 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4575	48.8027	48.6900	48.9132	48.9132	49.0212	49.1268	49.2299	49.3306	49.0212	49.2299	49.0212	
alpha	4.2305	4.2535	4.2460	4.2609	4.2609	4.2681	4.2751	4.2820	4.2887	4.2681	4.2820	4.2681	
util living area													
	0.9897	0.9814	0.9527	0.8711	0.7242	0.5091	0.3747	0.4019	0.6736	0.9094	0.9779	0.9918	(86)
MIT	19.7129	19.8832	20.2230	20.6149	20.8698	20.9772	20.9952	20.9937	20.9286	20.6021	20.1125	19.6943	(87)
Th 2	19.7380	19.7458	19.7433	19.7482	19.7482	19.7506	19.7529	19.7552	19.7574	19.7506	19.7552	19.7506	(88)
util rest of house													
	0.9861	0.9751	0.9369	0.8306	0.6473	0.4050	0.2568	0.2763	0.5664	0.8692	0.9689	0.9889	(89)
MIT 2	18.0855	18.3357	18.8153	19.3439	19.6427	19.7396	19.7518	19.7537	19.7140	19.3469	18.6756	18.0674	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9676	0.9266	0.8254	0.6574	0.4264	0.2816	0.3029	0.5861	0.8636	0.9611	0.9844	(94)
Useful gains	843.0126	954.5439	1077.2344	1119.0049	946.2101	643.1886	403.0269	401.9325	689.9141	854.0487	828.2100	788.3914	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1903.8081	1867.0638	1696.3449	1409.7218	1031.8058	653.7641	404.3346	403.6542	728.4057	1142.2414	1534.5453	1865.4727	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	789.2319	613.2134	460.6182	209.3162	63.6832	0.0000	0.0000	0.0000	0.0000	214.4154	508.5613	801.3485	(98)
Space heating												3660.3879	(98)
RHI space heating demand												3660	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							5 * 10 =	50.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030 (8)
Pressure test		Yes
Measured/design AP50		5.3900
Infiltration rate		0.4725 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5121	0.5021	0.4920	0.4418	0.4318	0.3816	0.3816	0.3715	0.4017	0.4318	0.4519	0.4719	(22b)
Effective ac	0.6311	0.6260	0.6210	0.5976	0.5932	0.5728	0.5728	0.5690	0.5807	0.5932	0.6021	0.6114	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2898	50.8760	50.4704	48.5653	48.2089	46.5496	46.5496	46.2423	47.1887	48.2089	48.9300	49.6838	(38)
Heat transfer coeff	144.1739	143.7601	143.3545	141.4494	141.0929	139.4336	139.4336	139.1264	140.0728	141.0929	141.8140	142.5679	(39)
Average = Sum(39)m / 12 =												141.4477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4680	1.4638	1.4597	1.4403	1.4366	1.4197	1.4197	1.4166	1.4263	1.4366	1.4440	1.4517	(40)
HLP (average)												1.4403	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202 (61)
Total heat required for water heating calculated for each month												
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913 (64)
								Total per year (kWh/year) = Sum(64)m =				1694.0565 (64)
Heat gains from water heating, kWh/month												
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.4772	50.1626	40.7949	30.8844	23.0864	19.4906	21.0602	27.3749	36.7425	46.6531	54.4510	58.0469	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	378.2106	382.1352	372.2452	351.1906	324.6130	299.6338	282.9462	279.0215	288.9115	309.9661	336.5437	361.5229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	622.2332	617.5571	593.5521	556.1310	517.5630	483.0862	462.9541	471.7708	493.3135	530.9605	572.8790	604.8387	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	10.6334	0.7200	0.7000	0.7700	34.3911	(74)
East	2.3800	19.6403	0.7200	0.7000	0.7700	16.3263	(76)
South	4.6200	46.7521	0.7200	0.7000	0.7700	75.4408	(78)
West	9.2300	19.6403	0.7200	0.7000	0.7700	63.3159	(80)

Solar gains	189.4742	345.0730	525.6396	731.4649	885.6065	906.5324	862.7556	744.7947	597.0897	396.3644	231.1535	159.3519	(83)
Total gains	811.7074	962.6300	1119.1917	1287.5959	1403.1695	1389.6186	1325.7097	1216.5656	1090.4032	927.3249	804.0325	764.1905	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3049	47.4411	47.5753	48.2161	48.3379	48.9132	48.9132	49.0212	48.6900	48.3379	48.0921	47.8378	
alpha	4.1537	4.1627	4.1717	4.2144	4.2225	4.2609	4.2609	4.2681	4.2460	4.2225	4.2061	4.1892	
util living area													
	0.9927	0.9847	0.9636	0.9035	0.7805	0.6036	0.4533	0.5094	0.7577	0.9417	0.9862	0.9943	(86)
MIT	19.5520	19.7638	20.0947	20.5021	20.8028	20.9512	20.9885	20.9815	20.8722	20.4601	19.9305	19.5176	(87)
Th 2	19.7116	19.7148	19.7179	19.7326	19.7354	19.7482	19.7482	19.7506	19.7433	19.7354	19.7298	19.7239	(88)
util rest of house													
	0.9903	0.9796	0.9513	0.8714	0.7141	0.5011	0.3291	0.3792	0.6625	0.9149	0.9807	0.9924	(89)
MIT 2	17.8341	18.1424	18.6172	19.1868	19.5600	19.7196	19.7447	19.7442	19.6525	19.1490	18.3970	17.7924	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.1942	18.4823	18.9270	19.4625	19.8205	19.9778	20.0055	20.0036	19.9082	19.4238	18.7185	18.1541	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1942	18.4823	18.9270	19.4625	19.8205	19.9778	20.0055	20.0036	19.9082	19.4238	18.7185	18.1541	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9859	0.9726	0.9412	0.8631	0.7191	0.5209	0.3553	0.4065	0.6765	0.9063	0.9743	0.9887	(94)
Useful gains	800.2696	936.2489	1053.4037	1111.3813	1008.9677	723.9154	470.9809	494.5877	737.6810	840.4665	783.4055	755.5799	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2003.1861	1952.5923	1781.4614	1494.0650	1145.7503	749.8427	474.8355	501.3542	813.5714	1244.9813	1647.6645	1989.4045	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	894.9699	682.9828	541.6749	275.5323	101.7663	0.0000	0.0000	0.0000	0.0000	300.9590	622.2665	917.9655	(98)
Space heating												4338.1171	(98)
Space heating per m2											(98) / (4) =	44.1718	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4669.6632	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	894.9699	682.9828	541.6749	275.5323	101.7663	0.0000	0.0000	0.0000	0.0000	300.9590	622.2665	917.9655	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	963.3691	735.1806	583.0731	296.5902	109.5439	0.0000	0.0000	0.0000	0.0000	323.9602	669.8240	988.1222	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3655	89.3009	89.1593	88.8047	88.0558	86.7000	86.7000	86.7000	86.7000	88.8412	89.2423	89.3896	(217)
Fuel for water heating, kWh/month													
	193.6847	169.8916	176.4745	155.7137	151.6134	134.2702	125.8008	142.3946	143.5123	161.5590	173.9538	187.9316	(219)
Water heating fuel used												1916.8004	(219)
Annual totals kWh/year													
Space heating fuel - main system												4669.6632	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) =										-750.6663		-750.6663	(233)
Total delivered energy for all uses												6309.7594	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4669.6632	3.4800	162.5043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1916.8004	3.4800	66.7047	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	398.9622	13.1900	52.6231	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			312.7117	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9171	(257)
SAP value		87.2064	
SAP rating (Section 12)		87	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4669.6632	0.2160	1008.6472	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.8004	0.2160	414.0289	(264)
Space and water heating			1422.6761	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.9622	0.5190	207.0614	(268)
Energy saving/generation technologies				
PV Unit	-750.6663	0.5190	-389.5958	(269)
Total kg/year			1279.0667	(272)
CO2 emissions per m2			13.0200	(273)
EI value			88.0319	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8825 = 3.943, stars = 4
Water heating environmental impact	0.216 / 0.8825 = 0.2448, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030	(8)
Pressure test		Yes	
Measured/design AP50		5.3900	
Infiltration rate		0.4725	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4217	0.3916	0.4017	0.3816	0.3816	0.3715	0.3615	0.3514	0.3414	0.3715	0.3514	0.3715	(22b)
Effective ac	0.5889	0.5767	0.5807	0.5728	0.5728	0.5690	0.5653	0.5618	0.5583	0.5690	0.5618	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.8606	46.8651	47.1887	46.5496	46.5496	46.2423	45.9432	45.6523	45.3696	46.2423	45.6523	46.2423	(38)
Heat transfer coeff	140.7447	139.7491	140.0728	139.4336	139.4336	139.1264	138.8273	138.5364	138.2537	139.1264	138.5364	139.1264	(39)
Average = Sum(39)m / 12 =												139.2472	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4331	1.4230	1.4263	1.4197	1.4197	1.4166	1.4136	1.4106	1.4077	1.4166	1.4106	1.4166	(40)
HLP (average)												1.4179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202	(61)
Total heat required for water heating calculated for each month													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(64)
								Total per year (kWh/year) = Sum(64)m =				1694.0565	(64)
Heat gains from water heating, kWh/month													
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.4772	50.1626	40.7949	30.8844	23.0864	19.4906	21.0602	27.3749	36.7425	46.6531	54.4510	58.0469	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	378.2106	382.1352	372.2452	351.1906	324.6130	299.6338	282.9462	279.0215	288.9115	309.9661	336.5437	361.5229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	622.2332	617.5571	593.5521	556.1310	517.5630	483.0862	462.9541	471.7708	493.3135	530.9605	572.8790	604.8387	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	13.4839	0.7200	0.7000	0.7700	43.6104	(74)
East	2.3800	25.1925	0.7200	0.7000	0.7700	20.9417	(76)
South	4.6200	56.7559	0.7200	0.7000	0.7700	91.5833	(78)
West	9.2300	25.1925	0.7200	0.7000	0.7700	81.2152	(80)

Solar gains	237.3507	368.9552	568.9527	799.6018	921.7327	1025.3202	968.0167	855.3503	683.7403	457.9583	288.8505	196.0785	(83)
Total gains	859.5839	986.5123	1162.5048	1355.7327	1439.2956	1508.4064	1430.9708	1327.1211	1177.0538	988.9188	861.7295	800.9172	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4575	48.8027	48.6900	48.9132	48.9132	49.0212	49.1268	49.2299	49.3306	49.0212	49.2299	49.0212	
alpha	4.2305	4.2535	4.2460	4.2609	4.2609	4.2681	4.2751	4.2820	4.2887	4.2681	4.2820	4.2681	
util living area													
	0.9897	0.9814	0.9527	0.8711	0.7242	0.5091	0.3747	0.4019	0.6736	0.9094	0.9779	0.9918	(86)
MIT	19.7129	19.8832	20.2230	20.6149	20.8698	20.9772	20.9952	20.9937	20.9286	20.6021	20.1125	19.6943	(87)
Th 2	19.7380	19.7458	19.7433	19.7482	19.7482	19.7506	19.7529	19.7552	19.7574	19.7506	19.7552	19.7506	(88)
util rest of house													
	0.9861	0.9751	0.9369	0.8306	0.6473	0.4050	0.2568	0.2763	0.5664	0.8692	0.9689	0.9889	(89)
MIT 2	18.0855	18.3357	18.8153	19.3439	19.6427	19.7396	19.7518	19.7537	19.7140	19.3469	18.6756	18.0674	(90)
Living area fraction										fLA = Living area / (4) =		0.2097	(91)
MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9676	0.9266	0.8254	0.6574	0.4264	0.2816	0.3029	0.5861	0.8636	0.9611	0.9844	(94)
Useful gains	843.0126	954.5439	1077.2344	1119.0049	946.2101	643.1886	403.0269	401.9325	689.9141	854.0487	828.2100	788.3914	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1903.8081	1867.0638	1696.3449	1409.7218	1031.8058	653.7641	404.3346	403.6542	728.4057	1142.2414	1534.5453	1865.4727	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	789.2319	613.2134	460.6182	209.3162	63.6832	0.0000	0.0000	0.0000	0.0000	214.4154	508.5613	801.3485	(98)
Space heating												3660.3879	(98)
Space heating per m2											(98) / (4) =	37.2710	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3940.1377	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	789.2319	613.2134	460.6182	209.3162	63.6832	0.0000	0.0000	0.0000	0.0000	214.4154	508.5613	801.3485	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	849.5499	660.0790	495.8215	225.3134	68.5502	0.0000	0.0000	0.0000	0.0000	230.8023	547.4288	862.5925	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3071	89.2467	89.0630	88.5991	87.7083	86.7000	86.7000	86.7000	86.7000	88.5889	89.1306	89.3286	(217)
Fuel for water heating, kWh/month													
	193.8112	169.9949	176.6652	156.0751	152.2141	134.2702	125.8008	142.3946	143.5123	162.0191	174.1718	188.0599	(219)
Water heating fuel used												1918.9894	(219)
Annual totals kWh/year													
Space heating fuel - main system												3940.1377	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												5482.3142	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3940.1377	7.3800	290.7822	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1918.9894	7.3800	141.6214	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	398.9622	28.6600	114.3426	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			431.4090	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3940.1377	0.2160	851.0697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1918.9894	0.2160	414.5017	(264)
Space and water heating			1265.5715	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.9622	0.5190	207.0614	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			1070.0055	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3940.1377	1.2200	4806.9680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1918.9894	1.2200	2341.1671	(264)
Space and water heating			7148.1351	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	398.9622	3.0700	1224.8139	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			5991.3193	(272)
Primary energy kWh/m2/year			61.0052	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 60	-193 kg (18.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£60	1.96 kg/m²	B 88	B 90
Total Savings	£60	1.96 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£136	£150	-£14
Mains gas	£539	£465	£75
Space heating	£419	£419	£0
Water heating	£142	£81	£60
Lighting	£114	£114	£0
Generated (PV)	-£244	-£244	£0
Total cost of fuels	£431	£371	£61
Total cost of uses	£431	£370	£60
Delivered energy	56 kWh/m²	46 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	50 kWh/m²	11 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030	(8)
Pressure test		Yes	
Measured/design AP50		5.3900	
Infiltration rate		0.4725	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5121	0.5021	0.4920	0.4418	0.4318	0.3816	0.3816	0.3715	0.4017	0.4318	0.4519	0.4719	(22b)
Effective ac	0.6311	0.6260	0.6210	0.5976	0.5932	0.5728	0.5728	0.5690	0.5807	0.5932	0.6021	0.6114	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	51.2898	50.8760	50.4704	48.5653	48.2089	46.5496	46.5496	46.2423	47.1887	48.2089	48.9300	49.6838	(38)
Heat transfer coeff	144.1739	143.7601	143.3545	141.4494	141.0929	139.4336	139.4336	139.1264	140.0728	141.0929	141.8140	142.5679	(39)
Average = Sum(39)m / 12 =												141.4477	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4680	1.4638	1.4597	1.4403	1.4366	1.4197	1.4197	1.4166	1.4263	1.4366	1.4440	1.4517	(40)
HLP (average)												1.4403	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202	(61)
Total heat required for water heating calculated for each month													
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1660	(H8)
Utilisation factor												0.5758	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												98.8552	(H14)
Volume ratio Veff/V												0.7587	(H15)
Solar storage volume factor												0.9448	(H16)
Solar input												-867.5480	(H17)
Solar input	-25.1572	-41.9801	-71.4969	-95.8199	-118.3774	-116.3839	-114.8458	-100.3413	-78.5874	-53.6659	-29.8400	-21.0523	(63)
								Solar input (sum of months) = Sum(63)m =				-867.5480	(63)
Output from w/h													
	147.9301	109.7347	85.8465	42.4612	15.1270	0.0284	0.0000	23.1148	45.8378	89.8650	125.4005	146.9391	(64)
								Total per year (kWh/year) = Sum(64)m =				832.2850	(64)
Heat gains from water heating, kWh/month													
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.4772	50.1626	40.7949	30.8844	23.0864	19.4906	21.0602	27.3749	36.7425	46.6531	54.4510	58.0469	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	378.2106	382.1352	372.2452	351.1906	324.6130	299.6338	282.9462	279.0215	288.9115	309.9661	336.5437	361.5229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	622.2332	617.5571	593.5521	556.1310	517.5630	483.0862	462.9541	471.7708	493.3135	530.9605	572.8790	604.8387	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	10.6334	0.7200	0.7000	0.7700	34.3911	(74)
East	2.3800	19.6403	0.7200	0.7000	0.7700	16.3263	(76)
South	4.6200	46.7521	0.7200	0.7000	0.7700	75.4408	(78)
West	9.2300	19.6403	0.7200	0.7000	0.7700	63.3159	(80)

Solar gains	189.4742	345.0730	525.6396	731.4649	885.6065	906.5324	862.7556	744.7947	597.0897	396.3644	231.1535	159.3519	(83)
Total gains	811.7074	962.6300	1119.1917	1287.5959	1403.1695	1389.6186	1325.7097	1216.5656	1090.4032	927.3249	804.0325	764.1905	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.3049	47.4411	47.5753	48.2161	48.3379	48.9132	48.9132	49.0212	48.6900	48.3379	48.0921	47.8378	
alpha	4.1537	4.1627	4.1717	4.2144	4.2225	4.2609	4.2609	4.2681	4.2460	4.2225	4.2061	4.1892	
util living area													
	0.9927	0.9847	0.9636	0.9035	0.7805	0.6036	0.4533	0.5094	0.7577	0.9417	0.9862	0.9943	(86)
MIT	19.5520	19.7638	20.0947	20.5021	20.8028	20.9512	20.9885	20.9815	20.8722	20.4601	19.9305	19.5176	(87)
Th 2	19.7116	19.7148	19.7179	19.7326	19.7354	19.7482	19.7482	19.7506	19.7433	19.7354	19.7298	19.7239	(88)
util rest of house													
	0.9903	0.9796	0.9513	0.8714	0.7141	0.5011	0.3291	0.3792	0.6625	0.9149	0.9807	0.9924	(89)
MIT 2	17.8341	18.1424	18.6172	19.1868	19.5600	19.7196	19.7447	19.7442	19.6525	19.1490	18.3970	17.7924	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.1942	18.4823	18.9270	19.4625	19.8205	19.9778	20.0055	20.0036	19.9082	19.4238	18.7185	18.1541	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1942	18.4823	18.9270	19.4625	19.8205	19.9778	20.0055	20.0036	19.9082	19.4238	18.7185	18.1541	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Utilisation	0.9859	0.9726	0.9412	0.8631	0.7191	0.5209	0.3553	0.4065	0.6765	0.9063	0.9743	0.9887	(94)
Useful gains	800.2696	936.2489	1053.4037	1111.3813	1008.9677	723.9154	470.9809	494.5877	737.6810	840.4665	783.4055	755.5799	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2003.1861	1952.5923	1781.4614	1494.0650	1145.7503	749.8427	474.8355	501.3542	813.5714	1244.9813	1647.6645	1989.4045	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	894.9699	682.9828	541.6749	275.5323	101.7663	0.0000	0.0000	0.0000	0.0000	300.9590	622.2665	917.9655	(98)

Space heating 4338.1171 (98)
Space heating per m2 (98) / (4) = 44.1718 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4669.6632 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	894.9699	682.9828	541.6749	275.5323	101.7663	0.0000	0.0000	0.0000	0.0000	300.9590	622.2665	917.9655	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	963.3691	735.1806	583.0731	296.5902	109.5439	0.0000	0.0000	0.0000	0.0000	323.9602	669.8240	988.1222	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	147.9301	109.7347	85.8465	42.4612	15.1270	0.0284	0.0000	23.1148	45.8378	89.8650	125.4005	146.9391	(64)

Efficiency of water heater 86.7000 (216)

(217)m	89.4318	89.4430	89.4484	89.4591	89.4727	86.7000	86.7000	86.7000	86.7000	89.1435	89.3469	89.4445	(217)

Fuel for water heating, kWh/month

	165.4111	122.6867	95.9732	47.4644	16.9068	0.0328	0.0000	26.6607	52.8694	100.8094	140.3523	164.2797	(219)

Water heating fuel used 933.4465 (219)
Annual totals kWh/year
Space heating fuel - main system 4669.6632 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 398.9622 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 1.10 * 853 * 1.00) = -750.6663 -750.6663 (233)
Total delivered energy for all uses 5376.4055 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4669.6632	3.4800	162.5043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	933.4465	3.4800	32.4839	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	398.9622	13.1900	52.6231	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-750.6663	13.1900	-99.0129	(252)
Total energy cost			285.0859	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8361 (257)
SAP value 88.3366
SAP rating (Section 12) 88 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4669.6632	0.2160	1008.6472	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	933.4465	0.2160	201.6244	(264)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space and water heating			1210.2717 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	398.9622	0.5190	207.0614 (268)
Energy saving/generation technologies			
PV Unit	-750.6663	0.5190	-389.5958 (269)
Total kg/year			1092.6122 (272)
CO2 emissions per m2			11.1300 (273)
EI value			89.7765
EI rating			90 (274)
EI band			B

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.1200	(1b)	x 2.3900	(2b) =	119.7868	(1b) - (3b)
First floor	48.0900	(1c)	x 2.6300	(2c) =	126.4767	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	98.2100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	246.2635	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000 / (5) =	0.2030	(8)
Pressure test		Yes	
Measured/design AP50		5.3900	
Infiltration rate		0.4725	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4017	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.4217	0.3916	0.4017	0.3816	0.3816	0.3715	0.3615	0.3514	0.3414	0.3715	0.3514	0.3715	(22b)
Effective ac	0.5889	0.5767	0.5807	0.5728	0.5728	0.5690	0.5653	0.5618	0.5583	0.5690	0.5618	0.5690	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			25.4900	1.2357	31.4990			(27)
Opening Type 14			4.2400	1.5000	6.3600			(26a)
Ground floor			50.1200	0.2000	10.0240			(28a)
External Wall	146.1800	29.7300	116.4500	0.2700	31.4415			(29a)
Main Roof	48.0900		48.0900	0.1600	7.6944			(30)
Bay Roof	2.0300		2.0300	0.1600	0.3248			(30)
Total net area of external elements Aum(A, m2)			246.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	87.3437			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5403	(36)
Total fabric heat loss (33) + (36) =	92.8841	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.8606	46.8651	47.1887	46.5496	46.5496	46.2423	45.9432	45.6523	45.3696	46.2423	45.6523	46.2423	(38)
Heat transfer coeff	140.7447	139.7491	140.0728	139.4336	139.4336	139.1264	138.8273	138.5364	138.2537	139.1264	138.5364	139.1264	(39)
Average = Sum(39)m / 12 =												139.2472	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4331	1.4230	1.4263	1.4197	1.4197	1.4166	1.4136	1.4106	1.4077	1.4166	1.4106	1.4166	(40)
HLP (average)												1.4179	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7223 (42)
Average daily hot water use (litres/day)	98.8552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.7408	104.7866	100.8323	96.8781	92.9239	88.9697	88.9697	92.9239	96.8781	100.8323	104.7866	108.7408	(44)
Energy conte	161.2594	141.0385	145.5391	126.8845	121.7487	105.0599	97.3534	111.7145	113.0487	131.7474	143.8126	156.1711	(45)
Energy content (annual)										Total = Sum(45)m =		1555.3779	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1889	21.1558	21.8309	19.0327	18.2623	15.7590	14.6030	16.7572	16.9573	19.7621	21.5719	23.4257	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8278	10.6763	11.8042	11.3966	11.7556	11.3524	11.7159	11.7417	11.3765	11.7836	11.4279	11.8202 (61)
Total heat required for water heating calculated for each month												
	173.0872	151.7148	157.3434	138.2811	133.5044	116.4123	109.0693	123.4561	124.4252	143.5309	155.2405	167.9913 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.3050 (H8)
Utilisation factor	0.5353 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	98.8552 (H14)
Volume ratio Veff/V	0.7587 (H15)
Solar storage volume factor	0.9448 (H16)
Solar input	-902.5401 (H17)

Solar input	-29.4430	-41.8661	-71.9578	-97.0878	-114.0354	-121.8078	-119.2462	-106.7290	-83.5614	-57.7715	-34.8234	-24.2107 (63)
								Solar input (sum of months) = Sum(63)m =				-902.5401 (63)
Output from w/h												
	143.6442	109.8487	85.3855	41.1933	19.4689	0.0000	0.0000	16.7272	40.8638	85.7594	120.4171	143.7806 (64)
								Total per year (kWh/year) = Sum(64)m =				807.0888 (64)
Heat gains from water heating, kWh/month												
	56.5757	49.5644	51.3428	45.0383	43.4204	37.7705	35.2990	40.0805	40.4328	46.7519	50.6747	54.8820 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	163.3396	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	56.4772	50.1626	40.7949	30.8844	23.0864	19.4906	21.0602	27.3749	36.7425	46.6531	54.4510	58.0469	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	378.2106	382.1352	372.2452	351.1906	324.6130	299.6338	282.9462	279.0215	288.9115	309.9661	336.5437	361.5229	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	54.0563	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	-108.8930	(71)
Water heating gains (Table 5)													
	76.0426	73.7565	69.0092	62.5531	58.3607	52.4590	47.4449	53.8716	56.1567	62.8386	70.3815	73.7661	(72)
Total internal gains													
	622.2332	617.5571	593.5521	556.1310	517.5630	483.0862	462.9541	471.7708	493.3135	530.9605	572.8790	604.8387	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.2600	13.4839	0.7200	0.7000	0.7700	43.6104	(74)
East	2.3800	25.1925	0.7200	0.7000	0.7700	20.9417	(76)
South	4.6200	56.7559	0.7200	0.7000	0.7700	91.5833	(78)
West	9.2300	25.1925	0.7200	0.7000	0.7700	81.2152	(80)

Solar gains	237.3507	368.9552	568.9527	799.6018	921.7327	1025.3202	968.0167	855.3503	683.7403	457.9583	288.8505	196.0785 (83)
Total gains	859.5839	986.5123	1162.5048	1355.7327	1439.2956	1508.4064	1430.9708	1327.1211	1177.0538	988.9188	861.7295	800.9172 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.4575	48.8027	48.6900	48.9132	48.9132	49.0212	49.1268	49.2299	49.3306	49.0212	49.2299	49.0212	
alpha	4.2305	4.2535	4.2460	4.2609	4.2609	4.2681	4.2751	4.2820	4.2887	4.2681	4.2820	4.2681	
util living area													
	0.9897	0.9814	0.9527	0.8711	0.7242	0.5091	0.3747	0.4019	0.6736	0.9094	0.9779	0.9918	(86)
MIT	19.7129	19.8832	20.2230	20.6149	20.8698	20.9772	20.9952	20.9937	20.9286	20.6021	20.1125	19.6943	(87)
Th 2	19.7380	19.7458	19.7433	19.7482	19.7482	19.7506	19.7529	19.7552	19.7574	19.7506	19.7552	19.7506	(88)
util rest of house													
	0.9861	0.9751	0.9369	0.8306	0.6473	0.4050	0.2568	0.2763	0.5664	0.8692	0.9689	0.9889	(89)
MIT 2	18.0855	18.3357	18.8153	19.3439	19.6427	19.7396	19.7518	19.7537	19.7140	19.3469	18.6756	18.0674	(90)
Living area fraction									fLA = Living area / (4) =			0.2097	(91)
MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4267	18.6601	19.1105	19.6103	19.9000	19.9991	20.0125	20.0137	19.9686	19.6101	18.9768	18.4085	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Utilisation	0.9807	0.9676	0.9266	0.8254	0.6574	0.4264	0.2816	0.3029	0.5861	0.8636	0.9611	0.9844	(94)
Useful gains	843.0126	954.5439	1077.2344	1119.0049	946.2101	643.1886	403.0269	401.9325	689.9141	854.0487	828.2100	788.3914	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1903.8081	1867.0638	1696.3449	1409.7218	1031.8058	653.7641	404.3346	403.6542	728.4057	1142.2414	1534.5453	1865.4727	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	789.2319	613.2134	460.6182	209.3162	63.6832	0.0000	0.0000	0.0000	0.0000	214.4154	508.5613	801.3485	(98)
Space heating												3660.3879	(98)
Space heating per m2											(98) / (4) =	37.2710	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3940.1377	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	789.2319	613.2134	460.6182	209.3162	63.6832	0.0000	0.0000	0.0000	0.0000	214.4154	508.5613	801.3485	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	849.5499	660.0790	495.8215	225.3134	68.5502	0.0000	0.0000	0.0000	0.0000	230.8023	547.4288	862.5925	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	143.6442	109.8487	85.3855	41.1933	19.4689	0.0000	0.0000	16.7272	40.8638	85.7594	120.4171	143.7806	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3920	89.3987	89.3841	89.3577	89.1298	86.7000	86.7000	86.7000	86.7000	88.9619	89.2692	89.3980	(217)
Fuel for water heating, kWh/month	160.6903	122.8750	95.5266	46.0994	21.8434	0.0000	0.0000	19.2932	47.1324	96.4002	134.8921	160.8319	(219)
Water heating fuel used												905.5844	(219)
Annual totals kWh/year													
Space heating fuel - main system												3940.1377	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.9622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 967 * 1.00) =										-850.7751		-850.7751	(233)
Total delivered energy for all uses												4518.9091	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3940.1377	7.3800	290.7822	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	905.5844	7.3800	66.8321	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	398.9622	28.6600	114.3426	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-850.7751	28.6600	-243.8322	(252)
Total energy cost			370.9497	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3940.1377	0.2160	851.0697	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.5844	0.2160	195.6062	(264)
Space and water heating			1046.6760	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	398.9622	0.5190	207.0614	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	0.5190	-441.5523	(269)
Total kg/year			877.0601	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3940.1377	1.2200	4806.9680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	905.5844	1.2200	1104.8130	(264)
Space and water heating			5911.7810	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	398.9622	3.0700	1224.8139	(268)
Energy saving/generation technologies				
PV Unit	-850.7751	3.0700	-2611.8796	(269)
Primary energy kWh/year			4908.4652	(272)
Primary energy kWh/m2/year			49.9793	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		650.14 (P1)
Transmission heat loss coefficient		92.88 (37)
Summer heat loss coefficient		743.02 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.985	0.90	1.000	0.887	(P8)
East	0.985	0.90	1.000	0.887	(P8)
South	0.985	0.90	1.000	0.887	(P8)
West	0.985	0.90	1.000	0.887	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.2600	87.1704	0.7200	0.7000	0.8865	324.5877
East	2.3800	125.2818	0.7200	0.7000	0.8865	119.8993
South	4.6200	118.5567	0.7200	0.7000	0.8865	220.2519
West	9.2300	125.2818	0.7200	0.7000	0.8865	464.9877
total:						1129.7266

	Jun	Jul	Aug	
Solar gains	1216	1130	995	(P3)
Internal gains	480	460	469	
Total summer gains	1696	1590	1464	(P5)
Summer gain/loss ratio	2.28	2.14	1.97	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.93	19.69	19.52	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 663 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 663 - EPC	**Prop Type Ref**	
Property	1 Kittiwake Place, Borley Green, Southampton, SO32 2ZB		

SAP Rating	87 B	**DER**	14.71	**TER**	18.94
Environmental	88 B	**% DER<TER**	22.32		
CO_2 Emissions (t/year)	1.07	**DFEE**	56.29	**TFEE**	60.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.48		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.94	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.71	$kgCO_2/m^2$	Pass
	-4.23 (-22.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	60.84	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	56.29	$kWh/m^2/yr$	
	-4.5 (-7.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.39 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	9.26 m², No overhang
Windows facing East	2.38 m², No overhang
Windows facing South	4.62 m², No overhang
Windows facing West	9.23 m², No overhang
Air change rate	8.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.39 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.022	W/m²K
Photovoltaic array	1.10	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 664 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 664 EPC	**Prop Type Ref**	Opp
Property	3 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.66	**TER**	16.22
Environmental	89 B	**% DER<TER**	21.95		
CO_2 Emissions (t/year)	1.10	**DFEE**	44.29	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.93		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 116 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 4.38 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.29 m², No overhang
Windows facing South: 7.61 m², No overhang
Windows facing West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				4.3800	
Infiltration rate				0.3540	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3686	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3385	0.3536	(22b)
Effective ac	0.5736	0.5707	0.5679	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.0719	55.7925	55.5187	54.2323	53.9916	52.8713	52.8713	52.6638	53.3028	53.9916	54.4785	54.9875	(38)
Heat transfer coeff	130.0327	129.7532	129.4794	128.1930	127.9523	126.8320	126.8320	126.6245	127.2635	127.9523	128.4392	128.9482	(39)
Average = Sum(39)m / 12 =												128.1919	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1209	1.1185	1.1161	1.1050	1.1029	1.0933	1.0933	1.0915	1.0970	1.1029	1.1071	1.1115	(40)
HLP (average)												1.1050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	453.6383	451.1898	434.5321	407.5956	379.9036	353.6301	336.8607	343.5737	357.6958	384.8651	416.0072	439.6884	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	624.8662	743.1395	837.1989	915.9006	960.7078	936.0490	895.8978	847.1223	796.4569	708.1601	621.0913	586.2607	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9556	62.0890	62.2203	62.8447	62.9629	63.5191	63.5191	63.6232	63.3037	62.9629	62.7242	62.4766	
alpha	5.1304	5.1393	5.1480	5.1896	5.1975	5.2346	5.2346	5.2415	5.2202	5.1975	5.1816	5.1651	
util living area													
	0.9988	0.9968	0.9913	0.9723	0.9138	0.7744	0.6021	0.6542	0.8772	0.9820	0.9973	0.9991	(86)
MIT	19.7406	19.9022	20.1467	20.4608	20.7452	20.9290	20.9848	20.9769	20.8533	20.4813	20.0487	19.7114	(87)
Th 2	19.9838	19.9858	19.9877	19.9967	19.9984	20.0063	20.0063	20.0078	20.0033	19.9984	19.9950	19.9914	(88)
util rest of house													
	0.9984	0.9957	0.9880	0.9612	0.8775	0.6877	0.4767	0.5293	0.8138	0.9728	0.9961	0.9989	(89)
MIT 2	18.2964	18.5339	18.8910	19.3486	19.7368	19.9560	20.0004	19.9977	19.8798	19.3841	18.7551	18.2592	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.5169	18.7428	19.0827	19.5184	19.8907	20.1045	20.1506	20.1471	20.0284	19.5516	18.9526	18.4809	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5169	18.7428	19.0827	19.5184	19.8907	20.1045	20.1506	20.1471	20.0284	19.5516	18.9526	18.4809	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9937	0.9839	0.9542	0.8728	0.6972	0.4957	0.5480	0.8157	0.9670	0.9943	0.9982	(94)
Useful gains	623.2797	738.4475	823.7603	873.9567	838.5043	652.5997	444.1337	464.2014	649.6496	684.7614	617.5456	585.1779	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1848.6627	1796.1436	1629.2041	1361.2028	1048.0224	698.1515	450.3352	474.4801	754.4696	1145.3755	1522.3363	1841.4963	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	911.6849	710.7718	599.2502	350.8171	155.8814	0.0000	0.0000	0.0000	0.0000	342.6969	651.4493	934.7009	(98)
Space heating												4657.2526	(98)
Space heating per m2											(98) / (4) =	40.1453	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5013.1890	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	911.6849	710.7718	599.2502	350.8171	155.8814	0.0000	0.0000	0.0000	0.0000	342.6969	651.4493	934.7009	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	981.3616	765.0934	645.0486	377.6288	167.7949	0.0000	0.0000	0.0000	0.0000	368.8879	701.2372	1006.1366	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3615	89.3070	89.2004	88.9536	88.3734	86.7000	86.7000	86.7000	86.7000	88.9127	89.2520	89.3856	(217)
Fuel for water heating, kWh/month													
	199.0843	174.5980	181.2673	159.7205	155.1896	137.8946	129.1593	146.2490	147.4133	165.8557	178.7487	193.1595	(219)
Water heating fuel used												1968.3398	(219)
Annual totals kWh/year													
Space heating fuel - main system												5013.1890	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6906.4691	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5013.1890	0.2160	1082.8488	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.3398	0.2160	425.1614	(264)
Space and water heating			1508.0102	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1469.0542	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6600	ZC1
Total Floor Area	TFA	116.0100	
Assumed number of occupants	N	2.8465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2985	ZC2
CO2 emissions from cooking, equation (L16)		1.6147	ZC3
Total CO2 emissions		28.5732	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.5732	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3850	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4040	(36)
Total fabric heat loss					(33) + (36) =		67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8465	(42)
Average daily hot water use (litres/day)												101.8040	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    50.9589    46.0274    50.9589    49.2006    48.7655    45.1842    46.6904    48.7655    49.2006    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   2188.7586 (64)
Heat gains from water heating, kWh/month
              67.9579    59.8010    62.5750    55.7477    53.8804    47.2705    45.0082    50.4445    51.0101    57.8524    61.5728    66.2156 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
              91.3412    88.9896    84.1061    77.4274    72.4198    65.6534    60.4949    67.8017    70.8474    77.7586    85.5178    88.9994 (72)
Total internal gains
             466.7848   464.3389   447.6867   420.7181   392.3363   365.3743   348.6102   356.0113   370.8257   398.0269   429.1603   452.8375 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700           20.4406 (74)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700          108.7320 (78)
West                                     1.4200           19.6403           0.6300           0.7000           0.7700            8.5233 (80)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000           12.1285 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   616.6092   719.7949   800.0202   865.4850   900.5400   874.9908   837.7677   796.6164   754.7417   680.9100   608.6088   581.0883 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha         5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
              0.9989     0.9972     0.9926     0.9765     0.9245     0.7907     0.6170     0.6668     0.8862     0.9838     0.9975     0.9992 (86)

MIT          19.7884    19.9374    20.1676    20.4689    20.7444    20.9289    20.9851    20.9777    20.8569    20.4993    20.0877    19.7644 (87)
Th 2         20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
              0.9985     0.9963     0.9899     0.9669     0.8919     0.7077     0.4938     0.5448     0.8264     0.9755     0.9964     0.9989 (89)
MIT 2        18.3899    18.6093    18.9462    19.3880    19.7675    19.9920    20.0375    20.0353    19.9174    19.4370    18.8374    18.3612 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1527 (91)
MIT          18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT 18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.9977     0.9945     0.9863     0.9606     0.8870     0.7165     0.5125     0.5631     0.8280     0.9702     0.9948     0.9983 (94)
Useful gains 615.1712   715.8353   789.0656   831.4208   798.8216   626.9470   429.3911   448.5395   624.9029   660.6464   605.4388   580.0929 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1793.1665  1739.5026  1575.4392  1312.3483  1009.8729   672.9526   435.5257   458.5435   727.7610  1106.0494  1472.9191  1783.7584 (97)
Month fracti  1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             876.4286   687.9044   585.0620   346.2678   157.0222     0.0000     0.0000     0.0000     0.0000   331.3798   624.5858   895.5271 (98)
Space heating                                                                                                                  4504.1777 (98)
Space heating per m2                                                                                          (98) / (4) =     38.8258 (99)
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4822.4601	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	876.4286	687.9044	585.0620	346.2678	157.0222	0.0000	0.0000	0.0000	0.0000	331.3798	624.5858	895.5271	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	938.3603	736.5144	626.4047	370.7364	168.1179	0.0000	0.0000	0.0000	0.0000	354.7964	668.7214	958.8085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.0286	191.2730	200.8393	179.8700	174.1459	153.3780	146.9478	163.8124	165.6215	186.6362	197.4174	211.7885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1982	87.9922	87.5848	86.6731	84.7918	80.3000	80.3000	80.3000	80.3000	86.4810	87.7493	88.2764	(217)
Fuel for water heating, kWh/month													
	246.0692	217.3750	229.3085	207.5270	205.3806	191.0062	182.9985	204.0004	206.2534	215.8119	224.9790	239.9153	(219)
Water heating fuel used												2570.6251	(219)
Annual totals kWh/year													
Space heating fuel - main system												4822.4601	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Total delivered energy for all uses												7941.7786	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4822.4601	0.2160	1041.6514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.6251	0.2160	555.2550	(264)
Space and water heating			1596.9064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Total CO2, kg/m2/year			1881.6783	(272)
Emissions per m2 for space and water heating			13.7652	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1192	(272b)
Emissions per m2 for pumps and fans			0.3355	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7652 * 1.00) + 2.1192 + 0.3355, rounded to 2 d.p.			16.2200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				4.3800	
Infiltration rate				0.3540	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3686	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3385	0.3536	(22b)
Effective ac	0.5736	0.5707	0.5679	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.0719	55.7925	55.5187	54.2323	53.9916	52.8713	52.8713	52.6638	53.3028	53.9916	54.4785	54.9875	(38)
Heat transfer coeff	130.0327	129.7532	129.4794	128.1930	127.9523	126.8320	126.8320	126.6245	127.2635	127.9523	128.4392	128.9482	(39)
Average = Sum(39)m / 12 =												128.1919	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1209	1.1185	1.1161	1.1050	1.1029	1.0933	1.0933	1.0915	1.0970	1.1029	1.1071	1.1115	(40)
HLP (average)												1.1050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1601.7736 (45)

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

35.2898	30.8647	31.8496	27.7672	26.6433	22.9912	21.3047	24.4475	24.7394	28.8314	31.4718	34.1763	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)

Pumps, fans

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)

Water heating gains (Table 5)

47.4325	45.9296	42.8086	38.5656	35.8109	31.9322	28.6353	32.8595	34.3603	38.7519	43.7108	45.9359	(72)

Total internal gains

419.8761	418.2789	403.3891	378.8563	352.7274	328.6531	313.7507	318.0691	331.3387	356.0201	384.3533	406.7739	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	591.1039	710.2286	806.0560	887.1613	933.5316	911.0719	872.7878	821.6178	770.0998	679.3152	589.4373	553.3462	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9556	62.0890	62.2203	62.8447	62.9629	63.5191	63.5191	63.6232	63.3037	62.9629	62.7242	62.4766	
alpha	5.1304	5.1393	5.1480	5.1896	5.1975	5.2346	5.2346	5.2415	5.2202	5.1975	5.1816	5.1651	

util living area

0.9991	0.9974	0.9926	0.9757	0.9215	0.7875	0.6158	0.6704	0.8889	0.9849	0.9978	0.9994	(86)

MIT	19.7133	19.8759	20.1224	20.4404	20.7308	20.9229	20.9831	20.9741	20.8418	20.4597	20.0232	19.6847	(87)
Th 2	19.9838	19.9858	19.9877	19.9967	19.9984	20.0063	20.0063	20.0078	20.0033	19.9984	19.9950	19.9914	(88)

util rest of house

0.9988	0.9965	0.9899	0.9657	0.8875	0.7019	0.4886	0.5443	0.8287	0.9770	0.9969	0.9991	(89)

MIT 2	18.8045	18.9683	19.2151	19.5349	19.8079	19.9686	20.0018	19.9999	19.9108	19.5584	19.1231	18.7821	(90)

Living area fraction fLA = Living area / (4) = 0.1527 (91)

MIT	18.9432	19.1068	19.3536	19.6731	19.9488	20.1142	20.1516	20.1486	20.0529	19.6960	19.2605	18.9199	(92)

Temperature adjustment 0.0000

adjusted MIT	18.9432	19.1068	19.3536	19.6731	19.9488	20.1142	20.1516	20.1486	20.0529	19.6960	19.2605	18.9199	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9954	0.9875	0.9615	0.8854	0.7123	0.5081	0.5635	0.8323	0.9737	0.9960	0.9988	(94)
Useful gains	590.0942	706.9737	795.9891	853.0456	826.5715	648.9754	443.5069	462.9911	640.9423	661.4545	587.0780	552.6724	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

Heat loss rate W

1904.0983	1843.3800	1664.2743	1381.0418	1055.4522	699.3826	450.4539	474.6705	757.5914	1163.8553	1561.8897	1898.0993	(97)
Month fracti 1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh

977.6191	763.6651	646.0042	380.1573	170.2873	0.0000	0.0000	0.0000	0.0000	373.7862	701.8644	1000.9976	(98)

Space heating 5014.3810 (98)

Space heating per m2 (98) / (4) = 43.2237 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

Heat loss rate W

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1192.2205	938.5566	962.3462	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8313	0.9045	0.8795	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	991.1524	848.9151	846.3381	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.3123	1122.4912	1065.9653	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.2752	203.5406	163.4027	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												495.2185	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	32.0688	50.8852	40.8507	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												123.8046	(107)
Space cooling per m2												1.0672	(108)
Energy for space heating												43.2237	(99)
Energy for space cooling												1.0672	(108)
Total												44.2909	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3850	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Primary loss    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (59)
Heat gains from water heating, kWh/month
              35.2898    30.8647    31.8496    27.7672    26.6433    22.9912    21.3047    24.4475    24.7394    28.8314    31.4718    34.1763 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
              47.4325    45.9296    42.8086    38.5656    35.8109    31.9322    28.6353    32.8595    34.3603    38.7519    43.7108    45.9359 (72)
Total internal gains
             419.8761   418.2789   403.3891   378.8563   352.7274   328.6531   313.7507   318.0691   331.3387   356.0201   384.3533   406.7739 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700          20.4406 (74)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700         108.7320 (78)
West                                     1.4200           19.6403           0.6300           0.7000           0.7700           8.5233 (80)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000          12.1285 (82)
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Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   569.7005   673.7349   755.7227   823.6232   860.9311   838.2696   802.9082   758.6742   715.2546   638.9033   563.8018   535.0247 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha          5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
               0.9992     0.9980     0.9943     0.9809     0.9355     0.8111     0.6397     0.6930     0.9039     0.9878     0.9983     0.9995 (86)

MIT           19.7502    19.9002    20.1325    20.4383    20.7221    20.9190    20.9824    20.9733    20.8385    20.4673    20.0513    19.7267 (87)
Th 2          20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
               0.9990     0.9973     0.9921     0.9730     0.9063     0.7303     0.5140     0.5696     0.8495     0.9813     0.9975     0.9993 (89)
MIT 2         18.8678    19.0194    19.2527    19.5631    19.8332    20.0026    20.0386    20.0369    19.9430    19.5957    19.1795    18.8516 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.1527 (91)
MIT           19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9986     0.9964     0.9903     0.9694     0.9039     0.7398     0.5333     0.5883     0.8522     0.9785     0.9968     0.9990 (94)
Useful gains  568.9046   671.3027   748.3565   798.3937   778.1642   620.1222   428.1819   446.3258   609.5692   625.1485   561.9700   534.4911 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1843.2002  1782.2447  1607.1624  1330.0521  1016.2957   673.8602   435.5823   458.6235   730.0646  1121.9816  1508.0325  1834.6060 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             948.0759   746.5530   638.9516   382.7941   177.1698     0.0000     0.0000     0.0000     0.0000   369.6438   681.1650   967.2855 (98)
Space heating                                                                                                                 4911.6387 (98)
Space heating per m2                                                                                                (98) / (4) =     42.3381 (99)


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8c. Space cooling requirement
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Calculated for June, July and August. See Table 10b
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Ext. temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000
Heat loss rate W
               0.0000     0.0000     0.0000     0.0000     0.0000  1142.8586   899.6972   922.1483     0.0000     0.0000     0.0000     0.0000 (100)
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8216	0.8990	0.8740	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.9724	808.8081	805.9772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.3888	1041.9369	993.4001	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.4198	173.4478	139.4426	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												418.3102	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3550	43.3619	34.8607	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												104.5776	(107)
Space cooling per m2												0.9015	(108)
Energy for space heating												42.3381	(99)
Energy for space cooling												0.9015	(108)
Total												43.2395	(109)
Target Fabric Energy Efficiency (TFEE)												49.7	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				4.3800	
Infiltration rate				0.3540	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3160	0.2934	0.3009	0.2859	0.2859	0.2784	0.2708	0.2633	0.2558	0.2784	0.2633	0.2784	(22b)
Effective ac	0.5499	0.5430	0.5453	0.5409	0.5409	0.5387	0.5367	0.5347	0.5327	0.5387	0.5347	0.5387	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.7565	53.0843	53.3028	52.8713	52.8713	52.6638	52.4618	52.2654	52.0746	52.6638	52.2654	52.6638	(38)
Heat transfer coeff	127.7172	127.0450	127.2635	126.8320	126.8320	126.6245	126.4226	126.2261	126.0353	126.6245	126.2261	126.6245	(39)
Average = Sum(39)m / 12 =												126.7061	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1009	1.0951	1.0970	1.0933	1.0933	1.0915	1.0898	1.0881	1.0864	1.0915	1.0881	1.0915	(40)
HLP (average)												1.0922	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m

	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244 (46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272 (61)

Total heat required for water heating calculated for each month

	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568 (64)

Total per year (kWh/year) = Sum(64)m = 1740.5488 (64)
RHI water heating demand 1741 (64)
Heat gains from water heating, kWh/month

	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594 (71)

Water heating gains (Table 5)

	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503 (72)

Total internal gains

	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0788	63.4126	63.3037	63.5191	63.5191	63.6232	63.7248	63.8239	63.9206	63.6232	63.8239	63.6232	
alpha	5.2053	5.2275	5.2202	5.2346	5.2346	5.2415	5.2483	5.2549	5.2614	5.2415	5.2549	5.2415	
util living area	0.9928	0.9876	0.9707	0.9212	0.8082	0.5948	0.4363	0.4517	0.7164	0.9256	0.9831	0.9943	(86)
MIT	20.0406	20.1585	20.3939	20.6731	20.8836	20.9814	20.9970	20.9964	20.9524	20.7191	20.3501	20.0223	(87)
Th 2	20.0001	20.0048	20.0033	20.0063	20.0063	20.0078	20.0092	20.0106	20.0119	20.0078	20.0106	20.0078	(88)
util rest of house	0.9904	0.9836	0.9609	0.8947	0.7478	0.5000	0.3273	0.3393	0.6261	0.8941	0.9765	0.9924	(89)
MIT 2	18.7451	18.9191	19.2549	19.6420	19.9030	19.9976	20.0084	20.0096	19.9804	19.7114	19.2016	18.7244	(90)

Living area fraction fLA = Living area / (4) = 0.1527 (91)

MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9536	0.8881	0.7510	0.5139	0.3440	0.3566	0.6376	0.8886	0.9708	0.9894	(94)
Useful gains	876.4352	956.7713	1021.9605	1020.9214	869.4616	603.9298	385.8113	385.1641	654.9890	837.4288	849.1096	827.0243	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1793.5201	1754.2721	1581.7298	1306.2987	957.9283	613.8488	386.7612	386.2824	684.2162	1071.9041	1448.6936	1762.9389	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	682.3112	535.9205	416.4683	205.4716	65.8192	0.0000	0.0000	0.0000	0.0000	174.4497	431.7005	696.3204	(98)

Space heating 3208.4614 (98)
RHI space heating demand 3208 (98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				4.3800	
Infiltration rate				0.3540	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3686	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3385	0.3536	(22b)
Effective ac	0.5736	0.5707	0.5679	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.0719	55.7925	55.5187	54.2323	53.9916	52.8713	52.8713	52.6638	53.3028	53.9916	54.4785	54.9875	(38)
Heat transfer coeff	130.0327	129.7532	129.4794	128.1930	127.9523	126.8320	126.8320	126.6245	127.2635	127.9523	128.4392	128.9482	(39)
Average = Sum(39)m / 12 =												128.1919	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1209	1.1185	1.1161	1.1050	1.1029	1.0933	1.0933	1.0915	1.0970	1.1029	1.1071	1.1115	(40)
HLP (average)												1.1050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Energy content (annual)                                                                          Total = Sum(45)m =    1601.7736 (45)
Distribution loss  (46)m = 0.15 x (45)m
               24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8350    10.6826    11.8108    11.4077    11.7659    11.3609    11.7237    11.7511    11.3864    11.7895    11.4344    11.8272 (61)
Total heat required for water heating calculated for each month
              177.9047   155.9282   161.6912   142.0771   137.1463   119.5546   111.9811   126.7979   127.8073   147.4668   159.5367   172.6568 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              177.9047   155.9282   161.6912   142.0771   137.1463   119.5546   111.9811   126.7979   127.8073   147.4668   159.5367   172.6568 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1740.5488 (64)
Heat gains from water heating, kWh/month
               58.1769    50.9648    52.7879    46.2995    44.6305    38.8146    36.2665    41.1908    41.5565    48.0601    52.1026    56.4326 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m      170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               67.0562    59.5587    48.4364    36.6695    27.4109    23.1414    25.0051    32.5026    43.6249    55.3918    64.6505    68.9199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              417.7967   422.1321   411.2070   387.9487   358.5893   330.9956   312.5613   308.2259   319.1510   342.4093   371.7687   399.3624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
               78.1948    75.8405    70.9515    64.3049    59.9872    53.9092    48.7453    55.3640    57.7174    64.5969    72.3648    75.8503 (72)
Total internal gains
              677.9028   672.3864   645.4500   603.7782   560.8424   522.9013   501.1668   510.9476   535.3484   577.2531   623.6390   658.9877 (73)
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6. Solar gains

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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2          Table 6a     Specific data     Specific data          factor                W
                                                          W/m2       or Table 6b       or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------------
North                                   6.2900           10.6334            0.7200            0.7000            0.7700           23.3607 (74)
South                                   7.6100           46.7521            0.7200            0.7000            0.7700          124.2651 (78)
West                                    1.4200           19.6403            0.7200            0.7000            0.7700            9.7409 (80)
South                                   0.6500           47.0123            0.7200            0.7000            1.0000           13.8611 (82)
-------------------------------------------------------------------------------------------------------------------------------------

Solar gains    171.2279   291.9497   402.6669   508.3050   580.8042   582.4189   559.0371   503.5487   438.7611   323.2950   205.0841   146.5723 (83)
Total gains    849.1307   964.3362  1048.1169  1112.0832  1141.6467  1105.3202  1060.2039  1014.4962   974.1095   900.5481   828.7231   805.5601 (84)
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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          61.9556    62.0890    62.2203    62.8447    62.9629    63.5191    63.5191    63.6232    63.3037    62.9629    62.7242    62.4766
alpha         5.1304     5.1393     5.1480     5.1896     5.1975     5.2346     5.2346     5.2415     5.2202     5.1975     5.1816     5.1651
util living area
                0.9951     0.9898     0.9774     0.9423     0.8555     0.6890     0.5175     0.5604     0.7928     0.9534     0.9899     0.9962 (86)

MIT           19.9203    20.0762    20.3051    20.5893    20.8259    20.9590    20.9923    20.9886    20.9134    20.6145    20.2127    19.8881 (87)
Th 2          19.9838    19.9858    19.9877    19.9967    19.9984    20.0063    20.0063    20.0078    20.0033    19.9984    19.9950    19.9914 (88)
util rest of house
                0.9935     0.9865     0.9698     0.9222     0.8068     0.6000     0.4053     0.4465     0.7145     0.9330     0.9860     0.9950 (89)
MIT 2         18.5584    18.7859    19.1169    19.5222    19.8301    19.9793    20.0035    20.0032    19.9371    19.5651    18.9922    18.5170 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1527 (91)
MIT           18.7663    18.9829    19.2983    19.6851    19.9821    20.1289    20.1545    20.1536    20.0862    19.7253    19.1785    18.7263 (92)
Temperature adjustment                                                                                                            0.0000
adjusted MIT  18.7663    18.9829    19.2983    19.6851    19.9821    20.1289    20.1545    20.1536    20.0862    19.7253    19.1785    18.7263 (93)
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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9907     0.9820     0.9630     0.9146     0.8059     0.6117     0.4224     0.4638     0.7218     0.9259     0.9815     0.9927 (94)
Useful gains  841.1993   946.9376  1009.3641  1017.1089   920.0231   676.0851   447.8590   470.5062   703.0727   833.7909   813.4211   799.6519 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1881.0870  1827.3013  1657.1146  1382.5769  1059.7157   701.2386   450.8208   475.2962   761.8188  1167.5986  1551.3588  1873.1441 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              773.6764   591.6044   481.9263   263.1369   103.9313     0.0000     0.0000     0.0000     0.0000   248.3529   531.3152   798.6782 (98)
Space heating                                                                                                                  3792.6217 (98)
Space heating per m2                                                                                                 (98) / (4) =     32.6922 (99)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4082.4776	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.6764	591.6044	481.9263	263.1369	103.9313	0.0000	0.0000	0.0000	0.0000	248.3529	531.3152	798.6782	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	832.8056	636.8186	518.7581	283.2475	111.8744	0.0000	0.0000	0.0000	0.0000	267.3336	571.9216	859.7182	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2839	89.2132	89.0741	88.7515	88.0512	86.7000	86.7000	86.7000	86.7000	88.6806	89.1402	89.3140	(217)
Fuel for water heating, kWh/month													
	199.2573	174.7816	181.5244	160.0843	155.7575	137.8946	129.1593	146.2490	147.4133	166.2898	178.9728	193.3143	(219)
Water heating fuel used												1970.6981	(219)
Annual totals kWh/year													
Space heating fuel - main system												4082.4776	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5978.1161	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4082.4776	3.4800	142.0702	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.6981	3.4800	68.5803	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			320.7501	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8367	(257)
SAP value		88.3282	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4082.4776	0.2160	881.8152	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.6981	0.2160	425.6708	(264)
Space and water heating			1307.4860	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1268.5300	(272)
CO2 emissions per m2			10.9300	(273)
EI value			89.4427	
EI rating			89	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact	0.216 / 0.8819 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.3800	
Infiltration rate			0.3540	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3160	0.2934	0.3009	0.2859	0.2859	0.2784	0.2708	0.2633	0.2558	0.2784	0.2633	0.2784	(22b)
Effective ac	0.5499	0.5430	0.5453	0.5409	0.5409	0.5387	0.5367	0.5347	0.5327	0.5387	0.5347	0.5387	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.7565	53.0843	53.3028	52.8713	52.8713	52.6638	52.4618	52.2654	52.0746	52.6638	52.2654	52.6638	(38)
Heat transfer coeff	127.7172	127.0450	127.2635	126.8320	126.8320	126.6245	126.4226	126.2261	126.0353	126.6245	126.2261	126.6245	(39)
Average = Sum(39)m / 12 =												126.7061	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1009	1.0951	1.0970	1.0933	1.0933	1.0915	1.0898	1.0881	1.0864	1.0915	1.0881	1.0915	(40)
HLP (average)												1.0922	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0788	63.4126	63.3037	63.5191	63.5191	63.6232	63.7248	63.8239	63.9206	63.6232	63.8239	63.6232	
alpha	5.2053	5.2275	5.2202	5.2346	5.2346	5.2415	5.2483	5.2549	5.2614	5.2415	5.2549	5.2415	
util living area													
	0.9928	0.9876	0.9707	0.9212	0.8082	0.5948	0.4363	0.4517	0.7164	0.9256	0.9831	0.9943	(86)
MIT	20.0406	20.1585	20.3939	20.6731	20.8836	20.9814	20.9970	20.9964	20.9524	20.7191	20.3501	20.0223	(87)
Th 2	20.0001	20.0048	20.0033	20.0063	20.0063	20.0078	20.0092	20.0106	20.0119	20.0078	20.0106	20.0078	(88)
util rest of house													
	0.9904	0.9836	0.9609	0.8947	0.7478	0.5000	0.3273	0.3393	0.6261	0.8941	0.9765	0.9924	(89)
MIT 2	18.7451	18.9191	19.2549	19.6420	19.9030	19.9976	20.0084	20.0096	19.9804	19.7114	19.2016	18.7244	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9536	0.8881	0.7510	0.5139	0.3440	0.3566	0.6376	0.8886	0.9708	0.9894	(94)
Useful gains	876.4352	956.7713	1021.9605	1020.9214	869.4616	603.9298	385.8113	385.1641	654.9890	837.4288	849.1096	827.0243	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1793.5201	1754.2721	1581.7298	1306.2987	957.9283	613.8488	386.7612	386.2824	684.2162	1071.9041	1448.6936	1762.9389	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	682.3112	535.9205	416.4683	205.4716	65.8192	0.0000	0.0000	0.0000	0.0000	174.4497	431.7005	696.3204	(98)
Space heating												3208.4614	(98)
Space heating per m2											(98) / (4) =	27.6568	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3453.6721	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	682.3112	535.9205	416.4683	205.4716	65.8192	0.0000	0.0000	0.0000	0.0000	174.4497	431.7005	696.3204	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	734.4577	576.8789	448.2975	221.1750	70.8495	0.0000	0.0000	0.0000	0.0000	187.7822	464.6937	749.5376	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2190	89.1583	88.9815	88.5637	87.7125	86.7000	86.7000	86.7000	86.7000	88.4053	89.0135	89.2455	(217)
Fuel for water heating, kWh/month													
	199.4023	174.8890	181.7132	160.4236	156.3590	137.8946	129.1593	146.2490	147.4133	166.8076	179.2276	193.4627	(219)
Water heating fuel used												1973.0013	(219)
Annual totals kWh/year													
Space heating fuel - main system												3453.6721	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												5282.4287	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3453.6721	7.3800	254.8810	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1973.0013	7.3800	145.6075	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			466.1480	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3453.6721	0.2160	745.9932	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.0013	0.2160	426.1683	(264)
Space and water heating			1172.1615	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			1097.2984	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3453.6721	1.2200	4213.4800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.0013	1.2200	2407.0616	(264)
Space and water heating			6620.5416	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			6177.7102	(272)
Primary energy kWh/m2/year			53.2515	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-197 kg (17.9%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£62	1.70 kg/m²	B 89	B 91
	Total Savings	£62	1.70 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£172	-£14
Mains gas	£507	£431	£76
Space heating	£383	£383	£0
Water heating	£146	£84	£62
Lighting	£136	£136	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£465	£404	£62
Total cost of uses	£466	£404	£62
Delivered energy	46 kWh/m²	37 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	44 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400	(1b)	x 2.3900	(2b) =	105.2556	(1b) - (3b)
First floor	39.7800	(1c)	x 2.6400	(2c) =	105.0192	(1c) - (3c)
Second floor	32.1900	(1d)	x 2.6700	(2d) =	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.3800	
Infiltration rate			0.3540	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3837	0.3762	0.3686	0.3310	0.3235	0.2859	0.2859	0.2784	0.3009	0.3235	0.3385	0.3536	(22b)
Effective ac	0.5736	0.5707	0.5679	0.5548	0.5523	0.5409	0.5409	0.5387	0.5453	0.5523	0.5573	0.5625	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	56.0719	55.7925	55.5187	54.2323	53.9916	52.8713	52.8713	52.6638	53.3028	53.9916	54.4785	54.9875	(38)
Heat transfer coeff	130.0327	129.7532	129.4794	128.1930	127.9523	126.8320	126.8320	126.6245	127.2635	127.9523	128.4392	128.9482	(39)
Average = Sum(39)m / 12 =												128.1919	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1209	1.1185	1.1161	1.1050	1.1029	1.0933	1.0933	1.0915	1.0970	1.1029	1.1071	1.1115	(40)
HLP (average)												1.1050	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1322	(H8)
Utilisation factor												0.5865	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-878.1906	(H17)
Solar input	-25.4658	-42.4951	-72.3740	-96.9954	-119.8296	-117.8116	-116.2547	-101.5723	-79.5515	-54.3243	-30.2061	-21.3105	(63)
										Solar input (sum of months) = Sum(63)m =		-878.1906	(63)
Output from w/h													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
										Total per year (kWh/year) = Sum(64)m =		866.6317	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	849.1307	964.3362	1048.1169	1112.0832	1141.6467	1105.3202	1060.2039	1014.4962	974.1095	900.5481	828.7231	805.5601	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.9556	62.0890	62.2203	62.8447	62.9629	63.5191	63.5191	63.6232	63.3037	62.9629	62.7242	62.4766	
alpha	5.1304	5.1393	5.1480	5.1896	5.1975	5.2346	5.2346	5.2415	5.2202	5.1975	5.1816	5.1651	
util living area													
	0.9951	0.9898	0.9774	0.9423	0.8555	0.6890	0.5175	0.5604	0.7928	0.9534	0.9899	0.9962	(86)
MIT	19.9203	20.0762	20.3051	20.5893	20.8259	20.9590	20.9923	20.9886	20.9134	20.6145	20.2127	19.8881	(87)
Th 2	19.9838	19.9858	19.9877	19.9967	19.9984	20.0063	20.0063	20.0078	20.0033	19.9984	19.9950	19.9914	(88)
util rest of house													
	0.9935	0.9865	0.9698	0.9222	0.8068	0.6000	0.4053	0.4465	0.7145	0.9330	0.9860	0.9950	(89)
MIT 2	18.5584	18.7859	19.1169	19.5222	19.8301	19.9793	20.0035	20.0032	19.9371	19.5651	18.9922	18.5170	(90)
Living area fraction										fLA = Living area / (4) =		0.1527	(91)
MIT	18.7663	18.9829	19.2983	19.6851	19.9821	20.1289	20.1545	20.1536	20.0862	19.7253	19.1785	18.7263	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7663	18.9829	19.2983	19.6851	19.9821	20.1289	20.1545	20.1536	20.0862	19.7253	19.1785	18.7263	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9820	0.9630	0.9146	0.8059	0.6117	0.4224	0.4638	0.7218	0.9259	0.9815	0.9927	(94)
Useful gains	841.1993	946.9376	1009.3641	1017.1089	920.0231	676.0851	447.8590	470.5062	703.0727	833.7909	813.4211	799.6519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1881.0870	1827.3013	1657.1146	1382.5769	1059.7157	701.2386	450.8208	475.2962	761.8188	1167.5986	1551.3588	1873.1441	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	773.6764	591.6044	481.9263	263.1369	103.9313	0.0000	0.0000	0.0000	0.0000	248.3529	531.3152	798.6782	(98)
Space heating												3792.6217	(98)
Space heating per m2											(98) / (4) =	32.6922	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4082.4776	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.6764	591.6044	481.9263	263.1369	103.9313	0.0000	0.0000	0.0000	0.0000	248.3529	531.3152	798.6782	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	832.8056	636.8186	518.7581	283.2475	111.8744	0.0000	0.0000	0.0000	0.0000	267.3336	571.9216	859.7182	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3571	89.3693	89.3842	89.4173	89.4286	86.7000	86.7000	86.7000	86.7000	89.0040	89.2551	89.3745	(217)
Fuel for water heating, kWh/month													
	170.5951	126.9263	99.9251	50.4173	19.3637	2.0104	0.0000	29.0953	55.6584	104.6497	144.9000	169.3395	(219)
Water heating fuel used												972.8809	(219)
Annual totals kWh/year													
Space heating fuel - main system												4082.4776	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5030.2989	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4082.4776	3.4800	142.0702	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	972.8809	3.4800	33.8563	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			292.6211	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7633	(257)
SAP value	89.3518	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4082.4776	0.2160	881.8152	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	972.8809	0.2160	210.1423	(264)
Space and water heating			1091.9574	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1078.9515	(272)
CO2 emissions per m2			9.3000	(273)
EI value			91.0205	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.3800	
Infiltration rate			0.3540	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3009	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3160	0.2934	0.3009	0.2859	0.2859	0.2784	0.2708	0.2633	0.2558	0.2784	0.2633	0.2784	(22b)
Effective ac	0.5499	0.5430	0.5453	0.5409	0.5409	0.5387	0.5367	0.5347	0.5327	0.5387	0.5347	0.5387	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.7565	53.0843	53.3028	52.8713	52.8713	52.6638	52.4618	52.2654	52.0746	52.6638	52.2654	52.6638	(38)
Heat transfer coeff	127.7172	127.0450	127.2635	126.8320	126.8320	126.6245	126.4226	126.2261	126.0353	126.6245	126.2261	126.6245	(39)
Average = Sum(39)m / 12 =												126.7061	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1009	1.0951	1.0970	1.0933	1.0933	1.0915	1.0898	1.0881	1.0864	1.0915	1.0881	1.0915	(40)
HLP (average)												1.0922	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2672	(H8)
Utilisation factor												0.5458	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-914.5224	(H17)
Solar input	-29.8339	-42.4220	-72.9131	-98.3767	-115.5494	-123.4250	-120.8293	-108.1459	-84.6708	-58.5385	-35.2857	-24.5322	(63)
											Solar input (sum of months) = Sum(63)m =	-914.5224	(63)
Output from w/h													
	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246	(64)
											Total per year (kWh/year) = Sum(64)m =	838.7449	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0788	63.4126	63.3037	63.5191	63.5191	63.6232	63.7248	63.8239	63.9206	63.6232	63.8239	63.6232	
alpha	5.2053	5.2275	5.2202	5.2346	5.2346	5.2415	5.2483	5.2549	5.2614	5.2415	5.2549	5.2415	
util living area													
	0.9928	0.9876	0.9707	0.9212	0.8082	0.5948	0.4363	0.4517	0.7164	0.9256	0.9831	0.9943	(86)
MIT	20.0406	20.1585	20.3939	20.6731	20.8836	20.9814	20.9970	20.9964	20.9524	20.7191	20.3501	20.0223	(87)
Th 2	20.0001	20.0048	20.0033	20.0063	20.0063	20.0078	20.0092	20.0106	20.0119	20.0078	20.0106	20.0078	(88)
util rest of house													
	0.9904	0.9836	0.9609	0.8947	0.7478	0.5000	0.3273	0.3393	0.6261	0.8941	0.9765	0.9924	(89)
MIT 2	18.7451	18.9191	19.2549	19.6420	19.9030	19.9976	20.0084	20.0096	19.9804	19.7114	19.2016	18.7244	(90)
Living area fraction										fLA = Living area / (4) =		0.1527	(91)
MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9429	19.1083	19.4288	19.7994	20.0527	20.1478	20.1593	20.1602	20.1288	19.8652	19.3770	18.9226	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9536	0.8881	0.7510	0.5139	0.3440	0.3566	0.6376	0.8886	0.9708	0.9894	(94)
Useful gains	876.4352	956.7713	1021.9605	1020.9214	869.4616	603.9298	385.8113	385.1641	654.9890	837.4288	849.1096	827.0243	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1793.5201	1754.2721	1581.7298	1306.2987	957.9283	613.8488	386.7612	386.2824	684.2162	1071.9041	1448.6936	1762.9389	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	682.3112	535.9205	416.4683	205.4716	65.8192	0.0000	0.0000	0.0000	0.0000	174.4497	431.7005	696.3204	(98)
Space heating												3208.4614	(98)
Space heating per m2											(98) / (4) =	27.6568	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3453.6721	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	682.3112	535.9205	416.4683	205.4716	65.8192	0.0000	0.0000	0.0000	0.0000	174.4497	431.7005	696.3204	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	734.4577	576.8789	448.2975	221.1750	70.8495	0.0000	0.0000	0.0000	0.0000	187.7822	464.6937	749.5376	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3122	89.3238	89.3207	89.3218	89.0876	86.7000	86.7000	86.7000	86.7000	88.7934	89.1645	89.3217	(217)
Fuel for water heating, kWh/month													
	165.7901	127.0728	99.3924	48.9247	24.2424	0.0000	0.0000	21.5133	49.7538	100.1518	139.3504	165.8327	(219)
Water heating fuel used												942.0243	(219)
Annual totals kWh/year													
Space heating fuel - main system												3453.6721	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4301.4517	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3453.6721	7.3800	254.8810	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.0243	7.3800	69.5214	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			404.3918	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3453.6721	0.2160	745.9932	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0243	0.2160	203.4773	(264)
Space and water heating			949.4704	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-692.9382	0.5190	-359.6349 (269)
Total kg/year			900.5574 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3453.6721	1.2200	4213.4800	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0243	1.2200	1149.2697	(264)
Space and water heating			5362.7497	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5073.4183	(272)
Primary energy kWh/m2/year			43.7326	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		782.03 (P1)
Transmission heat loss coefficient		73.96 (37)
Summer heat loss coefficient		855.99 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
South	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.2900	87.1704	0.7200	0.7000	0.7650	190.2630
South	7.6100	118.5567	0.7200	0.7000	0.7650	313.0727
West	1.4200	125.2818	0.7200	0.7000	0.7650	61.7321
South	0.6500	202.9386	0.7200	0.7000	0.8500	50.8593
total:						615.9270

	Jun	Jul	Aug	
Solar gains	658	616	563	(P3)
Internal gains	520	498	508	
Total summer gains	1178	1114	1071	(P5)
Summer gain/loss ratio	1.38	1.30	1.25	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.03	18.85	18.80	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 664 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 664 EPC	**Prop Type Ref**	Opp
Property	3 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.66	**TER**	16.22
Environmental	89 B	**% DER<TER**	21.95		
CO_2 Emissions (t/year)	1.10	**DFEE**	44.29	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.93		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.66	$kgCO_2/m^2$	Pass
	-3.56 (-21.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.29	$kWh/m^2/yr$	
	-5.4 (-10.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	6.29 m², No overhang 7.61 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 665 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 665 EPC	**Prop Type Ref**	
Property	5 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.63	**TER**	16.22
Environmental	89 B	**% DER<TER**	22.13		
CO_2 Emissions (t/year)	1.10	**DFEE**	44.14	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 116 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.63 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.20 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.29 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.026 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.2000	
Infiltration rate			0.3450	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3739	0.3666	0.3593	0.3226	0.3153	0.2786	0.2786	0.2713	0.2933	0.3153	0.3299	0.3446	(22b)
Effective ac	0.5699	0.5672	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5594	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.7108	55.4454	55.1853	53.9635	53.7349	52.6708	52.6708	52.4737	53.0806	53.7349	54.1973	54.6808	(38)
Heat transfer coeff	129.6715	129.4061	129.1460	127.9242	127.6956	126.6315	126.6315	126.4344	127.0413	127.6956	128.1580	128.6415	(39)
Average = Sum(39)m / 12 =												127.9231	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1178	1.1155	1.1132	1.1027	1.1007	1.0916	1.0916	1.0899	1.0951	1.1007	1.1047	1.1089	(40)
HLP (average)												1.1027	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8651	10.7097	11.8408	11.4368	11.7960	11.3900	11.7538	11.7812	11.4155	11.8195	11.4635	11.8573	(61)
Total heat required for water heating calculated for each month													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.9028	(64)
Heat gains from water heating, kWh/month													
	58.1844	50.9716	52.7955	46.3068	44.6380	38.8219	36.2740	41.1984	41.5638	48.0676	52.1099	56.4402	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.2049	75.8506	70.9616	64.3150	59.9973	53.9193	48.7554	55.3741	57.7275	64.6070	72.3749	75.8604	(72)
Total internal gains													
	453.6484	451.1999	434.5422	407.6057	379.9137	353.6402	336.8708	343.5838	357.7059	384.8752	416.0173	439.6985	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	624.8763	743.1496	837.2091	915.9107	960.7180	936.0591	895.9079	847.1324	796.4670	708.1702	621.1014	586.2708	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1282	62.2556	62.3810	62.9768	63.0895	63.6197	63.6197	63.7188	63.4144	63.0895	62.8618	62.6256	
alpha	5.1419	5.1504	5.1587	5.1985	5.2060	5.2413	5.2413	5.2479	5.2276	5.2060	5.1908	5.1750	
util living area													
	0.9988	0.9968	0.9912	0.9722	0.9134	0.7738	0.6013	0.6535	0.8768	0.9820	0.9973	0.9991	(86)
MIT	19.7448	19.9062	20.1502	20.4632	20.7467	20.9295	20.9849	20.9771	20.8542	20.4832	20.0515	19.7150	(87)
Th 2	19.9864	19.9882	19.9900	19.9986	20.0002	20.0077	20.0077	20.0091	20.0048	20.0002	19.9970	19.9936	(88)
util rest of house													
	0.9984	0.9957	0.9880	0.9611	0.8771	0.6871	0.4762	0.5288	0.8133	0.9727	0.9961	0.9989	(89)
MIT 2	18.3044	18.5414	18.8978	19.3534	19.7403	19.9578	20.0018	19.9991	19.8822	19.3882	18.7606	18.2660	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.5243	18.7497	19.0890	19.5228	19.8939	20.1062	20.1519	20.1484	20.0306	19.5554	18.9576	18.4872	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5243	18.7497	19.0890	19.5228	19.8939	20.1062	20.1519	20.1484	20.0306	19.5554	18.9576	18.4872	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9937	0.9839	0.9541	0.8724	0.6966	0.4952	0.5474	0.8152	0.9669	0.9943	0.9982	(94)
Useful gains	623.2928	738.4578	823.7494	873.8616	838.1567	652.0728	443.6528	463.7482	649.3041	684.7246	617.5563	585.1903	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1844.4844	1792.2409	1625.8165	1358.9109	1046.3290	697.2539	449.7851	473.9260	753.4281	1143.5606	1519.6515	1837.9256	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	908.5665	708.1423	596.7379	349.2355	154.8802	0.0000	0.0000	0.0000	0.0000	341.3740	649.5085	932.0350	(98)
Space heating												4640.4799	(98)
Space heating per m2											(98) / (4) =	40.0007	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4995.1345	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	908.5665	708.1423	596.7379	349.2355	154.8802	0.0000	0.0000	0.0000	0.0000	341.3740	649.5085	932.0350	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	978.0048	762.2629	642.3443	375.9263	166.7171	0.0000	0.0000	0.0000	0.0000	367.4639	699.1480	1003.2670	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3599	89.3051	89.1980	88.9505	88.3681	86.7000	86.7000	86.7000	86.7000	88.9099	89.2503	89.3843	(217)
Fuel for water heating, kWh/month													
	199.1216	174.6321	181.3059	159.7588	155.2330	137.9282	129.1940	146.2837	147.4468	165.8947	178.7846	193.1960	(219)
Water heating fuel used												1968.7793	(219)
Annual totals kWh/year													
Space heating fuel - main system												4995.1345	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6888.8540	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4995.1345	0.2160	1078.9490	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.7793	0.2160	425.2563	(264)
Space and water heating			1504.2054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1465.2494	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6300	ZC1
Total Floor Area	TFA	116.0100	
Assumed number of occupants	N	2.8465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2985	ZC2
CO2 emissions from cooking, equation (L16)		1.6147	ZC3
Total CO2 emissions		28.5432	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.5432	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3850	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.4040	(36)
Total fabric heat loss					(33) + (36) =		67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8465	(42)
Average daily hot water use (litres/day)												101.8040	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
              24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    50.9589    46.0274    50.9589    49.2006    48.7655    45.1842    46.6904    48.7655    49.2006    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   2188.7586 (64)
Heat gains from water heating, kWh/month
              67.9579    59.8010    62.5750    55.7477    53.8804    47.2705    45.0082    50.4445    51.0101    57.8524    61.5728    66.2156 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
              91.3412    88.9896    84.1061    77.4274    72.4198    65.6534    60.4949    67.8017    70.8474    77.7586    85.5178    88.9994 (72)
Total internal gains
             466.7848   464.3389   447.6867   420.7181   392.3363   365.3743   348.6102   356.0113   370.8257   398.0269   429.1603   452.8375 (73)
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6. Solar gains

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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700           20.4406 (74)
East                                     1.4200           19.6403           0.6300           0.7000           0.7700            8.5233 (76)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700          108.7320 (78)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000           12.1285 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   616.6092   719.7949   800.0202   865.4850   900.5400   874.9908   837.7677   796.6164   754.7417   680.9100   608.6088   581.0883 (84)
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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha         5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
               0.9989     0.9972     0.9926     0.9765     0.9245     0.7907     0.6170     0.6668     0.8862     0.9838     0.9975     0.9992 (86)

MIT           19.7884    19.9374    20.1676    20.4689    20.7444    20.9289    20.9851    20.9777    20.8569    20.4993    20.0877    19.7644 (87)
Th 2          20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
               0.9985     0.9963     0.9899     0.9669     0.8919     0.7077     0.4938     0.5448     0.8264     0.9755     0.9964     0.9989 (89)
MIT 2         18.3899    18.6093    18.9462    19.3880    19.7675    19.9920    20.0375    20.0353    19.9174    19.4370    18.8374    18.3612 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1527 (91)
MIT           18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT  18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9977     0.9945     0.9863     0.9606     0.8870     0.7165     0.5125     0.5631     0.8280     0.9702     0.9948     0.9983 (94)
Useful gains 615.1712   715.8353   789.0656   831.4208   798.8216   626.9470   429.3911   448.5395   624.9029   660.6464   605.4388   580.0929 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1793.1665  1739.5026  1575.4392  1312.3483  1009.8729   672.9526   435.5257   458.5435   727.7610  1106.0494  1472.9191  1783.7584 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             876.4286   687.9044   585.0620   346.2678   157.0222     0.0000     0.0000     0.0000     0.0000   331.3798   624.5858   895.5271 (98)
Space heating                                                                                                                  4504.1777 (98)
Space heating per m2                                                                                                 (98) / (4) =    38.8258 (99)
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4822.4601	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	876.4286	687.9044	585.0620	346.2678	157.0222	0.0000	0.0000	0.0000	0.0000	331.3798	624.5858	895.5271	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	938.3603	736.5144	626.4047	370.7364	168.1179	0.0000	0.0000	0.0000	0.0000	354.7964	668.7214	958.8085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.0286	191.2730	200.8393	179.8700	174.1459	153.3780	146.9478	163.8124	165.6215	186.6362	197.4174	211.7885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1982	87.9922	87.5848	86.6731	84.7918	80.3000	80.3000	80.3000	80.3000	86.4810	87.7493	88.2764	(217)
Fuel for water heating, kWh/month													
	246.0692	217.3750	229.3085	207.5270	205.3806	191.0062	182.9985	204.0004	206.2534	215.8119	224.9790	239.9153	(219)
Water heating fuel used												2570.6251	(219)
Annual totals kWh/year													
Space heating fuel - main system												4822.4601	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Total delivered energy for all uses												7941.7786	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4822.4601	0.2160	1041.6514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.6251	0.2160	555.2550	(264)
Space and water heating			1596.9064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Total CO2, kg/m2/year			1881.6783	(272)
Emissions per m2 for space and water heating			13.7652	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1192	(272b)
Emissions per m2 for pumps and fans			0.3355	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7652 * 1.00) + 2.1192 + 0.3355, rounded to 2 d.p.			16.2200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.2000	
Infiltration rate			0.3450	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3739	0.3666	0.3593	0.3226	0.3153	0.2786	0.2786	0.2713	0.2933	0.3153	0.3299	0.3446	(22b)
Effective ac	0.5699	0.5672	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5594	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.7108	55.4454	55.1853	53.9635	53.7349	52.6708	52.6708	52.4737	53.0806	53.7349	54.1973	54.6808	(38)
Heat transfer coeff	129.6715	129.4061	129.1460	127.9242	127.6956	126.6315	126.6315	126.4344	127.0413	127.6956	128.1580	128.6415	(39)
Average = Sum(39)m / 12 =												127.9231	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1178	1.1155	1.1132	1.1027	1.1007	1.0916	1.0916	1.0899	1.0951	1.1007	1.1047	1.1089	(40)
HLP (average)												1.1027	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.2898	30.8647	31.8496	27.7672	26.6433	22.9912	21.3047	24.4475	24.7394	28.8314	31.4718	34.1763	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	47.4325	45.9296	42.8086	38.5656	35.8109	31.9322	28.6353	32.8595	34.3603	38.7519	43.7108	45.9359	(72)
Total internal gains													
	419.8761	418.2789	403.3891	378.8563	352.7274	328.6531	313.7507	318.0691	331.3387	356.0201	384.3533	406.7739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	591.1039	710.2286	806.0560	887.1613	933.5316	911.0719	872.7878	821.6178	770.0998	679.3152	589.4373	553.3462	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1282	62.2556	62.3810	62.9768	63.0895	63.6197	63.6197	63.7188	63.4144	63.0895	62.8618	62.6256	
alpha	5.1419	5.1504	5.1587	5.1985	5.2060	5.2413	5.2413	5.2479	5.2276	5.2060	5.1908	5.1750	
util living area													
	0.9991	0.9974	0.9926	0.9756	0.9212	0.7869	0.6150	0.6697	0.8885	0.9849	0.9978	0.9994	(86)
MIT	19.7175	19.8798	20.1259	20.4428	20.7324	20.9235	20.9833	20.9743	20.8427	20.4617	20.0260	19.6883	(87)
Th 2	19.9864	19.9882	19.9900	19.9986	20.0002	20.0077	20.0077	20.0091	20.0048	20.0002	19.9970	19.9936	(88)
util rest of house													
	0.9988	0.9965	0.9898	0.9656	0.8871	0.7014	0.4881	0.5438	0.8282	0.9769	0.9969	0.9991	(89)
MIT 2	18.8107	18.9741	19.2204	19.5388	19.8109	19.9703	20.0032	20.0013	19.9130	19.5618	19.1275	18.7874	(90)
Living area fraction										fLA = Living area / (4) =		0.1527	(91)
MIT	18.9491	19.1124	19.3586	19.6768	19.9516	20.1158	20.1528	20.1499	20.0549	19.6992	19.2646	18.9249	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9491	19.1124	19.3586	19.6768	19.9516	20.1158	20.1528	20.1499	20.0549	19.6992	19.2646	18.9249	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9954	0.9875	0.9614	0.8851	0.7118	0.5076	0.5630	0.8319	0.9737	0.9960	0.9988	(94)
Useful gains	590.0965	706.9744	795.9737	852.9575	826.2459	648.4639	443.0309	462.5459	640.6191	661.4190	587.0790	552.6741	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1899.5742	1839.1713	1660.6412	1378.6095	1053.6889	698.4715	449.9021	474.1140	756.5192	1161.9232	1558.9956	1894.2311	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	974.2514	760.8363	643.3126	378.4695	169.2176	0.0000	0.0000	0.0000	0.0000	372.3751	699.7799	998.1184	(98)
Space heating												4996.3608	(98)
Space heating per m2											(98) / (4) =	43.0684	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1190.3357	937.0728	960.9014	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8322	0.9051	0.8802	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	990.5995	848.1805	845.7386	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.3123	1122.4912	1065.9653	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	128.6732	204.0871	163.8487	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												496.6090	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	32.1683	51.0218	40.9622	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												124.1522	(107)
Space cooling per m2												1.0702	(108)
Energy for space heating												43.0684	(99)
Energy for space cooling												1.0702	(108)
Total												44.1385	(109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3850	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Primary loss    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (59)
Heat gains from water heating, kWh/month
               35.2898    30.8647    31.8496    27.7672    26.6433    22.9912    21.3047    24.4475    24.7394    28.8314    31.4718    34.1763 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
               47.4325    45.9296    42.8086    38.5656    35.8109    31.9322    28.6353    32.8595    34.3603    38.7519    43.7108    45.9359 (72)
Total internal gains
              419.8761   418.2789   403.3891   378.8563   352.7274   328.6531   313.7507   318.0691   331.3387   356.0201   384.3533   406.7739 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c       Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700          20.4406 (74)
East                                     1.4200           19.6403           0.6300           0.7000           0.7700           8.5233 (76)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700         108.7320 (78)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000          12.1285 (82)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains    569.7005   673.7349   755.7227   823.6232   860.9311   838.2696   802.9082   758.6742   715.2546   638.9033   563.8018   535.0247 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha          5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
               0.9992     0.9980     0.9943     0.9809     0.9355     0.8111     0.6397     0.6930     0.9039     0.9878     0.9983     0.9995 (86)

MIT           19.7502    19.9002    20.1325    20.4383    20.7221    20.9190    20.9824    20.9733    20.8385    20.4673    20.0513    19.7267 (87)
Th 2          20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
               0.9990     0.9973     0.9921     0.9730     0.9063     0.7303     0.5140     0.5696     0.8495     0.9813     0.9975     0.9993 (89)
MIT 2         18.8678    19.0194    19.2527    19.5631    19.8332    20.0026    20.0386    20.0369    19.9430    19.5957    19.1795    18.8516 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.1527 (91)
MIT           19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9986     0.9964     0.9903     0.9694     0.9039     0.7398     0.5333     0.5883     0.8522     0.9785     0.9968     0.9990 (94)
Useful gains  568.9046   671.3027   748.3565   798.3937   778.1642   620.1222   428.1819   446.3258   609.5692   625.1485   561.9700   534.4911 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1843.2002  1782.2447  1607.1624  1330.0521  1016.2957   673.8602   435.5823   458.6235   730.0646  1121.9816  1508.0325  1834.6060 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              948.0759   746.5530   638.9516   382.7941   177.1698     0.0000     0.0000     0.0000     0.0000   369.6438   681.1650   967.2855 (98)
Space heating                                                                                                                 4911.6387 (98)
Space heating per m2                                                                                                 (98) / (4) =    42.3381 (99)


-------------------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Calculated for June, July and August. See Table 10b
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Ext. temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000
Heat loss rate W
               0.0000     0.0000     0.0000     0.0000     0.0000  1142.8586   899.6972   922.1483     0.0000     0.0000     0.0000     0.0000 (100)
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8216	0.8990	0.8740	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.9724	808.8081	805.9772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.3888	1041.9369	993.4001	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.4198	173.4478	139.4426	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												418.3102	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3550	43.3619	34.8607	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												104.5776	(107)
Space cooling per m2												0.9015	(108)
Energy for space heating												42.3381	(99)
Energy for space cooling												0.9015	(108)
Total												43.2395	(109)
Target Fabric Energy Efficiency (TFEE)												49.7	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				4.2000	
Infiltration rate				0.3450	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3079	0.2859	0.2933	0.2786	0.2786	0.2713	0.2640	0.2566	0.2493	0.2713	0.2566	0.2713	(22b)
Effective ac	0.5474	0.5409	0.5430	0.5388	0.5388	0.5368	0.5348	0.5329	0.5311	0.5368	0.5329	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.5116	52.8731	53.0806	52.6708	52.6708	52.4737	52.2819	52.0953	51.9140	52.4737	52.0953	52.4737	(38)
Heat transfer coeff	127.4723	126.8338	127.0413	126.6315	126.6315	126.4344	126.2426	126.0560	125.8747	126.4344	126.0560	126.4344	(39)
Average = Sum(39)m / 12 =												126.5119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0988	1.0933	1.0951	1.0916	1.0916	1.0899	1.0882	1.0866	1.0850	1.0899	1.0866	1.0899	(40)
HLP (average)												1.0905	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8651	10.7097	11.8408	11.4368	11.7960	11.3900	11.7538	11.7812	11.4155	11.8195	11.4635	11.8573	(61)
Total heat required for water heating calculated for each month													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
										Solar input (sum of months) = Sum(63)m =		0.0000	(63)
Output from w/h													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
										Total per year (kWh/year) = Sum(64)m =		1740.9028	(64)
RHI water heating demand												1741	(64)
Heat gains from water heating, kWh/month													
	58.1844	50.9716	52.7955	46.3068	44.6380	38.8219	36.2740	41.1984	41.5638	48.0676	52.1099	56.4402	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.2049	75.8506	70.9616	64.3150	59.9973	53.9193	48.7554	55.3741	57.7275	64.6070	72.3749	75.8604	(72)
Total internal gains													
	677.9129	672.3965	645.4601	603.7883	560.8525	522.9114	501.1769	510.9577	535.3585	577.2632	623.6491	658.9978	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1515	977.7034	1071.6649	1149.5309	1157.8236	1175.1753	1121.5407	1080.2288	1027.2844	942.4067	874.6532	835.9157	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2000	63.5182	63.4144	63.6197	63.6197	63.7188	63.8156	63.9101	64.0021	63.7188	63.9101	63.7188	
alpha	5.2133	5.2345	5.2276	5.2413	5.2413	5.2479	5.2544	5.2607	5.2668	5.2479	5.2607	5.2479	
util living area													
	0.9928	0.9876	0.9706	0.9210	0.8076	0.5941	0.4357	0.4511	0.7158	0.9254	0.9831	0.9943	(86)
MIT	20.0434	20.1609	20.3962	20.6747	20.8844	20.9816	20.9970	20.9965	20.9528	20.7203	20.3518	20.0245	(87)
Th 2	20.0018	20.0063	20.0048	20.0077	20.0077	20.0091	20.0105	20.0118	20.0131	20.0091	20.0118	20.0091	(88)
util rest of house													
	0.9904	0.9835	0.9608	0.8944	0.7472	0.4995	0.3270	0.3390	0.6256	0.8939	0.9765	0.9924	(89)
MIT 2	18.7505	18.9237	19.2593	19.6452	19.9052	19.9990	20.0096	20.0108	19.9817	19.7141	19.2049	18.7286	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9535	0.8879	0.7504	0.5133	0.3436	0.3562	0.6371	0.8884	0.9708	0.9894	(94)
Useful gains	876.4330	956.7513	1021.8617	1020.6243	868.8511	603.2737	385.4103	384.7869	654.4879	837.2061	849.0840	827.0286	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1790.7186	1751.8960	1579.4850	1304.6075	956.6639	613.0861	386.3483	385.8920	683.4971	1070.6088	1447.1185	1760.7818	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	680.2284	534.3372	414.8717	204.4678	65.3327	0.0000	0.0000	0.0000	0.0000	173.6516	430.5848	694.7123	(98)
Space heating												3198.1868	(98)
RHI space heating demand												3198	(98)

CALCULATION OF HEAT DEMAND 09 Jan 2014

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3450	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3739	0.3666	0.3593	0.3226	0.3153	0.2786	0.2786	0.2713	0.2933	0.3153	0.3299	0.3446	(22b)
Effective ac	0.5699	0.5672	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5594	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.7108	55.4454	55.1853	53.9635	53.7349	52.6708	52.6708	52.4737	53.0806	53.7349	54.1973	54.6808	(38)
Heat transfer coeff	129.6715	129.4061	129.1460	127.9242	127.6956	126.6315	126.6315	126.4344	127.0413	127.6956	128.1580	128.6415	(39)
Average = Sum(39)m / 12 =												127.9231	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1178	1.1155	1.1132	1.1027	1.1007	1.0916	1.0916	1.0899	1.0951	1.1007	1.1047	1.1089	(40)
HLP (average)												1.1027	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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Energy content (annual)                                                                          Total = Sum(45)m =    1601.7736 (45)
Distribution loss  (46)m = 0.15 x (45)m
               24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8651    10.7097    11.8408    11.4368    11.7960    11.3900    11.7538    11.7812    11.4155    11.8195    11.4635    11.8573 (61)
Total heat required for water heating calculated for each month
              177.9348   155.9553   161.7213   142.1062   137.1764   119.5837   112.0112   126.8280   127.8364   147.4968   159.5658   172.6868 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
              177.9348   155.9553   161.7213   142.1062   137.1764   119.5837   112.0112   126.8280   127.8364   147.4968   159.5658   172.6868 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =    1740.9028 (64)
Heat gains from water heating, kWh/month
               58.1844    50.9716    52.7955    46.3068    44.6380    38.8219    36.2740    41.1984    41.5638    48.0676    52.1099    56.4402 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               67.0562    59.5587    48.4364    36.6695    27.4109    23.1414    25.0051    32.5026    43.6249    55.3918    64.6505    68.9199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              417.7967   422.1321   411.2070   387.9487   358.5893   330.9956   312.5613   308.2259   319.1510   342.4093   371.7687   399.3624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
               78.2049    75.8506    70.9616    64.3150    59.9973    53.9193    48.7554    55.3741    57.7275    64.6070    72.3749    75.8604 (72)
Total internal gains
              677.9129   672.3965   645.4601   603.7883   560.8525   522.9114   501.1769   510.9577   535.3585   577.2632   623.6491   658.9978 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2          Table 6a     Specific data       Specific data       factor                W
                                                          W/m2       or Table 6b         or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                   6.2900           10.6334            0.7200              0.7000            0.7700           23.3607 (74)
East                                    1.4200           19.6403            0.7200              0.7000            0.7700            9.7409 (76)
South                                   7.6100           46.7521            0.7200              0.7000            0.7700          124.2651 (78)
South                                   0.6500           47.0123            0.7200              0.7000            1.0000           13.8611 (82)
-------------------------------------------------------------------------------------------------------------------

Solar gains    171.2279   291.9497   402.6669   508.3050   580.8042   582.4189   559.0371   503.5487   438.7611   323.2950   205.0841   146.5723 (83)
Total gains    849.1408   964.3463  1048.1270  1112.0933  1141.6568  1105.3303  1060.2140  1014.5063   974.1196   900.5582   828.7332   805.5702 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                        21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           62.1282    62.2556    62.3810    62.9768    63.0895    63.6197    63.6197    63.7188    63.4144    63.0895    62.8618    62.6256
alpha          5.1419     5.1504     5.1587     5.1985     5.2060     5.2413     5.2413     5.2479     5.2276     5.2060     5.1908     5.1750
util living area
               0.9950     0.9897     0.9773     0.9421     0.8549     0.6883     0.5168     0.5597     0.7921     0.9532     0.9898     0.9962 (86)

MIT           19.9246    20.0802    20.3086    20.5915    20.8272    20.9594    20.9924    20.9887    20.9142    20.6164    20.2155    19.8918 (87)
Th 2          19.9864    19.9882    19.9900    19.9986    20.0002    20.0077    20.0077    20.0091    20.0048    20.0002    19.9970    19.9936 (88)
util rest of house
               0.9934     0.9864     0.9697     0.9220     0.8062     0.5994     0.4048     0.4460     0.7139     0.9327     0.9860     0.9950 (89)
MIT 2         18.5664    18.7935    19.1236    19.5268    19.8333    19.9810    20.0050    20.0045    19.9392    19.5691    18.9978    18.5239 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.1527 (91)
MIT           18.7738    18.9900    19.3045    19.6894    19.9850    20.1304    20.1557    20.1548    20.0881    19.7289    19.1837    18.7327 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.7738    18.9900    19.3045    19.6894    19.9850    20.1304    20.1557    20.1548    20.0881    19.7289    19.1837    18.7327 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9907     0.9819     0.9629     0.9143     0.8053     0.6110     0.4219     0.4633     0.7212     0.9257     0.9815     0.9927 (94)
Useful gains 841.2037   946.9153  1009.2647  1016.8333   919.3923   675.4065   447.3406   469.9982   702.4875   833.6184   813.4072   799.6603 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1876.8356  1823.3274  1653.6560  1380.2200  1057.9593   700.3168   450.2652   474.7342   760.7320  1165.7263  1548.6196  1869.5127 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              770.5101   588.9489   479.4271   261.6384   103.0939     0.0000     0.0000     0.0000     0.0000   247.0883   529.3529   795.9701 (98)
Space heating                                                                                                                 3776.0298 (98)
Space heating per m2                                                                                          (98) / (4) =     32.5492 (99)
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4064.6176	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	770.5101	588.9489	479.4271	261.6384	103.0939	0.0000	0.0000	0.0000	0.0000	247.0883	529.3529	795.9701	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	829.3973	633.9601	516.0679	281.6344	110.9730	0.0000	0.0000	0.0000	0.0000	265.9724	569.8094	856.8032	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2818	89.2106	89.0708	88.7471	88.0447	86.7000	86.7000	86.7000	86.7000	88.6766	89.1380	89.3123	(217)
Fuel for water heating, kWh/month													
	199.2957	174.8170	181.5649	160.1249	155.8031	137.9282	129.1940	146.2837	147.4468	166.3312	179.0099	193.3516	(219)
Water heating fuel used												1971.1512	(219)
Annual totals kWh/year													
Space heating fuel - main system												4064.6176	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5960.7091	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4064.6176	3.4800	141.4487	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1971.1512	3.4800	68.5961	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			320.1444	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8351	(257)
SAP value		88.3503	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4064.6176	0.2160	877.9574	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1971.1512	0.2160	425.7687	(264)
Space and water heating			1303.7261	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1264.7701	(272)
CO2 emissions per m2			10.9000	(273)
EI value			89.4740	
EI rating			89	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact	0.216 / 0.8819 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			4.2000	
Infiltration rate			0.3450	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3079	0.2859	0.2933	0.2786	0.2786	0.2713	0.2640	0.2566	0.2493	0.2713	0.2566	0.2713	(22b)
Effective ac	0.5474	0.5409	0.5430	0.5388	0.5388	0.5368	0.5348	0.5329	0.5311	0.5368	0.5329	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.5116	52.8731	53.0806	52.6708	52.6708	52.4737	52.2819	52.0953	51.9140	52.4737	52.0953	52.4737	(38)
Heat transfer coeff	127.4723	126.8338	127.0413	126.6315	126.6315	126.4344	126.2426	126.0560	125.8747	126.4344	126.0560	126.4344	(39)
Average = Sum(39)m / 12 =												126.5119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0988	1.0933	1.0951	1.0916	1.0916	1.0899	1.0882	1.0866	1.0850	1.0899	1.0866	1.0899	(40)
HLP (average)												1.0905	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8651	10.7097	11.8408	11.4368	11.7960	11.3900	11.7538	11.7812	11.4155	11.8195	11.4635	11.8573	(61)
Total heat required for water heating calculated for each month													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.9028	(64)
Heat gains from water heating, kWh/month													
	58.1844	50.9716	52.7955	46.3068	44.6380	38.8219	36.2740	41.1984	41.5638	48.0676	52.1099	56.4402	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.2049	75.8506	70.9616	64.3150	59.9973	53.9193	48.7554	55.3741	57.7275	64.6070	72.3749	75.8604	(72)
Total internal gains													
	677.9129	672.3965	645.4601	603.7883	560.8525	522.9114	501.1769	510.9577	535.3585	577.2632	623.6491	658.9978	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1515	977.7034	1071.6649	1149.5309	1157.8236	1175.1753	1121.5407	1080.2288	1027.2844	942.4067	874.6532	835.9157	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2000	63.5182	63.4144	63.6197	63.6197	63.7188	63.8156	63.9101	64.0021	63.7188	63.9101	63.7188	
alpha	5.2133	5.2345	5.2276	5.2413	5.2413	5.2479	5.2544	5.2607	5.2668	5.2479	5.2607	5.2479	
util living area													
	0.9928	0.9876	0.9706	0.9210	0.8076	0.5941	0.4357	0.4511	0.7158	0.9254	0.9831	0.9943	(86)
MIT	20.0434	20.1609	20.3962	20.6747	20.8844	20.9816	20.9970	20.9965	20.9528	20.7203	20.3518	20.0245	(87)
Th 2	20.0018	20.0063	20.0048	20.0077	20.0077	20.0091	20.0105	20.0118	20.0131	20.0091	20.0118	20.0091	(88)
util rest of house													
	0.9904	0.9835	0.9608	0.8944	0.7472	0.4995	0.3270	0.3390	0.6256	0.8939	0.9765	0.9924	(89)
MIT 2	18.7505	18.9237	19.2593	19.6452	19.9052	19.9990	20.0096	20.0108	19.9817	19.7141	19.2049	18.7286	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9535	0.8879	0.7504	0.5133	0.3436	0.3562	0.6371	0.8884	0.9708	0.9894	(94)
Useful gains	876.4330	956.7513	1021.8617	1020.6243	868.8511	603.2737	385.4103	384.7869	654.4879	837.2061	849.0840	827.0286	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1790.7186	1751.8960	1579.4850	1304.6075	956.6639	613.0861	386.3483	385.8920	683.4971	1070.6088	1447.1185	1760.7818	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	680.2284	534.3372	414.8717	204.4678	65.3327	0.0000	0.0000	0.0000	0.0000	173.6516	430.5848	694.7123	(98)
Space heating												3198.1868	(98)
Space heating per m2											(98) / (4) =	27.5682	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3442.6122	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	680.2284	534.3372	414.8717	204.4678	65.3327	0.0000	0.0000	0.0000	0.0000	173.6516	430.5848	694.7123	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	732.2158	575.1746	446.5788	220.0946	70.3259	0.0000	0.0000	0.0000	0.0000	186.9232	463.4928	747.8066	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2172	89.1566	88.9789	88.5598	87.7072	86.7000	86.7000	86.7000	86.7000	88.4015	89.0117	89.2442	(217)
Fuel for water heating, kWh/month													
	199.4399	174.9230	181.7524	160.4637	156.4027	137.9282	129.1940	146.2837	147.4468	166.8488	179.2639	193.4992	(219)
Water heating fuel used												1973.4463	(219)
Annual totals kWh/year													
Space heating fuel - main system												3442.6122	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												5271.8138	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3442.6122	7.3800	254.0648	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1973.4463	7.3800	145.6403	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			465.3646	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3442.6122	0.2160	743.6042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.4463	0.2160	426.2644	(264)
Space and water heating			1169.8686	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			1095.0056	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3442.6122	1.2200	4199.9869	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.4463	1.2200	2407.6045	(264)
Space and water heating			6607.5914	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			6164.7600	(272)
Primary energy kWh/m2/year			53.1399	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-197 kg (18.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.70 kg/m²	B 89	B 91
Total Savings	£62	1.70 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£172	-£14
Mains gas	£507	£431	£76
Space heating	£383	£383	£0
Water heating	£146	£84	£62
Lighting	£136	£136	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£465	£404	£62
Total cost of uses	£466	£404	£62
Delivered energy	45 kWh/m²	37 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	44 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3450	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3739	0.3666	0.3593	0.3226	0.3153	0.2786	0.2786	0.2713	0.2933	0.3153	0.3299	0.3446	(22b)
Effective ac	0.5699	0.5672	0.5645	0.5520	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5544	0.5594	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	55.7108	55.4454	55.1853	53.9635	53.7349	52.6708	52.6708	52.4737	53.0806	53.7349	54.1973	54.6808	(38)
Heat transfer coeff	129.6715	129.4061	129.1460	127.9242	127.6956	126.6315	126.6315	126.4344	127.0413	127.6956	128.1580	128.6415	(39)
Average = Sum(39)m / 12 =												127.9231	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1178	1.1155	1.1132	1.1027	1.1007	1.0916	1.0916	1.0899	1.0951	1.1007	1.1047	1.1089	(40)
HLP (average)												1.1027	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8651	10.7097	11.8408	11.4368	11.7960	11.3900	11.7538	11.7812	11.4155	11.8195	11.4635	11.8573	(61)
Total heat required for water heating calculated for each month													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1322	(H8)
Utilisation factor												0.5865	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-878.1906	(H17)
Solar input	-25.4658	-42.4951	-72.3740	-96.9954	-119.8296	-117.8116	-116.2547	-101.5723	-79.5515	-54.3243	-30.2061	-21.3105	(63)
										Solar input (sum of months) = Sum(63)m =		-878.1906	(63)
Output from w/h													
	152.4690	113.4603	89.3473	45.1109	17.3468	1.7722	0.0000	25.2557	48.2849	93.1725	129.3598	151.3763	(64)
										Total per year (kWh/year) = Sum(64)m =		866.9557	(64)
Heat gains from water heating, kWh/month													
	58.1844	50.9716	52.7955	46.3068	44.6380	38.8219	36.2740	41.1984	41.5638	48.0676	52.1099	56.4402	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.2049	75.8506	70.9616	64.3150	59.9973	53.9193	48.7554	55.3741	57.7275	64.6070	72.3749	75.8604	(72)
Total internal gains													
	677.9129	672.3965	645.4601	603.7883	560.8525	522.9114	501.1769	510.9577	535.3585	577.2632	623.6491	658.9978	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	849.1408	964.3463	1048.1270	1112.0933	1141.6568	1105.3303	1060.2140	1014.5063	974.1196	900.5582	828.7332	805.5702	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.1282	62.2556	62.3810	62.9768	63.0895	63.6197	63.6197	63.7188	63.4144	63.0895	62.8618	62.6256	
alpha	5.1419	5.1504	5.1587	5.1985	5.2060	5.2413	5.2413	5.2479	5.2276	5.2060	5.1908	5.1750	
util living area													
	0.9950	0.9897	0.9773	0.9421	0.8549	0.6883	0.5168	0.5597	0.7921	0.9532	0.9898	0.9962	(86)
MIT	19.9246	20.0802	20.3086	20.5915	20.8272	20.9594	20.9924	20.9887	20.9142	20.6164	20.2155	19.8918	(87)
Th 2	19.9864	19.9882	19.9900	19.9986	20.0002	20.0077	20.0077	20.0091	20.0048	20.0002	19.9970	19.9936	(88)
util rest of house													
	0.9934	0.9864	0.9697	0.9220	0.8062	0.5994	0.4048	0.4460	0.7139	0.9327	0.9860	0.9950	(89)
MIT 2	18.5664	18.7935	19.1236	19.5268	19.8333	19.9810	20.0050	20.0045	19.9392	19.5691	18.9978	18.5239	(90)
Living area fraction										fLA = Living area / (4) =		0.1527	(91)
MIT	18.7738	18.9900	19.3045	19.6894	19.9850	20.1304	20.1557	20.1548	20.0881	19.7289	19.1837	18.7327	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7738	18.9900	19.3045	19.6894	19.9850	20.1304	20.1557	20.1548	20.0881	19.7289	19.1837	18.7327	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9819	0.9629	0.9143	0.8053	0.6110	0.4219	0.4633	0.7212	0.9257	0.9815	0.9927	(94)
Useful gains	841.2037	946.9153	1009.2647	1016.8333	919.3923	675.4065	447.3406	469.9982	702.4875	833.6184	813.4072	799.6603	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1876.8356	1823.3274	1653.6560	1380.2200	1057.9593	700.3168	450.2652	474.7342	760.7320	1165.7263	1548.6196	1869.5127	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	770.5101	588.9489	479.4271	261.6384	103.0939	0.0000	0.0000	0.0000	0.0000	247.0883	529.3529	795.9701	(98)
Space heating												3776.0298	(98)
Space heating per m2											(98) / (4) =	32.5492	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4064.6176	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	770.5101	588.9489	479.4271	261.6384	103.0939	0.0000	0.0000	0.0000	0.0000	247.0883	529.3529	795.9701	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	829.3973	633.9601	516.0679	281.6344	110.9730	0.0000	0.0000	0.0000	0.0000	265.9724	569.8094	856.8032	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	152.4690	113.4603	89.3473	45.1109	17.3468	1.7722	0.0000	25.2557	48.2849	93.1725	129.3598	151.3763	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3552	89.3672	89.3818	89.4147	89.4246	86.7000	86.7000	86.7000	86.7000	89.0005	89.2531	89.3729	(217)
Fuel for water heating, kWh/month	170.6325	126.9596	99.9614	50.4513	19.3982	2.0440	0.0000	29.1300	55.6920	104.6877	144.9359	169.3761	(219)
Water heating fuel used												973.2687	(219)
Annual totals kWh/year													
Space heating fuel - main system												4064.6176	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5012.8267	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4064.6176	3.4800	141.4487	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.2687	3.4800	33.8698	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			292.0131	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7617	(257)
SAP value	89.3739	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4064.6176	0.2160	877.9574	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.2687	0.2160	210.2260	(264)
Space and water heating			1088.1835	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1075.1775	(272)
CO2 emissions per m2			9.2700	(273)
EI value			91.0519	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		4.2000	
Infiltration rate		0.3450	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2933	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3079	0.2859	0.2933	0.2786	0.2786	0.2713	0.2640	0.2566	0.2493	0.2713	0.2566	0.2713	(22b)
Effective ac	0.5474	0.5409	0.5430	0.5388	0.5388	0.5368	0.5348	0.5329	0.5311	0.5368	0.5329	0.5368	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.5116	52.8731	53.0806	52.6708	52.6708	52.4737	52.2819	52.0953	51.9140	52.4737	52.0953	52.4737	(38)
Heat transfer coeff	127.4723	126.8338	127.0413	126.6315	126.6315	126.4344	126.2426	126.0560	125.8747	126.4344	126.0560	126.4344	(39)
Average = Sum(39)m / 12 =												126.5119	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0988	1.0933	1.0951	1.0916	1.0916	1.0899	1.0882	1.0866	1.0850	1.0899	1.0866	1.0899	(40)
HLP (average)												1.0905	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8651	10.7097	11.8408	11.4368	11.7960	11.3900	11.7538	11.7812	11.4155	11.8195	11.4635	11.8573	(61)
Total heat required for water heating calculated for each month													
	177.9348	155.9553	161.7213	142.1062	137.1764	119.5837	112.0112	126.8280	127.8364	147.4968	159.5658	172.6868	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2672	(H8)
Utilisation factor												0.5458	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-914.5224	(H17)
Solar input	-29.8339	-42.4220	-72.9131	-98.3767	-115.5494	-123.4250	-120.8293	-108.1459	-84.6708	-58.5385	-35.2857	-24.5322	(63)
										Solar input (sum of months) = Sum(63)m =		-914.5224	(63)
Output from w/h													
	148.1008	113.5334	88.8081	43.7295	21.6270	0.0000	0.0000	18.6821	43.1656	88.9583	124.2802	148.1547	(64)
										Total per year (kWh/year) = Sum(64)m =		839.0398	(64)
Heat gains from water heating, kWh/month													
	58.1844	50.9716	52.7955	46.3068	44.6380	38.8219	36.2740	41.1984	41.5638	48.0676	52.1099	56.4402	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.2049	75.8506	70.9616	64.3150	59.9973	53.9193	48.7554	55.3741	57.7275	64.6070	72.3749	75.8604	(72)
Total internal gains													
	677.9129	672.3965	645.4601	603.7883	560.8525	522.9114	501.1769	510.9577	535.3585	577.2632	623.6491	658.9978	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1515	977.7034	1071.6649	1149.5309	1157.8236	1175.1753	1121.5407	1080.2288	1027.2844	942.4067	874.6532	835.9157	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2000	63.5182	63.4144	63.6197	63.6197	63.7188	63.8156	63.9101	64.0021	63.7188	63.9101	63.7188	
alpha	5.2133	5.2345	5.2276	5.2413	5.2413	5.2479	5.2544	5.2607	5.2668	5.2479	5.2607	5.2479	
util living area													
	0.9928	0.9876	0.9706	0.9210	0.8076	0.5941	0.4357	0.4511	0.7158	0.9254	0.9831	0.9943	(86)
MIT	20.0434	20.1609	20.3962	20.6747	20.8844	20.9816	20.9970	20.9965	20.9528	20.7203	20.3518	20.0245	(87)
Th 2	20.0018	20.0063	20.0048	20.0077	20.0077	20.0091	20.0105	20.0118	20.0131	20.0091	20.0118	20.0091	(88)
util rest of house													
	0.9904	0.9835	0.9608	0.8944	0.7472	0.4995	0.3270	0.3390	0.6256	0.8939	0.9765	0.9924	(89)
MIT 2	18.7505	18.9237	19.2593	19.6452	19.9052	19.9990	20.0096	20.0108	19.9817	19.7141	19.2049	18.7286	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9479	19.1125	19.4328	19.8024	20.0547	20.1490	20.1604	20.1613	20.1300	19.8677	19.3800	18.9264	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9786	0.9535	0.8879	0.7504	0.5133	0.3436	0.3562	0.6371	0.8884	0.9708	0.9894	(94)
Useful gains	876.4330	956.7513	1021.8617	1020.6243	868.8511	603.2737	385.4103	384.7869	654.4879	837.2061	849.0840	827.0286	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1790.7186	1751.8960	1579.4850	1304.6075	956.6639	613.0861	386.3483	385.8920	683.4971	1070.6088	1447.1185	1760.7818	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	680.2284	534.3372	414.8717	204.4678	65.3327	0.0000	0.0000	0.0000	0.0000	173.6516	430.5848	694.7123	(98)
Space heating												3198.1868	(98)
Space heating per m2											(98) / (4) =	27.5682	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3442.6122	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	680.2284	534.3372	414.8717	204.4678	65.3327	0.0000	0.0000	0.0000	0.0000	173.6516	430.5848	694.7123	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	732.2158	575.1746	446.5788	220.0946	70.3259	0.0000	0.0000	0.0000	0.0000	186.9232	463.4928	747.8066	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.1008	113.5334	88.8081	43.7295	21.6270	0.0000	0.0000	18.6821	43.1656	88.9583	124.2802	148.1547	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3106	89.3223	89.3187	89.3192	89.0823	86.7000	86.7000	86.7000	86.7000	88.7899	89.1629	89.3205	(217)
Fuel for water heating, kWh/month													
	165.8267	127.1053	99.4283	48.9587	24.2776	0.0000	0.0000	21.5480	49.7873	100.1897	139.3855	165.8686	(219)
Water heating fuel used												942.3757	(219)
Annual totals kWh/year													
Space heating fuel - main system												3442.6122	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4290.7432	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3442.6122	7.3800	254.0648	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.3757	7.3800	69.5473	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			403.6016	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3442.6122	0.2160	743.6042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.3757	0.2160	203.5532	(264)
Space and water heating			947.1574	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-692.9382	0.5190	-359.6349 (269)
Total kg/year			898.2444 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3442.6122	1.2200	4199.9869	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.3757	1.2200	1149.6984	(264)
Space and water heating			5349.6853	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5060.3539	(272)
Primary energy kWh/m2/year			43.6200	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		782.03 (P1)
Transmission heat loss coefficient		73.96 (37)
Summer heat loss coefficient		855.99 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
South	0.850	1.00	1.000	0.850	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.2900	87.1704	0.7200	0.7000	0.7650	190.2630
East	1.4200	125.2818	0.7200	0.7000	0.7650	61.7321
South	7.6100	118.5567	0.7200	0.7000	0.7650	313.0727
South	0.6500	202.9386	0.7200	0.7000	0.8500	50.8593
total:						615.9270

	Jun	Jul	Aug	
Solar gains	658	616	563	(P3)
Internal gains	520	498	508	
Total summer gains	1178	1114	1071	(P5)
Summer gain/loss ratio	1.38	1.30	1.25	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.03	18.85	18.80	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 665 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 665 EPC	**Prop Type Ref**	
Property	5 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	88 B	**DER**	12.63	**TER**	16.22
Environmental	89 B	**% DER<TER**	22.13		
CO_2 Emissions (t/year)	1.10	**DFEE**	44.14	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.24		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.63	$kgCO_2/m^2$	Pass
	-3.59 (-22.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.14	$kWh/m^2/yr$	
	-5.6 (-11.3%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Potterton ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	6.29 m², No overhang 1.42 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.20 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.026	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 666	**Issued on Date**	07/08/2024
Assessment Reference	EPC - Plot 666	**Prop Type Ref**	Opp
Property	7 Kittiwake Place, Boorley Green, SOUTHAMPTON, SO32 2ZB		

SAP Rating	88 B	**DER**	12.55	**TER**	16.22
Environmental	90 B	**% DER<TER**	22.63		
CO_2 Emissions (t/year)	1.05	**DFEE**	43.77	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 116 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.55 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.8 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.74 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.29 m², No overhang
Windows facing South: 7.61 m², No overhang
Windows facing West: 1.42 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.026 W/m²K
Air permeability 3.7 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.3220	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3490	0.3422	0.3353	0.3011	0.2943	0.2600	0.2600	0.2532	0.2737	0.2943	0.3079	0.3216	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5321	0.5375	0.5433	0.5474	0.5517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.8300	54.5988	54.3722	53.3079	53.1088	52.1818	52.1818	52.0101	52.5388	53.1088	53.5116	53.9328	(38)
Heat transfer coeff	128.7907	128.5595	128.3329	127.2686	127.0695	126.1425	126.1425	125.9708	126.4995	127.0695	127.4723	127.8935	(39)
Average = Sum(39)m / 12 =												127.2677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1102	1.1082	1.1062	1.0970	1.0953	1.0873	1.0873	1.0859	1.0904	1.0953	1.0988	1.1024	(40)
HLP (average)												1.0970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)	
Total heat required for water heating calculated for each month													
177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)	
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
									Solar input (sum of months) = Sum(63)m =		0.0000	(63)	
Output from w/h													
177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)	
									Total per year (kWh/year) = Sum(64)m =		1740.5488	(64)	
Heat gains from water heating, kWh/month													
58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)	
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	453.6383	451.1898	434.5321	407.5956	379.9036	353.6301	336.8607	343.5737	357.6958	384.8651	416.0072	439.6884	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	624.8662	743.1395	837.1989	915.9006	960.7078	936.0490	895.8978	847.1223	796.4569	708.1601	621.0913	586.2607	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5530	62.6655	62.7762	63.3012	63.4004	63.8663	63.8663	63.9533	63.6860	63.4004	63.2000	62.9919	
alpha	5.1702	5.1777	5.1851	5.2201	5.2267	5.2578	5.2578	5.2636	5.2457	5.2267	5.2133	5.1995	
util living area													
	0.9988	0.9968	0.9912	0.9720	0.9125	0.7722	0.5995	0.6518	0.8757	0.9818	0.9972	0.9992	(86)
MIT	19.7550	19.9158	20.1586	20.4689	20.7506	20.9308	20.9853	20.9776	20.8565	20.4879	20.0582	19.7237	(87)
Th 2	19.9925	19.9942	19.9958	20.0032	20.0046	20.0112	20.0112	20.0124	20.0087	20.0046	20.0018	19.9988	(88)
util rest of house													
	0.9984	0.9957	0.9879	0.9608	0.8761	0.6856	0.4750	0.5275	0.8121	0.9725	0.9961	0.9989	(89)
MIT 2	18.3238	18.5597	18.9143	19.3650	19.7488	19.9623	20.0055	20.0026	19.8880	19.3982	18.7739	18.2825	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.5423	18.7668	19.1042	19.5335	19.9017	20.1101	20.1550	20.1514	20.0358	19.5646	18.9700	18.5025	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5423	18.7668	19.1042	19.5335	19.9017	20.1101	20.1550	20.1514	20.0358	19.5646	18.9700	18.5025	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9937	0.9839	0.9538	0.8715	0.6952	0.4939	0.5461	0.8142	0.9667	0.9943	0.9982	(94)
Useful gains	623.2905	738.4489	823.6892	873.5973	837.2786	650.7726	442.4747	462.6366	648.4389	684.6032	617.5486	585.1861	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1834.2726	1782.7030	1617.5369	1353.3095	1042.1898	695.0611	448.4412	472.5726	750.8818	1139.1238	1513.0902	1829.2003	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
900.9707	701.7388	590.6227	345.3928	152.4539	0.0000	0.0000	0.0000	0.0000	338.1633	644.7899	925.5466	(98)	
Space heating												4599.6786	(98)
Space heating per m2											(98) / (4) =	39.6490	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4951.2149	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	900.9707	701.7388	590.6227	345.3928	152.4539	0.0000	0.0000	0.0000	0.0000	338.1633	644.7899	925.5466	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	969.8285	755.3700	635.7618	371.7899	164.1054	0.0000	0.0000	0.0000	0.0000	364.0079	694.0688	996.2826	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3562	89.3008	89.1925	88.9432	88.3556	86.7000	86.7000	86.7000	86.7000	88.9036	89.2466	89.3813	(217)
Fuel for water heating, kWh/month													
	199.0962	174.6101	181.2835	159.7392	155.2208	137.8946	129.1593	146.2490	147.4133	165.8727	178.7594	193.1687	(219)
Water heating fuel used												1968.4667	(219)
Annual totals kWh/year													
Space heating fuel - main system												4951.2149	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6844.6219	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4951.2149	0.2160	1069.4624	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.4667	0.2160	425.1888	(264)
Space and water heating			1494.6512	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1455.6952	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5500	ZC1
Total Floor Area	TFA	116.0100	
Assumed number of occupants	N	2.8465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2985	ZC2
CO2 emissions from cooking, equation (L16)		1.6147	ZC3
Total CO2 emissions		28.4632	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4632	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3850	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    50.9589    46.0274    50.9589    49.2006    48.7655    45.1842    46.6904    48.7655    49.2006    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   2188.7586 (64)
Heat gains from water heating, kWh/month
              67.9579    59.8010    62.5750    55.7477    53.8804    47.2705    45.0082    50.4445    51.0101    57.8524    61.5728    66.2156 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
              91.3412    88.9896    84.1061    77.4274    72.4198    65.6534    60.4949    67.8017    70.8474    77.7586    85.5178    88.9994 (72)
Total internal gains
             466.7848   464.3389   447.6867   420.7181   392.3363   365.3743   348.6102   356.0113   370.8257   398.0269   429.1603   452.8375 (73)
```

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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700           20.4406 (74)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700          108.7320 (78)
West                                     1.4200           19.6403           0.6300           0.7000           0.7700            8.5233 (80)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000           12.1285 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   616.6092   719.7949   800.0202   865.4850   900.5400   874.9908   837.7677   796.6164   754.7417   680.9100   608.6088   581.0883 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha         5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
               0.9989     0.9972     0.9926     0.9765     0.9245     0.7907     0.6170     0.6668     0.8862     0.9838     0.9975     0.9992 (86)

MIT           19.7884    19.9374    20.1676    20.4689    20.7444    20.9289    20.9851    20.9777    20.8569    20.4993    20.0877    19.7644 (87)
Th 2          20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
               0.9985     0.9963     0.9899     0.9669     0.8919     0.7077     0.4938     0.5448     0.8264     0.9755     0.9964     0.9989 (89)
MIT 2         18.3899    18.6093    18.9462    19.3880    19.7675    19.9920    20.0375    20.0353    19.9174    19.4370    18.8374    18.3612 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1527 (91)
MIT           18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT  18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9977     0.9945     0.9863     0.9606     0.8870     0.7165     0.5125     0.5631     0.8280     0.9702     0.9948     0.9983 (94)
Useful gains 615.1712   715.8353   789.0656   831.4208   798.8216   626.9470   429.3911   448.5395   624.9029   660.6464   605.4388   580.0929 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1793.1665  1739.5026  1575.4392  1312.3483  1009.8729   672.9526   435.5257   458.5435   727.7610  1106.0494  1472.9191  1783.7584 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             876.4286   687.9044   585.0620   346.2678   157.0222     0.0000     0.0000     0.0000     0.0000   331.3798   624.5858   895.5271 (98)
Space heating                                                                                                                  4504.1777 (98)
Space heating per m2                                                                                                (98) / (4) =     38.8258 (99)
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4822.4601	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	876.4286	687.9044	585.0620	346.2678	157.0222	0.0000	0.0000	0.0000	0.0000	331.3798	624.5858	895.5271	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	938.3603	736.5144	626.4047	370.7364	168.1179	0.0000	0.0000	0.0000	0.0000	354.7964	668.7214	958.8085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.0286	191.2730	200.8393	179.8700	174.1459	153.3780	146.9478	163.8124	165.6215	186.6362	197.4174	211.7885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1982	87.9922	87.5848	86.6731	84.7918	80.3000	80.3000	80.3000	80.3000	86.4810	87.7493	88.2764	(217)
Fuel for water heating, kWh/month													
	246.0692	217.3750	229.3085	207.5270	205.3806	191.0062	182.9985	204.0004	206.2534	215.8119	224.9790	239.9153	(219)
Water heating fuel used												2570.6251	(219)
Annual totals kWh/year													
Space heating fuel - main system												4822.4601	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Total delivered energy for all uses												7941.7786	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4822.4601	0.2160	1041.6514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.6251	0.2160	555.2550	(264)
Space and water heating			1596.9064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Total CO2, kg/m2/year			1881.6783	(272)
Emissions per m2 for space and water heating			13.7652	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1192	(272b)
Emissions per m2 for pumps and fans			0.3355	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7652 * 1.00) + 2.1192 + 0.3355, rounded to 2 d.p.			16.2200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.7400	
Infiltration rate				0.3220	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3490	0.3422	0.3353	0.3011	0.2943	0.2600	0.2600	0.2532	0.2737	0.2943	0.3079	0.3216	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5321	0.5375	0.5433	0.5474	0.5517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.8300	54.5988	54.3722	53.3079	53.1088	52.1818	52.1818	52.0101	52.5388	53.1088	53.5116	53.9328	(38)
Heat transfer coeff	128.7907	128.5595	128.3329	127.2686	127.0695	126.1425	126.1425	125.9708	126.4995	127.0695	127.4723	127.8935	(39)
Average = Sum(39)m / 12 =												127.2677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1102	1.1082	1.1062	1.0970	1.0953	1.0873	1.0873	1.0859	1.0904	1.0953	1.0988	1.1024	(40)
HLP (average)												1.0970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1601.7736 (45)

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

35.2898	30.8647	31.8496	27.7672	26.6433	22.9912	21.3047	24.4475	24.7394	28.8314	31.4718	34.1763	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)

Pumps, fans

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)

Water heating gains (Table 5)

47.4325	45.9296	42.8086	38.5656	35.8109	31.9322	28.6353	32.8595	34.3603	38.7519	43.7108	45.9359	(72)

Total internal gains

419.8761	418.2789	403.3891	378.8563	352.7274	328.6531	313.7507	318.0691	331.3387	356.0201	384.3533	406.7739	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	591.1039	710.2286	806.0560	887.1613	933.5316	911.0719	872.7878	821.6178	770.0998	679.3152	589.4373	553.3462	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5530	62.6655	62.7762	63.3012	63.4004	63.8663	63.8663	63.9533	63.6860	63.4004	63.2000	62.9919	
alpha	5.1702	5.1777	5.1851	5.2201	5.2267	5.2578	5.2578	5.2636	5.2457	5.2267	5.2133	5.1995	
util living area													
	0.9991	0.9974	0.9926	0.9754	0.9204	0.7854	0.6132	0.6680	0.8875	0.9848	0.9978	0.9994	(86)
MIT	19.7277	19.8894	20.1343	20.4485	20.7363	20.9249	20.9837	20.9749	20.8450	20.4664	20.0327	19.6970	(87)
Th 2	19.9925	19.9942	19.9958	20.0032	20.0046	20.0112	20.0112	20.0124	20.0087	20.0046	20.0018	19.9988	(88)
util rest of house													
	0.9988	0.9965	0.9898	0.9653	0.8861	0.6999	0.4869	0.5426	0.8271	0.9768	0.9969	0.9991	(89)
MIT 2	18.8259	18.9885	19.2334	19.5482	19.8182	19.9744	20.0068	20.0048	19.9182	19.5700	19.1381	18.8003	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9635	19.1261	19.3710	19.6856	19.9583	20.1195	20.1559	20.1529	20.0597	19.7069	19.2746	18.9372	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9635	19.1261	19.3710	19.6856	19.9583	20.1195	20.1559	20.1529	20.0597	19.7069	19.2746	18.9372	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9954	0.9874	0.9612	0.8842	0.7104	0.5063	0.5616	0.8308	0.9735	0.9960	0.9988	(94)
Useful gains	590.1021	706.9761	795.9352	852.7386	825.4407	647.2080	441.8659	461.4559	639.8224	661.3309	587.0814	552.6782	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1888.5275	1828.8950	1651.7704	1372.6714	1049.3830	696.2470	448.5543	472.7547	753.9008	1157.2062	1551.9306	1884.7880	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	966.0285	753.9295	636.7414	374.3516	166.6131	0.0000	0.0000	0.0000	0.0000	368.9312	694.6914	991.0897	(98)
Space heating												4952.3764	(98)
Space heating per m2											(98) / (4) =	42.6892	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1185.7393	933.4544	957.3782	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8343	0.9067	0.8819	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	989.2386	846.3767	844.2658	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.3123	1122.4912	1065.9653	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	129.6531	205.4292	164.9444	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												500.0267	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	32.4133	51.3573	41.2361	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												125.0067	(107)
Space cooling per m2												1.0776	(108)
Energy for space heating												42.6892	(99)
Energy for space cooling												1.0776	(108)
Total												43.7668	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.8	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3850	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (46)
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Primary loss    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (59)
Heat gains from water heating, kWh/month
               35.2898    30.8647    31.8496    27.7672    26.6433    22.9912    21.3047    24.4475    24.7394    28.8314    31.4718    34.1763 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
               47.4325    45.9296    42.8086    38.5656    35.8109    31.9322    28.6353    32.8595    34.3603    38.7519    43.7108    45.9359 (72)
Total internal gains
              419.8761   418.2789   403.3891   378.8563   352.7274   328.6531   313.7507   318.0691   331.3387   356.0201   384.3533   406.7739 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data       Specific data      factor                W
                                                           W/m2      or Table 6b         or Table 6c        Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700           20.4406 (74)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700          108.7320 (78)
West                                     1.4200           19.6403           0.6300           0.7000           0.7700            8.5233 (80)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000           12.1285 (82)
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Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   569.7005   673.7349   755.7227   823.6232   860.9311   838.2696   802.9082   758.6742   715.2546   638.9033   563.8018   535.0247 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha          5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
               0.9992     0.9980     0.9943     0.9809     0.9355     0.8111     0.6397     0.6930     0.9039     0.9878     0.9983     0.9995 (86)

MIT           19.7502    19.9002    20.1325    20.4383    20.7221    20.9190    20.9824    20.9733    20.8385    20.4673    20.0513    19.7267 (87)
Th 2          20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
               0.9990     0.9973     0.9921     0.9730     0.9063     0.7303     0.5140     0.5696     0.8495     0.9813     0.9975     0.9993 (89)
MIT 2         18.8678    19.0194    19.2527    19.5631    19.8332    20.0026    20.0386    20.0369    19.9430    19.5957    19.1795    18.8516 (90)
Living area fraction                                                                                  fLA = Living area / (4) =      0.1527 (91)
MIT           19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  19.0025    19.1539    19.3870    19.6967    19.9689    20.1425    20.1827    20.1798    20.0797    19.7288    19.3126    18.9852 (93)


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8. Space heating requirement
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                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation     0.9986     0.9964     0.9903     0.9694     0.9039     0.7398     0.5333     0.5883     0.8522     0.9785     0.9968     0.9990 (94)
Useful gains  568.9046   671.3027   748.3565   798.3937   778.1642   620.1222   428.1819   446.3258   609.5692   625.1485   561.9700   534.4911 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1843.2002  1782.2447  1607.1624  1330.0521  1016.2957   673.8602   435.5823   458.6235   730.0646  1121.9816  1508.0325  1834.6060 (97)
Month fracti    1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              948.0759   746.5530   638.9516   382.7941   177.1698     0.0000     0.0000     0.0000     0.0000   369.6438   681.1650   967.2855 (98)
Space heating                                                                                                                 4911.6387 (98)
Space heating per m2                                                                                                (98) / (4) =     42.3381 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
Calculated for June, July and August. See Table 10b
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Ext. temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000
Heat loss rate W
               0.0000     0.0000     0.0000     0.0000     0.0000  1142.8586   899.6972   922.1483     0.0000     0.0000     0.0000     0.0000 (100)
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8216	0.8990	0.8740	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.9724	808.8081	805.9772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.3888	1041.9369	993.4001	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.4198	173.4478	139.4426	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												418.3102	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3550	43.3619	34.8607	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												104.5776	(107)
Space cooling per m2												0.9015	(108)
Energy for space heating												42.3381	(99)
Energy for space cooling												0.9015	(108)
Total												43.2395	(109)
Target Fabric Energy Efficiency (TFEE)												49.7	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.7400	
Infiltration rate				0.3220	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2874	0.2669	0.2737	0.2600	0.2600	0.2532	0.2464	0.2395	0.2327	0.2532	0.2395	0.2532	(22b)
Effective ac	0.5413	0.5356	0.5375	0.5338	0.5338	0.5321	0.5303	0.5287	0.5271	0.5321	0.5287	0.5321	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9142	52.3580	52.5388	52.1818	52.1818	52.0101	51.8430	51.6805	51.5226	52.0101	51.6805	52.0101	(38)
Heat transfer coeff	126.8749	126.3187	126.4995	126.1425	126.1425	125.9708	125.8037	125.6412	125.4833	125.9708	125.6412	125.9708	(39)
Average = Sum(39)m / 12 =												126.0383	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0889	1.0904	1.0873	1.0873	1.0859	1.0844	1.0830	1.0817	1.0859	1.0830	1.0859	(40)
HLP (average)												1.0864	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
RHI water heating demand												1741	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4976	63.7772	63.6860	63.8663	63.8663	63.9533	64.0382	64.1211	64.2018	63.9533	64.1211	63.9533	
alpha	5.2332	5.2518	5.2457	5.2578	5.2578	5.2636	5.2692	5.2747	5.2801	5.2636	5.2747	5.2636	
util living area													
	0.9927	0.9875	0.9704	0.9203	0.8063	0.5924	0.4343	0.4498	0.7144	0.9248	0.9830	0.9943	(86)
MIT	20.0504	20.1668	20.4017	20.6784	20.8864	20.9821	20.9971	20.9966	20.9536	20.7233	20.3557	20.0298	(87)
Th 2	20.0060	20.0099	20.0087	20.0112	20.0112	20.0124	20.0136	20.0147	20.0158	20.0124	20.0147	20.0124	(88)
util rest of house													
	0.9903	0.9834	0.9605	0.8937	0.7459	0.4982	0.3262	0.3383	0.6244	0.8932	0.9764	0.9924	(89)
MIT 2	18.7637	18.9348	19.2700	19.6530	19.9105	20.0026	20.0128	20.0138	19.9851	19.7207	19.2127	18.7388	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8872	0.7491	0.5120	0.3428	0.3554	0.6359	0.8878	0.9707	0.9894	(94)
Useful gains	876.3946	956.6700	1021.5894	1019.8715	867.3412	601.6669	384.4304	383.8648	653.2563	836.6369	848.9905	827.0059	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1783.8738	1746.0910	1574.0004	1300.4752	953.5751	611.2238	385.3399	384.9388	681.7409	1067.4430	1443.2695	1755.5118	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.1645	530.4909	410.9938	202.0347	64.1581	0.0000	0.0000	0.0000	0.0000	171.7198	427.8809	690.8084	(98)
Space heating												3173.2511	(98)
RHI space heating demand												3173	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.7400	
Infiltration rate				0.3220	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3490	0.3422	0.3353	0.3011	0.2943	0.2600	0.2600	0.2532	0.2737	0.2943	0.3079	0.3216	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5321	0.5375	0.5433	0.5474	0.5517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.8300	54.5988	54.3722	53.3079	53.1088	52.1818	52.1818	52.0101	52.5388	53.1088	53.5116	53.9328	(38)
Heat transfer coeff	128.7907	128.5595	128.3329	127.2686	127.0695	126.1425	126.1425	125.9708	126.4995	127.0695	127.4723	127.8935	(39)
Average = Sum(39)m / 12 =												127.2677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1102	1.1082	1.1062	1.0970	1.0953	1.0873	1.0873	1.0859	1.0904	1.0953	1.0988	1.1024	(40)
HLP (average)												1.0970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	849.1307	964.3362	1048.1169	1112.0832	1141.6467	1105.3202	1060.2039	1014.4962	974.1095	900.5481	828.7231	805.5601	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5530	62.6655	62.7762	63.3012	63.4004	63.8663	63.8663	63.9533	63.6860	63.4004	63.2000	62.9919	
alpha	5.1702	5.1777	5.1851	5.2201	5.2267	5.2578	5.2578	5.2636	5.2457	5.2267	5.2133	5.1995	
util living area													
	0.9950	0.9897	0.9771	0.9415	0.8535	0.6865	0.5151	0.5579	0.7905	0.9528	0.9898	0.9962	(86)
MIT	19.9351	20.0901	20.3172	20.5970	20.8305	20.9603	20.9927	20.9890	20.9159	20.6210	20.2224	19.9007	(87)
Th 2	19.9925	19.9942	19.9958	20.0032	20.0046	20.0112	20.0112	20.0124	20.0087	20.0046	20.0018	19.9988	(88)
util rest of house													
	0.9934	0.9864	0.9694	0.9212	0.8046	0.5978	0.4037	0.4449	0.7123	0.9322	0.9859	0.9949	(89)
MIT 2	18.5862	18.8121	19.1401	19.5380	19.8410	19.9851	20.0085	20.0079	19.9444	19.5788	19.0113	18.5407	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.7921	19.0072	19.3198	19.6997	19.9921	20.1339	20.1587	20.1577	20.0927	19.7379	19.1962	18.7484	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7921	19.0072	19.3198	19.6997	19.9921	20.1339	20.1587	20.1577	20.0927	19.7379	19.1962	18.7484	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9818	0.9627	0.9137	0.8039	0.6095	0.4207	0.4621	0.7197	0.9252	0.9814	0.9927	(94)
Useful gains	841.1805	946.8270	1008.9873	1016.1273	917.8227	673.7397	446.0726	468.7549	701.0410	833.1665	813.3405	799.6470	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1866.4453	1813.6155	1645.2032	1374.4600	1053.6668	698.0653	448.9084	473.3616	758.0762	1161.1497	1541.9257	1860.6392	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	762.7970	582.4819	473.3446	257.9995	101.0680	0.0000	0.0000	0.0000	0.0000	244.0195	524.5814	789.3782	(98)
Space heating												3735.6701	(98)
Space heating per m2											(98) / (4) =	32.2013	(99)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4021.1735	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	762.7970	582.4819	473.3446	257.9995	101.0680	0.0000	0.0000	0.0000	0.0000	244.0195	524.5814	789.3782	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	821.0948	626.9988	509.5206	277.7175	108.7923	0.0000	0.0000	0.0000	0.0000	262.6690	564.6732	849.7074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2768	89.2047	89.0630	88.7369	88.0294	86.7000	86.7000	86.7000	86.7000	88.6673	89.1328	89.3084	(217)
Fuel for water heating, kWh/month													
	199.2731	174.7981	181.5469	160.1105	155.7960	137.8946	129.1593	146.2490	147.4133	166.3148	178.9876	193.3264	(219)
Water heating fuel used												1970.8697	(219)
Annual totals kWh/year													
Space heating fuel - main system												4021.1735	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5916.9835	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4021.1735	3.4800	139.9368	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.8697	3.4800	68.5863	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			318.6227	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8311	(257)
SAP value		88.4056	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4021.1735	0.2160	868.5735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.8697	0.2160	425.7079	(264)
Space and water heating			1294.2813	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1255.3254	(272)
CO2 emissions per m2			10.8200	(273)
EI value			89.5526	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8818 = 3.946, stars = 4
Water heating environmental impact	0.216 / 0.8818 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.7400	
Infiltration rate				0.3220	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2874	0.2669	0.2737	0.2600	0.2600	0.2532	0.2464	0.2395	0.2327	0.2532	0.2395	0.2532	(22b)
Effective ac	0.5413	0.5356	0.5375	0.5338	0.5338	0.5321	0.5303	0.5287	0.5271	0.5321	0.5287	0.5321	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9142	52.3580	52.5388	52.1818	52.1818	52.0101	51.8430	51.6805	51.5226	52.0101	51.6805	52.0101	(38)
Heat transfer coeff	126.8749	126.3187	126.4995	126.1425	126.1425	125.9708	125.8037	125.6412	125.4833	125.9708	125.6412	125.9708	(39)
Average = Sum(39)m / 12 =												126.0383	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0889	1.0904	1.0873	1.0873	1.0859	1.0844	1.0830	1.0817	1.0859	1.0830	1.0859	(40)
HLP (average)												1.0864	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4976	63.7772	63.6860	63.8663	63.8663	63.9533	64.0382	64.1211	64.2018	63.9533	64.1211	63.9533	
alpha	5.2332	5.2518	5.2457	5.2578	5.2578	5.2636	5.2692	5.2747	5.2801	5.2636	5.2747	5.2636	
util living area													
	0.9927	0.9875	0.9704	0.9203	0.8063	0.5924	0.4343	0.4498	0.7144	0.9248	0.9830	0.9943	(86)
MIT	20.0504	20.1668	20.4017	20.6784	20.8864	20.9821	20.9971	20.9966	20.9536	20.7233	20.3557	20.0298	(87)
Th 2	20.0060	20.0099	20.0087	20.0112	20.0112	20.0124	20.0136	20.0147	20.0158	20.0124	20.0147	20.0124	(88)
util rest of house													
	0.9903	0.9834	0.9605	0.8937	0.7459	0.4982	0.3262	0.3383	0.6244	0.8932	0.9764	0.9924	(89)
MIT 2	18.7637	18.9348	19.2700	19.6530	19.9105	20.0026	20.0128	20.0138	19.9851	19.7207	19.2127	18.7388	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8872	0.7491	0.5120	0.3428	0.3554	0.6359	0.8878	0.9707	0.9894	(94)
Useful gains	876.3946	956.6700	1021.5894	1019.8715	867.3412	601.6669	384.4304	383.8648	653.2563	836.6369	848.9905	827.0059	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1783.8738	1746.0910	1574.0004	1300.4752	953.5751	611.2238	385.3399	384.9388	681.7409	1067.4430	1443.2695	1755.5118	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.1645	530.4909	410.9938	202.0347	64.1581	0.0000	0.0000	0.0000	0.0000	171.7198	427.8809	690.8084	(98)
Space heating												3173.2511	(98)
Space heating per m2											(98) / (4) =	27.3533	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3415.7708	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	675.1645	530.4909	410.9938	202.0347	64.1581	0.0000	0.0000	0.0000	0.0000	171.7198	427.8809	690.8084	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	726.7648	571.0343	442.4046	217.4755	69.0614	0.0000	0.0000	0.0000	0.0000	184.8437	460.5822	743.6043	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2133	89.1525	88.9728	88.5506	87.6949	86.7000	86.7000	86.7000	86.7000	88.3927	89.0078	89.2414	(217)
Fuel for water heating, kWh/month													
	199.4150	174.9005	181.7310	160.4474	156.3904	137.8946	129.1593	146.2490	147.4133	166.8314	179.2391	193.4717	(219)
Water heating fuel used												1973.1426	(219)
Annual totals kWh/year													
Space heating fuel - main system												3415.7708	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												5244.6687	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3415.7708	7.3800	252.0839	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1973.1426	7.3800	145.6179	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			463.3613	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3415.7708	0.2160	737.8065	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.1426	0.2160	426.1988	(264)
Space and water heating			1164.0053	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			1089.1423	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3415.7708	1.2200	4167.2404	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.1426	1.2200	2407.2339	(264)
Space and water heating			6574.4744	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			6131.6429	(272)
Primary energy kWh/m2/year			52.8544	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-197 kg (18.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.70 kg/m²	B 89	B 91
Total Savings	£62	1.70 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£172	-£14
Mains gas	£505	£429	£76
Space heating	£381	£381	-£0
Water heating	£146	£84	£62
Lighting	£136	£136	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£463	£402	£62
Total cost of uses	£464	£402	£62
Delivered energy	45 kWh/m²	37 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	43 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		3.7400	
Infiltration rate		0.3220	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3490	0.3422	0.3353	0.3011	0.2943	0.2600	0.2600	0.2532	0.2737	0.2943	0.3079	0.3216	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5321	0.5375	0.5433	0.5474	0.5517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.8300	54.5988	54.3722	53.3079	53.1088	52.1818	52.1818	52.0101	52.5388	53.1088	53.5116	53.9328	(38)
Heat transfer coeff	128.7907	128.5595	128.3329	127.2686	127.0695	126.1425	126.1425	125.9708	126.4995	127.0695	127.4723	127.8935	(39)
Average = Sum(39)m / 12 =												127.2677	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1102	1.1082	1.1062	1.0970	1.0953	1.0873	1.0873	1.0859	1.0904	1.0953	1.0988	1.1024	(40)
HLP (average)												1.0970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1322	(H8)
Utilisation factor												0.5865	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-878.1906	(H17)
Solar input	-25.4658	-42.4951	-72.3740	-96.9954	-119.8296	-117.8116	-116.2547	-101.5723	-79.5515	-54.3243	-30.2061	-21.3105	(63)
										Solar input (sum of months) = Sum(63)m =		-878.1906	(63)
Output from w/h													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
										Total per year (kWh/year) = Sum(64)m =		866.6317	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
West	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	849.1307	964.3362	1048.1169	1112.0832	1141.6467	1105.3202	1060.2039	1014.4962	974.1095	900.5481	828.7231	805.5601	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.5530	62.6655	62.7762	63.3012	63.4004	63.8663	63.8663	63.9533	63.6860	63.4004	63.2000	62.9919	
alpha	5.1702	5.1777	5.1851	5.2201	5.2267	5.2578	5.2578	5.2636	5.2457	5.2267	5.2133	5.1995	
util living area													
	0.9950	0.9897	0.9771	0.9415	0.8535	0.6865	0.5151	0.5579	0.7905	0.9528	0.9898	0.9962	(86)
MIT	19.9351	20.0901	20.3172	20.5970	20.8305	20.9603	20.9927	20.9890	20.9159	20.6210	20.2224	19.9007	(87)
Th 2	19.9925	19.9942	19.9958	20.0032	20.0046	20.0112	20.0112	20.0124	20.0087	20.0046	20.0018	19.9988	(88)
util rest of house													
	0.9934	0.9864	0.9694	0.9212	0.8046	0.5978	0.4037	0.4449	0.7123	0.9322	0.9859	0.9949	(89)
MIT 2	18.5862	18.8121	19.1401	19.5380	19.8410	19.9851	20.0085	20.0079	19.9444	19.5788	19.0113	18.5407	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.7921	19.0072	19.3198	19.6997	19.9921	20.1339	20.1587	20.1577	20.0927	19.7379	19.1962	18.7484	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7921	19.0072	19.3198	19.6997	19.9921	20.1339	20.1587	20.1577	20.0927	19.7379	19.1962	18.7484	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9818	0.9627	0.9137	0.8039	0.6095	0.4207	0.4621	0.7197	0.9252	0.9814	0.9927	(94)
Useful gains	841.1805	946.8270	1008.9873	1016.1273	917.8227	673.7397	446.0726	468.7549	701.0410	833.1665	813.3405	799.6470	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1866.4453	1813.6155	1645.2032	1374.4600	1053.6668	698.0653	448.9084	473.3616	758.0762	1161.1497	1541.9257	1860.6392	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	762.7970	582.4819	473.3446	257.9995	101.0680	0.0000	0.0000	0.0000	0.0000	244.0195	524.5814	789.3782	(98)
Space heating												3735.6701	(98)
Space heating per m2											(98) / (4) =	32.2013	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4021.1735	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	762.7970	582.4819	473.3446	257.9995	101.0680	0.0000	0.0000	0.0000	0.0000	244.0195	524.5814	789.3782	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	821.0948	626.9988	509.5206	277.7175	108.7923	0.0000	0.0000	0.0000	0.0000	262.6690	564.6732	849.7074	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3507	89.3624	89.3763	89.4091	89.4173	86.7000	86.7000	86.7000	86.7000	88.9926	89.2485	89.3693	(217)
Fuel for water heating, kWh/month													
	170.6074	126.9361	99.9339	50.4219	19.3662	2.0104	0.0000	29.0953	55.6584	104.6631	144.9107	169.3492	(219)
Water heating fuel used												972.9527	(219)
Annual totals kWh/year													
Space heating fuel - main system												4021.1735	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4969.0664	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4021.1735	3.4800	139.9368	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	972.9527	3.4800	33.8588	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			290.4902	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7578	(257)
SAP value	89.4293	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4021.1735	0.2160	868.5735	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	972.9527	0.2160	210.1578	(264)
Space and water heating			1078.7312	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1065.7253	(272)
CO2 emissions per m2			9.1900	(273)
EI value			91.1305	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			3.7400	
Infiltration rate			0.3220	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2874	0.2669	0.2737	0.2600	0.2600	0.2532	0.2464	0.2395	0.2327	0.2532	0.2395	0.2532	(22b)
Effective ac	0.5413	0.5356	0.5375	0.5338	0.5338	0.5321	0.5303	0.5287	0.5271	0.5321	0.5287	0.5321	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.9142	52.3580	52.5388	52.1818	52.1818	52.0101	51.8430	51.6805	51.5226	52.0101	51.6805	52.0101	(38)
Heat transfer coeff	126.8749	126.3187	126.4995	126.1425	126.1425	125.9708	125.8037	125.6412	125.4833	125.9708	125.6412	125.9708	(39)
Average = Sum(39)m / 12 =												126.0383	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0937	1.0889	1.0904	1.0873	1.0873	1.0859	1.0844	1.0830	1.0817	1.0859	1.0830	1.0859	(40)
HLP (average)												1.0864	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2672	(H8)
Utilisation factor												0.5458	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-914.5224	(H17)
Solar input	-29.8339	-42.4220	-72.9131	-98.3767	-115.5494	-123.4250	-120.8293	-108.1459	-84.6708	-58.5385	-35.2857	-24.5322	(63)
											Solar input (sum of months) = Sum(63)m =	-914.5224	(63)
Output from w/h													
	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246	(64)
											Total per year (kWh/year) = Sum(64)m =	838.7449	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
West	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4976	63.7772	63.6860	63.8663	63.8663	63.9533	64.0382	64.1211	64.2018	63.9533	64.1211	63.9533	
alpha	5.2332	5.2518	5.2457	5.2578	5.2578	5.2636	5.2692	5.2747	5.2801	5.2636	5.2747	5.2636	
util living area													
	0.9927	0.9875	0.9704	0.9203	0.8063	0.5924	0.4343	0.4498	0.7144	0.9248	0.9830	0.9943	(86)
MIT	20.0504	20.1668	20.4017	20.6784	20.8864	20.9821	20.9971	20.9966	20.9536	20.7233	20.3557	20.0298	(87)
Th 2	20.0060	20.0099	20.0087	20.0112	20.0112	20.0124	20.0136	20.0147	20.0158	20.0124	20.0147	20.0124	(88)
util rest of house													
	0.9903	0.9834	0.9605	0.8937	0.7459	0.4982	0.3262	0.3383	0.6244	0.8932	0.9764	0.9924	(89)
MIT 2	18.7637	18.9348	19.2700	19.6530	19.9105	20.0026	20.0128	20.0138	19.9851	19.7207	19.2127	18.7388	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9601	19.1229	19.4427	19.8096	20.0595	20.1521	20.1630	20.1638	20.1329	19.8737	19.3872	18.9359	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8872	0.7491	0.5120	0.3428	0.3554	0.6359	0.8878	0.9707	0.9894	(94)
Useful gains	876.3946	956.6700	1021.5894	1019.8715	867.3412	601.6669	384.4304	383.8648	653.2563	836.6369	848.9905	827.0059	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1783.8738	1746.0910	1574.0004	1300.4752	953.5751	611.2238	385.3399	384.9388	681.7409	1067.4430	1443.2695	1755.5118	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.1645	530.4909	410.9938	202.0347	64.1581	0.0000	0.0000	0.0000	0.0000	171.7198	427.8809	690.8084	(98)
Space heating												3173.2511	(98)
Space heating per m2											(98) / (4) =	27.3533	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3415.7708	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	675.1645	530.4909	410.9938	202.0347	64.1581	0.0000	0.0000	0.0000	0.0000	171.7198	427.8809	690.8084	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	726.7648	571.0343	442.4046	217.4755	69.0614	0.0000	0.0000	0.0000	0.0000	184.8437	460.5822	743.6043	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3071	89.3190	89.3144	89.3138	89.0720	86.7000	86.7000	86.7000	86.7000	88.7820	89.1594	89.3179	(217)
Fuel for water heating, kWh/month													
	165.7995	127.0797	99.3995	48.9291	24.2466	0.0000	0.0000	21.5133	49.7538	100.1648	139.3583	165.8397	(219)
Water heating fuel used												942.0841	(219)
Annual totals kWh/year													
Space heating fuel - main system												3415.7708	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4263.6102	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3415.7708	7.3800	252.0839	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.0841	7.3800	69.5258	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			401.5991	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3415.7708	0.2160	737.8065	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0841	0.2160	203.4902	(264)
Space and water heating			941.2967	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				

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PV Unit	-692.9382	0.5190	-359.6349 (269)
Total kg/year			892.3836 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3415.7708	1.2200	4167.2404	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0841	1.2200	1149.3426	(264)
Space and water heating			5316.5830	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5027.2516	(272)
Primary energy kWh/m2/year			43.3346	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		782.03 (P1)
Transmission heat loss coefficient		73.96 (37)
Summer heat loss coefficient		855.99 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
South	0.850	1.00	1.000	0.850	(P8)
West	0.850	0.90	1.000	0.765	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.2900	87.1704	0.7200	0.7000	0.7650	190.2630
South	7.6100	118.5567	0.7200	0.7000	0.7650	313.0727
West	1.4200	125.2818	0.7200	0.7000	0.7650	61.7321
South	0.6500	202.9386	0.7200	0.7000	0.8500	50.8593
total:						615.9270

	Jun	Jul	Aug	
Solar gains	658	616	563	(P3)
Internal gains	520	498	508	
Total summer gains	1178	1114	1071	(P5)
Summer gain/loss ratio	1.38	1.30	1.25	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.03	18.85	18.80	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 666	**Issued on Date**	07/08/2024
Assessment Reference	EPC - Plot 666	**Prop Type Ref**	Opp
Property	7 Kittiwake Place, Boorley Green, SOUTHAMPTON, SO32 2ZB		

SAP Rating	88 B	**DER**	12.55	**TER**	16.22
Environmental	90 B	**% DER<TER**	22.63		
CO_2 Emissions (t/year)	1.05	**DFEE**	43.77	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.98		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.55	$kgCO_2/m^2$	Pass
	-3.67 (-22.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.77	$kWh/m^2/yr$	
	-5.9 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.74 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South Windows facing West	6.29 m², No overhang 7.61 m², No overhang 1.42 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.74 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.026	W/m²K
Air permeability	3.7	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 667	**Issued on Date**	07/08/2024
Assessment Reference	EPC - Plot 667	**Prop Type Ref**	
Property	9 Kittiwake Place, Boorley Green, SOUTHAMPTON, SO32 2ZB		

SAP Rating	88 B	**DER**	12.56	**TER**	16.22
Environmental	90 B	**% DER<TER**	22.56		
CO_2 Emissions (t/year)	1.09	**DFEE**	43.82	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.87		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Semi-Detached House, total floor area 116 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.56 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.8 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.81 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.29 m², No overhang
Windows facing East: 1.42 m², No overhang
Windows facing South: 7.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.026 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			3.8100	
Infiltration rate			0.3255	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3528	0.3459	0.3390	0.3044	0.2975	0.2629	0.2629	0.2560	0.2767	0.2975	0.3113	0.3251	(22b)
Effective ac	0.5622	0.5598	0.5574	0.5463	0.5442	0.5345	0.5345	0.5328	0.5383	0.5442	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.9601	54.7239	54.4923	53.4048	53.2013	52.2540	52.2540	52.0786	52.6189	53.2013	53.6129	54.0433	(38)
Heat transfer coeff	128.9208	128.6846	128.4530	127.3655	127.1620	126.2147	126.2147	126.0393	126.5796	127.1620	127.5736	128.0040	(39)
Average = Sum(39)m / 12 =												127.3645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1113	1.1093	1.1073	1.0979	1.0961	1.0880	1.0880	1.0865	1.0911	1.0961	1.0997	1.1034	(40)
HLP (average)												1.0979	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss 11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)	
Total heat required for water heating calculated for each month													
177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)	
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
									Solar input (sum of months) = Sum(63)m =		0.0000	(63)	
Output from w/h													
177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)	
									Total per year (kWh/year) = Sum(64)m =		1740.5488	(64)	
Heat gains from water heating, kWh/month													
58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	453.6383	451.1898	434.5321	407.5956	379.9036	353.6301	336.8607	343.5737	357.6958	384.8651	416.0072	439.6884	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	624.8662	743.1395	837.1989	915.9006	960.7078	936.0490	895.8978	847.1223	796.4569	708.1601	621.0913	586.2607	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4899	62.6046	62.7175	63.2530	63.3542	63.8297	63.8297	63.9186	63.6457	63.3542	63.1498	62.9375	
alpha	5.1660	5.1736	5.1812	5.2169	5.2236	5.2553	5.2553	5.2612	5.2430	5.2236	5.2100	5.1958	
util living area													
	0.9988	0.9968	0.9912	0.9720	0.9127	0.7725	0.5998	0.6520	0.8759	0.9818	0.9972	0.9992	(86)
MIT	19.7535	19.9144	20.1574	20.4681	20.7500	20.9306	20.9853	20.9775	20.8562	20.4872	20.0572	19.7224	(87)
Th 2	19.9916	19.9933	19.9949	20.0026	20.0040	20.0107	20.0107	20.0119	20.0081	20.0040	20.0011	19.9981	(88)
util rest of house													
	0.9984	0.9957	0.9880	0.9608	0.8762	0.6859	0.4751	0.5277	0.8122	0.9725	0.9961	0.9989	(89)
MIT 2	18.3209	18.5570	18.9118	19.3632	19.7475	19.9616	20.0049	20.0021	19.8871	19.3967	18.7719	18.2801	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.5396	18.7642	19.1020	19.5319	19.9006	20.1095	20.1546	20.1510	20.0351	19.5632	18.9681	18.5003	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5396	18.7642	19.1020	19.5319	19.9006	20.1095	20.1546	20.1510	20.0351	19.5632	18.9681	18.5003	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9937	0.9839	0.9539	0.8717	0.6954	0.4941	0.5463	0.8143	0.9668	0.9943	0.9982	(94)
Useful gains	623.2894	738.4488	823.6969	873.6356	837.4086	650.9651	442.6491	462.8012	648.5669	684.6200	617.5483	585.1853	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1835.7825	1784.1132	1618.7610	1354.1375	1042.8018	695.3853	448.6399	472.7727	751.2582	1139.7796	1514.0601	1830.4902	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	902.0949	702.6865	591.5277	345.9614	152.8125	0.0000	0.0000	0.0000	0.0000	338.6387	645.4884	926.5069	(98)
Space heating												4605.7170	(98)
Space heating per m2											(98) / (4) =	39.7010	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4957.7148	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	902.0949	702.6865	591.5277	345.9614	152.8125	0.0000	0.0000	0.0000	0.0000	338.6387	645.4884	926.5069	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	971.0386	756.3902	636.7360	372.4020	164.4914	0.0000	0.0000	0.0000	0.0000	364.5196	694.8207	997.3163	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3567	89.3014	89.1933	88.9443	88.3575	86.7000	86.7000	86.7000	86.7000	88.9046	89.2472	89.3818	(217)
Fuel for water heating, kWh/month													
	199.0949	174.6088	181.2817	159.7372	155.2175	137.8946	129.1593	146.2490	147.4133	165.8709	178.7582	193.1677	(219)
Water heating fuel used												1968.4533	(219)
Annual totals kWh/year													
Space heating fuel - main system												4957.7148	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												6851.1084	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4957.7148	0.2160	1070.8664	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1968.4533	0.2160	425.1859	(264)
Space and water heating			1496.0523	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1457.0963	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.5600	ZC1
Total Floor Area	TFA	116.0100	
Assumed number of occupants	N	2.8465	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2985	ZC2
CO2 emissions from cooking, equation (L16)		1.6147	ZC3
Total CO2 emissions		28.4732	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4732	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3850	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
Distribution loss  (46)m = 0.15 x (45)m
              24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss    50.9589    46.0274    50.9589    49.2006    48.7655    45.1842    46.6904    48.7655    49.2006    50.9589    49.3151    50.9589 (61)
Total heat required for water heating calculated for each month
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (62)
Solar input    0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             217.0286   191.2730   200.8393   179.8700   174.1459   153.3780   146.9478   163.8124   165.6215   186.6362   197.4174   211.7885 (64)
                                                                                                  Total per year (kWh/year) = Sum(64)m =   2188.7586 (64)
Heat gains from water heating, kWh/month
              67.9579    59.8010    62.5750    55.7477    53.8804    47.2705    45.0082    50.4445    51.0101    57.8524    61.5728    66.2156 (65)
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5. Internal gains (see Table 5 and 5a)

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Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242   142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225    23.8235    19.3746    14.6678    10.9643     9.2566    10.0020    13.0010    17.4500    22.1567    25.8602    27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238   282.8285   275.5087   259.9256   240.2548   221.7670   209.4161   206.5113   213.8312   229.4142   249.0850   267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324    37.2324 (69)
Pumps, fans    3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
              91.3412    88.9896    84.1061    77.4274    72.4198    65.6534    60.4949    67.8017    70.8474    77.7586    85.5178    88.9994 (72)
Total internal gains
             466.7848   464.3389   447.6867   420.7181   392.3363   365.3743   348.6102   356.0113   370.8257   398.0269   429.1603   452.8375 (73)
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6. Solar gains

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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2            Table 6a      Specific data    Specific data       factor                W
                                                            W/m2      or Table 6b      or Table 6c      Table 6d
-----------------------------------------------------------------------------------------------------------------------------------
North                                    6.2900           10.6334           0.6300           0.7000           0.7700           20.4406 (74)
East                                     1.4200           19.6403           0.6300           0.7000           0.7700            8.5233 (76)
South                                    7.6100           46.7521           0.6300           0.7000           0.7700          108.7320 (78)
South                                    0.6500           47.0123           0.6300           0.7000           1.0000           12.1285 (82)
-----------------------------------------------------------------------------------------------------------------------------------

Solar gains   149.8244   255.4560   352.3335   444.7669   508.2037   509.6165   489.1575   440.6051   383.9159   282.8832   179.4486   128.2508 (83)
Total gains   616.6092   719.7949   800.0202   865.4850   900.5400   874.9908   837.7677   796.6164   754.7417   680.9100   608.6088   581.0883 (84)
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7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)                                                      21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          64.2616    64.4315    64.5988    65.3967    65.5481    66.2626    66.2626    66.3966    65.9855    65.5481    65.2424    64.9259
alpha         5.2841     5.2954     5.3066     5.3598     5.3699     5.4175     5.4175     5.4264     5.3990     5.3699     5.3495     5.3284
util living area
              0.9989     0.9972     0.9926     0.9765     0.9245     0.7907     0.6170     0.6668     0.8862     0.9838     0.9975     0.9992 (86)

MIT          19.7884    19.9374    20.1676    20.4689    20.7444    20.9289    20.9851    20.9777    20.8569    20.4993    20.0877    19.7644 (87)
Th 2         20.0167    20.0190    20.0213    20.0321    20.0341    20.0435    20.0435    20.0453    20.0399    20.0341    20.0300    20.0257 (88)
util rest of house
              0.9985     0.9963     0.9899     0.9669     0.8919     0.7077     0.4938     0.5448     0.8264     0.9755     0.9964     0.9989 (89)
MIT 2        18.3899    18.6093    18.9462    19.3880    19.7675    19.9920    20.0375    20.0353    19.9174    19.4370    18.8374    18.3612 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.1527 (91)
MIT          18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT 18.6034    18.8120    19.1326    19.5530    19.9166    20.1350    20.1822    20.1791    20.0608    19.5992    19.0282    18.5754 (93)
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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.9977     0.9945     0.9863     0.9606     0.8870     0.7165     0.5125     0.5631     0.8280     0.9702     0.9948     0.9983 (94)
Useful gains 615.1712   715.8353   789.0656   831.4208   798.8216   626.9470   429.3911   448.5395   624.9029   660.6464   605.4388   580.0929 (95)
Ext temp.      4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
            1793.1665  1739.5026  1575.4392  1312.3483  1009.8729   672.9526   435.5257   458.5435   727.7610  1106.0494  1472.9191  1783.7584 (97)
Month fracti  1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             876.4286   687.9044   585.0620   346.2678   157.0222     0.0000     0.0000     0.0000     0.0000   331.3798   624.5858   895.5271 (98)
Space heating                                                                                                                  4504.1777 (98)
Space heating per m2                                                                                                 (98) / (4) =    38.8258 (99)
```

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4822.4601	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	876.4286	687.9044	585.0620	346.2678	157.0222	0.0000	0.0000	0.0000	0.0000	331.3798	624.5858	895.5271	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	938.3603	736.5144	626.4047	370.7364	168.1179	0.0000	0.0000	0.0000	0.0000	354.7964	668.7214	958.8085	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.0286	191.2730	200.8393	179.8700	174.1459	153.3780	146.9478	163.8124	165.6215	186.6362	197.4174	211.7885	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.1982	87.9922	87.5848	86.6731	84.7918	80.3000	80.3000	80.3000	80.3000	86.4810	87.7493	88.2764	(217)
Fuel for water heating, kWh/month													
	246.0692	217.3750	229.3085	207.5270	205.3806	191.0062	182.9985	204.0004	206.2534	215.8119	224.9790	239.9153	(219)
Water heating fuel used												2570.6251	(219)
Annual totals kWh/year													
Space heating fuel - main system												4822.4601	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Total delivered energy for all uses												7941.7786	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4822.4601	0.2160	1041.6514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2570.6251	0.2160	555.2550	(264)
Space and water heating			1596.9064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Total CO2, kg/m2/year			1881.6783	(272)
Emissions per m2 for space and water heating			13.7652	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1192	(272b)
Emissions per m2 for pumps and fans			0.3355	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7652 * 1.00) + 2.1192 + 0.3355, rounded to 2 d.p.			16.2200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			3.8100	
Infiltration rate			0.3255	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3528	0.3459	0.3390	0.3044	0.2975	0.2629	0.2629	0.2560	0.2767	0.2975	0.3113	0.3251	(22b)
Effective ac	0.5622	0.5598	0.5574	0.5463	0.5442	0.5345	0.5345	0.5328	0.5383	0.5442	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.9601	54.7239	54.4923	53.4048	53.2013	52.2540	52.2540	52.0786	52.6189	53.2013	53.6129	54.0433	(38)
Heat transfer coeff	128.9208	128.6846	128.4530	127.3655	127.1620	126.2147	126.2147	126.0393	126.5796	127.1620	127.5736	128.0040	(39)
Average = Sum(39)m / 12 =												127.3645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1113	1.1093	1.1073	1.0979	1.0961	1.0880	1.0880	1.0865	1.0911	1.0961	1.0997	1.1034	(40)
HLP (average)												1.0979	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	35.2898	30.8647	31.8496	27.7672	26.6433	22.9912	21.3047	24.4475	24.7394	28.8314	31.4718	34.1763	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	142.3242	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.8225	23.8235	19.3746	14.6678	10.9643	9.2566	10.0020	13.0010	17.4500	22.1567	25.8602	27.5680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.9238	282.8285	275.5087	259.9256	240.2548	221.7670	209.4161	206.5113	213.8312	229.4142	249.0850	267.5728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	37.2324	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	47.4325	45.9296	42.8086	38.5656	35.8109	31.9322	28.6353	32.8595	34.3603	38.7519	43.7108	45.9359	(72)
Total internal gains													
	419.8761	418.2789	403.3891	378.8563	352.7274	328.6531	313.7507	318.0691	331.3387	356.0201	384.3533	406.7739	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	591.1039	710.2286	806.0560	887.1613	933.5316	911.0719	872.7878	821.6178	770.0998	679.3152	589.4373	553.3462	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4899	62.6046	62.7175	63.2530	63.3542	63.8297	63.8297	63.9186	63.6457	63.3542	63.1498	62.9375	
alpha	5.1660	5.1736	5.1812	5.2169	5.2236	5.2553	5.2553	5.2612	5.2430	5.2236	5.2100	5.1958	
util living area													
	0.9991	0.9974	0.9926	0.9754	0.9205	0.7856	0.6134	0.6683	0.8877	0.9848	0.9978	0.9994	(86)
MIT	19.7262	19.8880	20.1331	20.4477	20.7357	20.9247	20.9837	20.9748	20.8447	20.4657	20.0317	19.6957	(87)
Th 2	19.9916	19.9933	19.9949	20.0026	20.0040	20.0107	20.0107	20.0119	20.0081	20.0040	20.0011	19.9981	(88)
util rest of house													
	0.9988	0.9965	0.9898	0.9654	0.8863	0.7002	0.4871	0.5427	0.8273	0.9768	0.9969	0.9991	(89)
MIT 2	18.8236	18.9864	19.2315	19.5468	19.8171	19.9738	20.0063	20.0043	19.9175	19.5688	19.1365	18.7984	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9614	19.1240	19.3692	19.6843	19.9573	20.1190	20.1555	20.1524	20.0590	19.7057	19.2732	18.9354	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9614	19.1240	19.3692	19.6843	19.9573	20.1190	20.1555	20.1524	20.0590	19.7057	19.2732	18.9354	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9954	0.9875	0.9612	0.8843	0.7106	0.5065	0.5618	0.8310	0.9735	0.9960	0.9988	(94)
Useful gains	590.1013	706.9759	795.9410	852.7713	825.5607	647.3943	442.0384	461.6173	639.9408	661.3441	587.0811	552.6776	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1890.1606	1830.4143	1653.0819	1373.5492	1050.0196	696.5759	448.7536	472.9557	754.2880	1157.9035	1552.9749	1886.1839	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	967.2441	754.9506	637.7128	374.9601	166.9975	0.0000	0.0000	0.0000	0.0000	369.4402	695.4436	992.1287	(98)
Space heating												4958.8776	(98)
Space heating per m2											(98) / (4) =	42.7453	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	1186.4183	933.9889	957.8987	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8340	0.9065	0.8816	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	989.4408	846.6443	844.4844	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1169.3123	1122.4912	1065.9653	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	129.5075	205.2301	164.7818	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												499.5194	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	32.3769	51.3075	41.1955	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												124.8798	(107)
Space cooling per m2												1.0765	(108)
Energy for space heating												42.7453	(99)
Energy for space cooling												1.0765	(108)
Total												43.8217	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.8	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3850	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3273	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3846	(22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			15.3200	1.3258	20.3106			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
Ground floor			44.0400	0.1300	5.7252			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1800	0.6552			(29a)
External Wall	97.3100	15.4600	81.8500	0.1800	14.7330			(29a)
Gable	22.4200	0.7100	21.7100	0.1800	3.9078			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1300	6.8276			(30)
Dormer roof	2.1800		2.1800	0.1300	0.2834			(30)
Lower roof	4.2600		4.2600	0.1300	0.5538			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.5753			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4040	(36)
Total fabric heat loss (33) + (36) =	67.9793	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.3872	57.0567	56.7328	55.2113	54.9266	53.6015	53.6015	53.3561	54.1119	54.9266	55.5025	56.1046	(38)
Heat transfer coeff	125.3664	125.0360	124.7120	123.1905	122.9059	121.5807	121.5807	121.3353	122.0911	122.9059	123.4818	124.0838	(39)
Average = Sum(39)m / 12 =												123.1892	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0807	1.0778	1.0750	1.0619	1.0594	1.0480	1.0480	1.0459	1.0524	1.0594	1.0644	1.0696	(40)
HLP (average)												1.0619	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)
Energy content (annual)										Total = Sum(45)m =		1601.7736	(45)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (46)
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Primary loss    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (59)
Heat gains from water heating, kWh/month
              35.2898   30.8647   31.8496   27.7672   26.6433   22.9912   21.3047   24.4475   24.7394   28.8314   31.4718   34.1763 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242  142.3242 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              26.8225   23.8235   19.3746   14.6678   10.9643    9.2566   10.0020   13.0010   17.4500   22.1567   25.8602   27.5680 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             279.9238  282.8285  275.5087  259.9256  240.2548  221.7670  209.4161  206.5113  213.8312  229.4142  249.0850  267.5728 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324   37.2324 (69)
Pumps, fans     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
            -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 -113.8594 (71)
Water heating gains (Table 5)
              47.4325   45.9296   42.8086   38.5656   35.8109   31.9322   28.6353   32.8595   34.3603   38.7519   43.7108   45.9359 (72)
Total internal gains
             419.8761  418.2789  403.3891  378.8563  352.7274  328.6531  313.7507  318.0691  331.3387  356.0201  384.3533  406.7739 (73)


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6. Solar gains
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[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2             Table 6a       Specific data    Specific data       factor                W
                                                           W/m2       or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------
North                                  6.2900            10.6334            0.6300           0.7000           0.7700           20.4406 (74)
East                                   1.4200            19.6403            0.6300           0.7000           0.7700            8.5233 (76)
South                                  7.6100            46.7521            0.6300           0.7000           0.7700          108.7320 (78)
South                                  0.6500            47.0123            0.6300           0.7000           1.0000           12.1285 (82)
-------------------------------------------------------------------------------------------------------------------

Solar gains   149.8244  255.4560  352.3335  444.7669  508.2037  509.6165  489.1575  440.6051  383.9159  282.8832  179.4486  128.2508 (83)
Total gains   569.7005  673.7349  755.7227  823.6232  860.9311  838.2696  802.9082  758.6742  715.2546  638.9033  563.8018  535.0247 (84)


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7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           64.2616   64.4315   64.5988   65.3967   65.5481   66.2626   66.2626   66.3966   65.9855   65.5481   65.2424   64.9259
alpha          5.2841    5.2954    5.3066    5.3598    5.3699    5.4175    5.4175    5.4264    5.3990    5.3699    5.3495    5.3284
util living area
               0.9992    0.9980    0.9943    0.9809    0.9355    0.8111    0.6397    0.6930    0.9039    0.9878    0.9983    0.9995 (86)

MIT           19.7502   19.9002   20.1325   20.4383   20.7221   20.9190   20.9824   20.9733   20.8385   20.4673   20.0513   19.7267 (87)
Th 2          20.0167   20.0190   20.0213   20.0321   20.0341   20.0435   20.0435   20.0453   20.0399   20.0341   20.0300   20.0257 (88)
util rest of house
               0.9990    0.9973    0.9921    0.9730    0.9063    0.7303    0.5140    0.5696    0.8495    0.9813    0.9975    0.9993 (89)
MIT 2         18.8678   19.0194   19.2527   19.5631   19.8332   20.0026   20.0386   20.0369   19.9430   19.5957   19.1795   18.8516 (90)
Living area fraction                                                                          fLA = Living area / (4) =      0.1527 (91)
MIT           19.0025   19.1539   19.3870   19.6967   19.9689   20.1425   20.1827   20.1798   20.0797   19.7288   19.3126   18.9852 (92)
Temperature adjustment                                                                                                   0.0000
adjusted MIT  19.0025   19.1539   19.3870   19.6967   19.9689   20.1425   20.1827   20.1798   20.0797   19.7288   19.3126   18.9852 (93)


-------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------

                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9986    0.9964    0.9903    0.9694    0.9039    0.7398    0.5333    0.5883    0.8522    0.9785    0.9968    0.9990 (94)
Useful gains  568.9046  671.3027  748.3565  798.3937  778.1642  620.1222  428.1819  446.3258  609.5692  625.1485  561.9700  534.4911 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
            1843.2002 1782.2447 1607.1624 1330.0521 1016.2957  673.8602  435.5823  458.6235  730.0646 1121.9816 1508.0325 1834.6060 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
             948.0759  746.5530  638.9516  382.7941  177.1698    0.0000    0.0000    0.0000    0.0000  369.6438  681.1650  967.2855 (98)
Space heating                                                                                                          4911.6387 (98)
Space heating per m2                                                                                  (98) / (4) =     42.3381 (99)


-------------------------------------------------------------------------------------------------------------------
8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------
Calculated for June, July and August. See Table 10b
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Ext. temp.      4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000
Heat loss rate W
               0.0000    0.0000    0.0000    0.0000    0.0000 1142.8586  899.6972  922.1483    0.0000    0.0000    0.0000    0.0000 (100)
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8216	0.8990	0.8740	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	938.9724	808.8081	805.9772	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1085.3888	1041.9369	993.4001	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.4198	173.4478	139.4426	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												418.3102	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	26.3550	43.3619	34.8607	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												104.5776	(107)
Space cooling per m2												0.9015	(108)
Energy for space heating												42.3381	(99)
Energy for space cooling												0.9015	(108)
Total												43.2395	(109)
Target Fabric Energy Efficiency (TFEE)												49.7	(109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.8100	
Infiltration rate				0.3255	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2905	0.2698	0.2767	0.2629	0.2629	0.2560	0.2490	0.2421	0.2352	0.2560	0.2421	0.2560	(22b)
Effective ac	0.5422	0.5364	0.5383	0.5345	0.5345	0.5328	0.5310	0.5293	0.5277	0.5328	0.5293	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0025	52.4341	52.6189	52.2540	52.2540	52.0786	51.9079	51.7418	51.5804	52.0786	51.7418	52.0786	(38)
Heat transfer coeff	126.9632	126.3948	126.5796	126.2147	126.2147	126.0393	125.8686	125.7025	125.5411	126.0393	125.7025	126.0393	(39)
Average = Sum(39)m / 12 =												126.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0944	1.0895	1.0911	1.0880	1.0880	1.0865	1.0850	1.0835	1.0822	1.0865	1.0835	1.0865	(40)
HLP (average)												1.0870	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465	(42)
Average daily hot water use (litres/day)	101.8040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1601.7736	(45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
									Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
									Total per year (kWh/year) = Sum(64)m =			1740.5488	(64)
RHI water heating demand												1741	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4534	63.7388	63.6457	63.8297	63.8297	63.9186	64.0053	64.0898	64.1722	63.9186	64.0898	63.9186	
alpha	5.2302	5.2493	5.2430	5.2553	5.2553	5.2612	5.2670	5.2727	5.2781	5.2612	5.2727	5.2612	
util living area													
	0.9927	0.9875	0.9704	0.9204	0.8065	0.5926	0.4345	0.4500	0.7146	0.9249	0.9830	0.9943	(86)
MIT	20.0493	20.1659	20.4009	20.6779	20.8861	20.9820	20.9971	20.9966	20.9535	20.7229	20.3551	20.0290	(87)
Th 2	20.0054	20.0094	20.0081	20.0107	20.0107	20.0119	20.0131	20.0143	20.0154	20.0119	20.0143	20.0119	(88)
util rest of house													
	0.9903	0.9835	0.9606	0.8938	0.7461	0.4984	0.3263	0.3384	0.6246	0.8933	0.9764	0.9924	(89)
MIT 2	18.7617	18.9332	19.2684	19.6519	19.9097	20.0021	20.0123	20.0133	19.9846	19.7197	19.2116	18.7373	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8873	0.7493	0.5122	0.3429	0.3555	0.6361	0.8879	0.9707	0.9894	(94)
Useful gains	876.3989	956.6808	1021.6288	1019.9826	867.5649	601.9047	384.5753	384.0012	653.4386	836.7206	849.0031	827.0079	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1784.8854	1746.9489	1574.8111	1301.0860	954.0317	611.4991	385.4890	385.0798	682.0005	1067.9109	1443.8382	1756.2905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.9140	531.0602	411.5676	202.3945	64.3313	0.0000	0.0000	0.0000	0.0000	172.0056	428.2813	691.3863	(98)
Space heating												3176.9407	(98)
RHI space heating demand												3177	(98)

Energy&Design

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.8100	
Infiltration rate				0.3255	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3528	0.3459	0.3390	0.3044	0.2975	0.2629	0.2629	0.2560	0.2767	0.2975	0.3113	0.3251	(22b)
Effective ac	0.5622	0.5598	0.5574	0.5463	0.5442	0.5345	0.5345	0.5328	0.5383	0.5442	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.9601	54.7239	54.4923	53.4048	53.2013	52.2540	52.2540	52.0786	52.6189	53.2013	53.6129	54.0433	(38)
Heat transfer coeff	128.9208	128.6846	128.4530	127.3655	127.1620	126.2147	126.2147	126.0393	126.5796	127.1620	127.5736	128.0040	(39)
Average = Sum(39)m / 12 =												127.3645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1113	1.1093	1.1073	1.0979	1.0961	1.0880	1.0880	1.0865	1.0911	1.0961	1.0997	1.1034	(40)
HLP (average)												1.0979	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
Energy content (annual)                                                                          Total = Sum(45)m =   1601.7736 (45)
Distribution loss  (46)m = 0.15 x (45)m
              24.9104    21.7868    22.4821    19.6004    18.8071    16.2291    15.0386    17.2570    17.4631    20.3516    22.2154    24.1244 (46)
Water storage loss:
Total storage loss
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
               0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.8350    10.6826    11.8108    11.4077    11.7659    11.3609    11.7237    11.7511    11.3864    11.7895    11.4344    11.8272 (61)
Total heat required for water heating calculated for each month
              177.9047   155.9282   161.6912   142.0771   137.1463   119.5546   111.9811   126.7979   127.8073   147.4668   159.5367   172.6568 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              177.9047   155.9282   161.6912   142.0771   137.1463   119.5546   111.9811   126.7979   127.8073   147.4668   159.5367   172.6568 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1740.5488 (64)
Heat gains from water heating, kWh/month
               58.1769    50.9648    52.7879    46.2995    44.6305    38.8146    36.2665    41.1908    41.5565    48.0601    52.1026    56.4326 (65)
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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891   170.7891 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               67.0562    59.5587    48.4364    36.6695    27.4109    23.1414    25.0051    32.5026    43.6249    55.3918    64.6505    68.9199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              417.7967   422.1321   411.2070   387.9487   358.5893   330.9956   312.5613   308.2259   319.1510   342.4093   371.7687   399.3624 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254    54.9254 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594  -113.8594 (71)
Water heating gains (Table 5)
               78.1948    75.8405    70.9515    64.3049    59.9872    53.9092    48.7453    55.3640    57.7174    64.5969    72.3648    75.8503 (72)
Total internal gains
              677.9028   672.3864   645.4500   603.7782   560.8424   522.9013   501.1668   510.9476   535.3484   577.2531   623.6390   658.9877 (73)
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6. Solar gains

```
[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                         m2            Table 6a      Specific data      Specific data       factor                W
                                                         W/m2        or Table 6b        or Table 6c         Table 6d
-------------------------------------------------------------------------------------------------------------------------------------
North                                  6.2900           10.6334           0.7200             0.7000           0.7700           23.3607 (74)
East                                   1.4200           19.6403           0.7200             0.7000           0.7700            9.7409 (76)
South                                  7.6100           46.7521           0.7200             0.7000           0.7700          124.2651 (78)
South                                  0.6500           47.0123           0.7200             0.7000           1.0000           13.8611 (82)
-------------------------------------------------------------------------------------------------------------------------------------

Solar gains    171.2279   291.9497   402.6669   508.3050   580.8042   582.4189   559.0371   503.5487   438.7611   323.2950   205.0841   146.5723 (83)
Total gains    849.1307   964.3362  1048.1169  1112.0832  1141.6467  1105.3202  1060.2039  1014.4962   974.1095   900.5481   828.7231   805.5601 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                    21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           62.4899    62.6046    62.7175    63.2530    63.3542    63.8297    63.8297    63.9186    63.6457    63.3542    63.1498    62.9375
alpha          5.1660     5.1736     5.1812     5.2169     5.2236     5.2553     5.2553     5.2612     5.2430     5.2236     5.2100     5.1958
util living area
               0.9950     0.9897     0.9771     0.9416     0.8537     0.6868     0.5153     0.5582     0.7907     0.9528     0.9898     0.9962 (86)

MIT           19.9335    20.0886    20.3159    20.5962    20.8300    20.9601    20.9926    20.9889    20.9156    20.6203    20.2214    19.8994 (87)
Th 2          19.9916    19.9933    19.9949    20.0026    20.0040    20.0107    20.0107    20.0119    20.0081    20.0040    20.0011    19.9981 (88)
util rest of house
               0.9934     0.9864     0.9695     0.9214     0.8049     0.5981     0.4039     0.4451     0.7125     0.9323     0.9859     0.9949 (89)
MIT 2         18.5832    18.8094    19.1377    19.5364    19.8399    19.9845    20.0080    20.0074    19.9437    19.5774    19.0093    18.5382 (90)
Living area fraction                                                                                 fLA = Living area / (4) =      0.1527 (91)
MIT           18.7894    19.0047    19.3175    19.6982    19.9910    20.1334    20.1583    20.1573    20.0920    19.7366    19.1943    18.7460 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  18.7894    19.0047    19.3175    19.6982    19.9910    20.1334    20.1583    20.1573    20.0920    19.7366    19.1943    18.7460 (93)
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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9906     0.9819     0.9627     0.9138     0.8042     0.6098     0.4209     0.4622     0.7199     0.9253     0.9814     0.9927 (94)
Useful gains  841.1826   946.8389  1009.0276  1016.2316   918.0556   673.9865   446.2602   468.9388   701.2554   833.2328   813.3491   799.6476 (95)
Ext temp.       4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             1867.9816  1815.0515  1646.4530  1375.3116  1054.3015   698.3982   449.1090   473.5645   758.4689  1161.8263  1542.9152  1861.9510 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              763.9385   583.4389   474.2445   258.5375   101.3669     0.0000     0.0000     0.0000     0.0000   244.4735   525.2876   790.3537 (98)
Space heating                                                                                                                  3741.6412 (98)
Space heating per m2                                                                                          (98) / (4) =     32.2527 (99)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4027.6008	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	763.9385	583.4389	474.2445	258.5375	101.3669	0.0000	0.0000	0.0000	0.0000	244.4735	525.2876	790.3537	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	822.3234	628.0289	510.4892	278.2966	109.1140	0.0000	0.0000	0.0000	0.0000	263.1577	565.4334	850.7575	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2776	89.2056	89.0642	88.7384	88.0317	86.7000	86.7000	86.7000	86.7000	88.6687	89.1336	89.3090	(217)
Fuel for water heating, kWh/month													
	199.2714	174.7963	181.5446	160.1078	155.7919	137.8946	129.1593	146.2490	147.4133	166.3121	178.9861	193.3251	(219)
Water heating fuel used												1970.8516	(219)
Annual totals kWh/year													
Space heating fuel - main system												4027.6008	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												5923.3927	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4027.6008	3.4800	140.1605	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1970.8516	3.4800	68.5856	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			318.8458	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8317	(257)
SAP value		88.3975	
SAP rating (Section 12)		88	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4027.6008	0.2160	869.9618	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1970.8516	0.2160	425.7039	(264)
Space and water heating			1295.6657	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1256.7097	(272)
CO2 emissions per m2			10.8300	(273)
EI value			89.5411	
EI rating			90	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8819 = 3.946, stars = 4
Water heating environmental impact	0.216 / 0.8819 = 0.2449, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			40.0000 / (5) =	0.1350	(8)
Pressure test				Yes	
Measured/design AP50				3.8100	
Infiltration rate				0.3255	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2905	0.2698	0.2767	0.2629	0.2629	0.2560	0.2490	0.2421	0.2352	0.2560	0.2421	0.2560	(22b)
Effective ac	0.5422	0.5364	0.5383	0.5345	0.5345	0.5328	0.5310	0.5293	0.5277	0.5328	0.5293	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0025	52.4341	52.6189	52.2540	52.2540	52.0786	51.9079	51.7418	51.5804	52.0786	51.7418	52.0786	(38)
Heat transfer coeff	126.9632	126.3948	126.5796	126.2147	126.2147	126.0393	125.8686	125.7025	125.5411	126.0393	125.7025	126.0393	(39)
Average = Sum(39)m / 12 =												126.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0944	1.0895	1.0911	1.0880	1.0880	1.0865	1.0850	1.0835	1.0822	1.0865	1.0835	1.0865	(40)
HLP (average)												1.0870	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
								Total per year (kWh/year) = Sum(64)m =				1740.5488	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179	(83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4534	63.7388	63.6457	63.8297	63.8297	63.9186	64.0053	64.0898	64.1722	63.9186	64.0898	63.9186	
alpha	5.2302	5.2493	5.2430	5.2553	5.2553	5.2612	5.2670	5.2727	5.2781	5.2612	5.2727	5.2612	
util living area													
	0.9927	0.9875	0.9704	0.9204	0.8065	0.5926	0.4345	0.4500	0.7146	0.9249	0.9830	0.9943	(86)
MIT	20.0493	20.1659	20.4009	20.6779	20.8861	20.9820	20.9971	20.9966	20.9535	20.7229	20.3551	20.0290	(87)
Th 2	20.0054	20.0094	20.0081	20.0107	20.0107	20.0119	20.0131	20.0143	20.0154	20.0119	20.0143	20.0119	(88)
util rest of house													
	0.9903	0.9835	0.9606	0.8938	0.7461	0.4984	0.3263	0.3384	0.6246	0.8933	0.9764	0.9924	(89)
MIT 2	18.7617	18.9332	19.2684	19.6519	19.9097	20.0021	20.0123	20.0133	19.9846	19.7197	19.2116	18.7373	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8873	0.7493	0.5122	0.3429	0.3555	0.6361	0.8879	0.9707	0.9894	(94)
Useful gains	876.3989	956.6808	1021.6288	1019.9826	867.5649	601.9047	384.5753	384.0012	653.4386	836.7206	849.0031	827.0079	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1784.8854	1746.9489	1574.8111	1301.0860	954.0317	611.4991	385.4890	385.0798	682.0005	1067.9109	1443.8382	1756.2905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.9140	531.0602	411.5676	202.3945	64.3313	0.0000	0.0000	0.0000	0.0000	172.0056	428.2813	691.3863	(98)
Space heating												3176.9407	(98)
Space heating per m2											(98) / (4) =	27.3851	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3419.7424	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	675.9140	531.0602	411.5676	202.3945	64.3313	0.0000	0.0000	0.0000	0.0000	172.0056	428.2813	691.3863	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	727.5715	571.6471	443.0222	217.8627	69.2479	0.0000	0.0000	0.0000	0.0000	185.1513	461.0132	744.2264	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2139	89.1531	88.9737	88.5520	87.6967	86.7000	86.7000	86.7000	86.7000	88.3940	89.0084	89.2418	(217)
Fuel for water heating, kWh/month													
	199.4136	174.8993	181.7291	160.4449	156.3871	137.8946	129.1593	146.2490	147.4133	166.8288	179.2379	193.4707	(219)
Water heating fuel used												1973.1277	(219)
Annual totals kWh/year													
Space heating fuel - main system												3419.7424	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												5248.6253	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3419.7424	7.3800	252.3770	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1973.1277	7.3800	145.6168	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			463.6533	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3419.7424	0.2160	738.6644	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.1277	0.2160	426.1956	(264)
Space and water heating			1164.8599	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			1089.9969	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3419.7424	1.2200	4172.0858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1973.1277	1.2200	2407.2158	(264)
Space and water heating			6579.3015	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			6136.4701	(272)
Primary energy kWh/m2/year			52.8960	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 62	-197 kg (18.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.70 kg/m²	B 89	B 91
Total Savings	£62	1.70 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£157	£172	-£14
Mains gas	£505	£429	£76
Space heating	£381	£381	£0
Water heating	£146	£84	£62
Lighting	£136	£136	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£463	£402	£62
Total cost of uses	£464	£402	£62
Delivered energy	45 kWh/m²	37 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	43 kWh/m²	10 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1350	(8)
Pressure test		Yes	
Measured/design AP50		3.8100	
Infiltration rate		0.3255	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3528	0.3459	0.3390	0.3044	0.2975	0.2629	0.2629	0.2560	0.2767	0.2975	0.3113	0.3251	(22b)
Effective ac	0.5622	0.5598	0.5574	0.5463	0.5442	0.5345	0.5345	0.5328	0.5383	0.5442	0.5485	0.5529	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.9601	54.7239	54.4923	53.4048	53.2013	52.2540	52.2540	52.0786	52.6189	53.2013	53.6129	54.0433	(38)
Heat transfer coeff	128.9208	128.6846	128.4530	127.3655	127.1620	126.2147	126.2147	126.0393	126.5796	127.1620	127.5736	128.0040	(39)
Average = Sum(39)m / 12 =												127.3645	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1113	1.1093	1.1073	1.0979	1.0961	1.0880	1.0880	1.0865	1.0911	1.0961	1.0997	1.1034	(40)
HLP (average)												1.0979	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1601.7736 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272	(61)
Total heat required for water heating calculated for each month													
	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1322	(H8)
Utilisation factor												0.5865	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												101.8040	(H14)
Volume ratio Veff/V												0.7367	(H15)
Solar storage volume factor												0.9389	(H16)
Solar input												-878.1906	(H17)
Solar input	-25.4658	-42.4951	-72.3740	-96.9954	-119.8296	-117.8116	-116.2547	-101.5723	-79.5515	-54.3243	-30.2061	-21.3105	(63)
										Solar input (sum of months) = Sum(63)m =		-878.1906	(63)
Output from w/h													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
										Total per year (kWh/year) = Sum(64)m =		866.6317	(64)
Heat gains from water heating, kWh/month													
	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	(71)
Water heating gains (Table 5)													
	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503	(72)
Total internal gains													
	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	10.6334	0.7200	0.7000	0.7700	23.3607	(74)
East	1.4200	19.6403	0.7200	0.7000	0.7700	9.7409	(76)
South	7.6100	46.7521	0.7200	0.7000	0.7700	124.2651	(78)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	171.2279	291.9497	402.6669	508.3050	580.8042	582.4189	559.0371	503.5487	438.7611	323.2950	205.0841	146.5723	(83)
Total gains	849.1307	964.3362	1048.1169	1112.0832	1141.6467	1105.3202	1060.2039	1014.4962	974.1095	900.5481	828.7231	805.5601	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.4899	62.6046	62.7175	63.2530	63.3542	63.8297	63.8297	63.9186	63.6457	63.3542	63.1498	62.9375	
alpha	5.1660	5.1736	5.1812	5.2169	5.2236	5.2553	5.2553	5.2612	5.2430	5.2236	5.2100	5.1958	
util living area													
	0.9950	0.9897	0.9771	0.9416	0.8537	0.6868	0.5153	0.5582	0.7907	0.9528	0.9898	0.9962	(86)
MIT	19.9335	20.0886	20.3159	20.5962	20.8300	20.9601	20.9926	20.9889	20.9156	20.6203	20.2214	19.8994	(87)
Th 2	19.9916	19.9933	19.9949	20.0026	20.0040	20.0107	20.0107	20.0119	20.0081	20.0040	20.0011	19.9981	(88)
util rest of house													
	0.9934	0.9864	0.9695	0.9214	0.8049	0.5981	0.4039	0.4451	0.7125	0.9323	0.9859	0.9949	(89)
MIT 2	18.5832	18.8094	19.1377	19.5364	19.8399	19.9845	20.0080	20.0074	19.9437	19.5774	19.0093	18.5382	(90)
Living area fraction										fLA = Living area / (4) =		0.1527	(91)
MIT	18.7894	19.0047	19.3175	19.6982	19.9910	20.1334	20.1583	20.1573	20.0920	19.7366	19.1943	18.7460	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7894	19.0047	19.3175	19.6982	19.9910	20.1334	20.1583	20.1573	20.0920	19.7366	19.1943	18.7460	(93)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9906	0.9819	0.9627	0.9138	0.8042	0.6098	0.4209	0.4622	0.7199	0.9253	0.9814	0.9927	(94)
Useful gains	841.1826	946.8389	1009.0276	1016.2316	918.0556	673.9865	446.2602	468.9388	701.2554	833.2328	813.3491	799.6476	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1867.9816	1815.0515	1646.4530	1375.3116	1054.3015	698.3982	449.1090	473.5645	758.4689	1161.8263	1542.9152	1861.9510	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	763.9385	583.4389	474.2445	258.5375	101.3669	0.0000	0.0000	0.0000	0.0000	244.4735	525.2876	790.3537	(98)
Space heating												3741.6412	(98)
Space heating per m2											(98) / (4) =	32.2527	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4027.6008	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	763.9385	583.4389	474.2445	258.5375	101.3669	0.0000	0.0000	0.0000	0.0000	244.4735	525.2876	790.3537	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	822.3234	628.0289	510.4892	278.2966	109.1140	0.0000	0.0000	0.0000	0.0000	263.1577	565.4334	850.7575	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	152.4389	113.4331	89.3172	45.0818	17.3167	1.7431	0.0000	25.2256	48.2558	93.1425	129.3307	151.3463	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3514	89.3631	89.3772	89.4100	89.4185	86.7000	86.7000	86.7000	86.7000	88.9938	89.2492	89.3699	(217)
Fuel for water heating, kWh/month													
	170.6061	126.9350	99.9329	50.4214	19.3659	2.0104	0.0000	29.0953	55.6584	104.6617	144.9096	169.3482	(219)
Water heating fuel used												972.9451	(219)
Annual totals kWh/year													
Space heating fuel - main system												4027.6008	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =										-623.7532		-623.7532	(233)
Total delivered energy for all uses												4975.4862	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4027.6008	3.4800	140.1605	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	972.9451	3.4800	33.8585	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	473.6935	13.1900	62.4802	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-623.7532	13.1900	-82.2730	(252)
Total energy cost			290.7136	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.7583	(257)
SAP value	89.4212	
SAP rating (Section 12)	89	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4027.6008	0.2160	869.9618	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	972.9451	0.2160	210.1561	(264)
Space and water heating			1080.1179	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			1067.1119	(272)
CO2 emissions per m2			9.2000	(273)
EI value			91.1190	
EI rating			91	(274)
EI band			B	

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	44.0400 (1b)	x	2.3900 (2b)	=	105.2556	(1b) - (3b)
First floor	39.7800 (1c)	x	2.6400 (2c)	=	105.0192	(1c) - (3c)
Second floor	32.1900 (1d)	x	2.6700 (2d)	=	85.9473	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	296.2221	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1350	(8)
Pressure test			Yes	
Measured/design AP50			3.8100	
Infiltration rate			0.3255	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2767	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2905	0.2698	0.2767	0.2629	0.2629	0.2560	0.2490	0.2421	0.2352	0.2560	0.2421	0.2560	(22b)
Effective ac	0.5422	0.5364	0.5383	0.5345	0.5345	0.5328	0.5310	0.5293	0.5277	0.5328	0.5293	0.5328	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.30)			15.3200	1.2357	18.9316			(27)
Door			2.1200	1.5000	3.1800			(26a)
Rooflight (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
Ground floor			44.0400	0.1800	7.9272			(28a)
Dormer Wall	4.9100	1.2700	3.6400	0.1900	0.6916			(29a)
External Wall	97.3100	15.4600	81.8500	0.2700	22.0995			(29a)
Gable	22.4200	0.7100	21.7100	0.2300	4.9933			(29a)
Sloping roof	53.1700	0.6500	52.5200	0.1600	8.4032			(30)
Dormer roof	2.1800		2.1800	0.1600	0.3488			(30)
Lower roof	4.2600		4.2600	0.1600	0.6816			(30)
Total net area of external elements Aum(A, m2)			228.2900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.0600			(33)
Party Wall			66.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9007	(36)
Total fabric heat loss (33) + (36) =	73.9607	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	53.0025	52.4341	52.6189	52.2540	52.2540	52.0786	51.9079	51.7418	51.5804	52.0786	51.7418	52.0786	(38)
Heat transfer coeff	126.9632	126.3948	126.5796	126.2147	126.2147	126.0393	125.8686	125.7025	125.5411	126.0393	125.7025	126.0393	(39)
Average = Sum(39)m / 12 =												126.1083	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0944	1.0895	1.0911	1.0880	1.0880	1.0865	1.0850	1.0835	1.0822	1.0865	1.0835	1.0865	(40)
HLP (average)												1.0870	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8465 (42)
Average daily hot water use (litres/day)	101.8040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.9844	107.9123	103.8401	99.7679	95.6958	91.6236	91.6236	95.6958	99.7679	103.8401	107.9123	111.9844	(44)
Energy conte	166.0697	145.2456	149.8804	130.6694	125.3804	108.1937	100.2574	115.0468	116.4209	135.6773	148.1024	160.8296	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1601.7736 (45)

Distribution loss (46)m = 0.15 x (45)m

	24.9104	21.7868	22.4821	19.6004	18.8071	16.2291	15.0386	17.2570	17.4631	20.3516	22.2154	24.1244 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8350	10.6826	11.8108	11.4077	11.7659	11.3609	11.7237	11.7511	11.3864	11.7895	11.4344	11.8272 (61)

Total heat required for water heating calculated for each month

	177.9047	155.9282	161.6912	142.0771	137.1463	119.5546	111.9811	126.7979	127.8073	147.4668	159.5367	172.6568 (62)

Aperture area of solar collector	3.0000 (H1)
Zero-loss collector efficiency	0.7000 (H2)
Collector heat loss coefficient	1.8000 (H3)
Collector 2nd order heat loss coefficient	0.0050 (H3a)
Collector effective heat loss coefficient	1.8063 (H3b)
Collector performance ratio	2.5804 (H4)
Annual solar radiation per m2	1208.1510 (H5)
Overshading factor	0.8000 (H6)
Solar energy available	2029.6937 (H7)
Adjustment factor for showers	1.0000 (H7a)
Solar-to-load ratio	1.2672 (H8)
Utilisation factor	0.5458 (H9)
Collector performance factor	0.8793 (H10)
Dedicated solar storage volume	75.0000 (H11)
Effective solar volume	75.0000 (H13)
Daily hot water demand	101.8040 (H14)
Volume ratio Veff/V	0.7367 (H15)
Solar storage volume factor	0.9389 (H16)
Solar input	-914.5224 (H17)

Solar input

	-29.8339	-42.4220	-72.9131	-98.3767	-115.5494	-123.4250	-120.8293	-108.1459	-84.6708	-58.5385	-35.2857	-24.5322 (63)

Solar input (sum of months) = Sum(63)m = -914.5224 (63)

Output from w/h

	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246 (64)

Total per year (kWh/year) = Sum(64)m = 838.7449 (64)

Heat gains from water heating, kWh/month

	58.1769	50.9648	52.7879	46.2995	44.6305	38.8146	36.2665	41.1908	41.5565	48.0601	52.1026	56.4326 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	170.7891	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	67.0562	59.5587	48.4364	36.6695	27.4109	23.1414	25.0051	32.5026	43.6249	55.3918	64.6505	68.9199 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	417.7967	422.1321	411.2070	387.9487	358.5893	330.9956	312.5613	308.2259	319.1510	342.4093	371.7687	399.3624 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254	54.9254 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594	-113.8594 (71)

Water heating gains (Table 5)

	78.1948	75.8405	70.9515	64.3049	59.9872	53.9092	48.7453	55.3640	57.7174	64.5969	72.3648	75.8503 (72)

Total internal gains

	677.9028	672.3864	645.4500	603.7782	560.8424	522.9013	501.1668	510.9476	535.3484	577.2531	623.6390	658.9877 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2900	13.4839	0.7200	0.7000	0.7700	29.6230	(74)
East	1.4200	25.1925	0.7200	0.7000	0.7700	12.4946	(76)
South	7.6100	56.7559	0.7200	0.7000	0.7700	150.8548	(78)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	210.2386	305.3069	426.2047	545.7427	596.9711	652.2639	620.3638	569.2711	491.9259	365.1435	251.0041	176.9179 (83)
Total gains	888.1414	977.6933	1071.6547	1149.5208	1157.8135	1175.1652	1121.5306	1080.2187	1027.2743	942.3966	874.6431	835.9056 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4534	63.7388	63.6457	63.8297	63.8297	63.9186	64.0053	64.0898	64.1722	63.9186	64.0898	63.9186	
alpha	5.2302	5.2493	5.2430	5.2553	5.2553	5.2612	5.2670	5.2727	5.2781	5.2612	5.2727	5.2612	
util living area	0.9927	0.9875	0.9704	0.9204	0.8065	0.5926	0.4345	0.4500	0.7146	0.9249	0.9830	0.9943	(86)
MIT	20.0493	20.1659	20.4009	20.6779	20.8861	20.9820	20.9971	20.9966	20.9535	20.7229	20.3551	20.0290	(87)
Th 2	20.0054	20.0094	20.0081	20.0107	20.0107	20.0119	20.0131	20.0143	20.0154	20.0119	20.0143	20.0119	(88)
util rest of house	0.9903	0.9835	0.9606	0.8938	0.7461	0.4984	0.3263	0.3384	0.6246	0.8933	0.9764	0.9924	(89)
MIT 2	18.7617	18.9332	19.2684	19.6519	19.9097	20.0021	20.0123	20.0133	19.9846	19.7197	19.2116	18.7373	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9583	19.1214	19.4413	19.8085	20.0588	20.1517	20.1626	20.1634	20.1325	19.8728	19.3862	18.9345	(93)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9868	0.9785	0.9533	0.8873	0.7493	0.5122	0.3429	0.3555	0.6361	0.8879	0.9707	0.9894	(94)
Useful gains	876.3989	956.6808	1021.6288	1019.9826	867.5649	601.9047	384.5753	384.0012	653.4386	836.7206	849.0031	827.0079	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1784.8854	1746.9489	1574.8111	1301.0860	954.0317	611.4991	385.4890	385.0798	682.0005	1067.9109	1443.8382	1756.2905	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	675.9140	531.0602	411.5676	202.3945	64.3313	0.0000	0.0000	0.0000	0.0000	172.0056	428.2813	691.3863	(98)
Space heating												3176.9407	(98)
Space heating per m2											(98) / (4) =	27.3851	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3419.7424	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	675.9140	531.0602	411.5676	202.3945	64.3313	0.0000	0.0000	0.0000	0.0000	172.0056	428.2813	691.3863	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	727.5715	571.6471	443.0222	217.8627	69.2479	0.0000	0.0000	0.0000	0.0000	185.1513	461.0132	744.2264	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	148.0708	113.5062	88.7780	43.7004	21.5969	0.0000	0.0000	18.6520	43.1365	88.9283	124.2511	148.1246	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3077	89.3195	89.3151	89.3146	89.0737	86.7000	86.7000	86.7000	86.7000	88.7832	89.1600	89.3183	(217)
Fuel for water heating, kWh/month	165.7985	127.0789	99.3987	48.9286	24.2461	0.0000	0.0000	21.5133	49.7538	100.1634	139.3574	165.8390	(219)
Water heating fuel used												942.0778	(219)
Annual totals kWh/year													
Space heating fuel - main system												3419.7424	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												473.6935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =										-692.9382		-692.9382	(233)
Total delivered energy for all uses												4267.5754	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3419.7424	7.3800	252.3770	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	942.0778	7.3800	69.5253	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	473.6935	28.6600	135.7605	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.9382	28.6600	-198.5961	(252)
Total energy cost			401.8918	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3419.7424	0.2160	738.6644	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0778	0.2160	203.4888	(264)
Space and water heating			942.1532	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	473.6935	0.5190	245.8469	(268)
Energy saving/generation technologies				

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-692.9382	0.5190	-359.6349 (269)
Total kg/year			893.2401 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3419.7424	1.2200	4172.0858	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	942.0778	1.2200	1149.3349	(264)
Space and water heating			5321.4207	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	473.6935	3.0700	1454.2389	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			5032.0892	(272)
Primary energy kWh/m2/year			43.3763	(273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient		782.03 (P1)
Transmission heat loss coefficient		73.96 (37)
Summer heat loss coefficient		855.99 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer	
North	0.850	0.90	1.000	0.765	(P8)
East	0.850	0.90	1.000	0.765	(P8)
South	0.850	0.90	1.000	0.765	(P8)
South	0.850	1.00	1.000	0.850	(P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.2900	87.1704	0.7200	0.7000	0.7650	190.2630
East	1.4200	125.2818	0.7200	0.7000	0.7650	61.7321
South	7.6100	118.5567	0.7200	0.7000	0.7650	313.0727
South	0.6500	202.9386	0.7200	0.7000	0.8500	50.8593
total:						615.9270

	Jun	Jul	Aug	
Solar gains	658	616	563	(P3)
Internal gains	520	498	508	
Total summer gains	1178	1114	1071	(P5)
Summer gain/loss ratio	1.38	1.30	1.25	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.03	18.85	18.80	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 667	**Issued on Date**	07/08/2024
Assessment Reference	EPC - Plot 667	**Prop Type Ref**	
Property	9 Kittiwake Place, Boorley Green, SOUTHAMPTON, SO32 2ZB		

SAP Rating	88 B	**DER**	12.56	**TER**	16.22
Environmental	90 B	**% DER<TER**	22.56		
CO_2 Emissions (t/year)	1.09	**DFEE**	43.82	**TFEE**	49.73
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.87		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.22	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.56	$kgCO_2/m^2$	Pass
	-3.66 (-22.6%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.73	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.82	$kWh/m^2/yr$	
	-5.9 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.81 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South	6.29 m², No overhang 1.42 m², No overhang 7.61 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.81 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.026	W/m²K
Air permeability	3.8	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 668 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 668	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 668, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.32	**TER**	16.64
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.91	**TFEE**	56.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 128 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.64 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.32 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.07 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.50 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 536 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power:
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 9.16 m², No overhang
Windows facing East: 1.29 m², No overhang
Windows facing South: 8.17 m², No overhang
Windows facing West: 9.64 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.07 W/m²K
Floor U-value 0.12 W/m²K
Thermal bridging y-value 0.021 W/m²K
Photovoltaic array 3.24 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7400 (1b)	x	2.3100 (2b)	=	149.5494	(1b) - (3b)
First floor	63.4200 (1c)	x	2.6300 (2c)	=	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	316.3440	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							5 * 10	=	50.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	50.0000	/ (5) =	0.1581	(8)
Pressure test			Yes	
Measured/design AP50			4.5000	
Infiltration rate			0.3831	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)]	=	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20)	=	0.3256	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4151	0.4070	0.3989	0.3582	0.3500	0.3093	0.3093	0.3012	0.3256	0.3500	0.3663	0.3826	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.6651	0.6570	0.6489	0.6082	0.6000	0.5593	0.5593	0.5512	0.5756	0.6000	0.6163	0.6326	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			28.2600	1.2357	34.9221			(27)
Opening Type 8			4.2800	1.5000	6.4200			(26a)
Ground floor			64.7400	0.1200	7.7688			(28a)
External Wall	162.6500	32.5400	130.1100	0.2100	27.3231			(29a)
Main Roof	63.4200		63.4200	0.0700	4.4394			(30)
Bay roof	1.3300		1.3300	0.1600	0.2128			(30)
Total net area of external elements Aum(A, m2)			292.1400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		81.0862			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2210	(36)
Total fabric heat loss					(33) + (36) =		87.3071	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	69.4360	68.5862	67.7364	63.4877	62.6379	58.3891	58.3891	57.5394	60.0886	62.6379	64.3374	66.0369	(38)
Heat transfer coeff	156.7431	155.8933	155.0436	150.7948	149.9450	145.6963	145.6963	144.8465	147.3958	149.9450	151.6446	153.3441	(39)
Average = Sum(39)m / 12 =												150.5824	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2230	1.2164	1.2098	1.1766	1.1700	1.1368	1.1368	1.1302	1.1501	1.1700	1.1832	1.1965	(40)
HLP (average)												1.1750	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8901	(42)
Average daily hot water use (litres/day)	102.8388	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1227	109.0092	104.8956	100.7821	96.6685	92.5550	92.5550	96.6685	100.7821	104.8956	109.0092	113.1227	(44)
Energy conte	167.7577	146.7220	151.4040	131.9976	126.6549	109.2935	101.2765	116.2163	117.6043	137.0565	149.6078	162.4644	(45)
Energy content (annual)										Total = Sum(45)m =		1618.0555	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1637	22.0083	22.7106	19.7996	18.9982	16.3940	15.1915	17.4324	17.6406	20.5585	22.4412	24.3697	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	11.8297	10.6748	11.7954	11.3844	11.7346	11.3196	11.6743	11.7134	11.3542	11.7653	11.4214	11.8186 (61)

Total heat required for water heating calculated for each month

	179.5875	157.3968	163.1993	143.3820	138.3894	120.6132	112.9508	127.9297	128.9584	148.8217	161.0292	174.2830 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	179.5875	157.3968	163.1993	143.3820	138.3894	120.6132	112.9508	127.9297	128.9584	148.8217	161.0292	174.2830 (64)
								Total per year (kWh/year) = Sum(64)m =				1756.5411 (64)

Heat gains from water heating, kWh/month

	58.7369	51.4538	53.2907	46.7353	45.0464	39.1700	36.5930	41.5703	41.9420	48.5126	52.5999	56.9741 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	26.3503	23.4041	19.0335	14.4096	10.7713	9.0936	9.8260	12.7721	17.1427	21.7667	25.4049	27.0826	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	295.4890	298.5552	290.8284	274.3788	253.6142	234.0984	221.0606	217.9944	225.7212	242.1708	262.9354	282.4512	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	(71)

Water heating gains (Table 5)

	78.9474	76.5681	71.6272	64.9102	60.5462	54.4028	49.1842	55.8740	58.2527	65.2051	73.0555	76.5781	(72)

Total internal gains

	470.1375	467.8783	450.8399	423.0494	394.2826	366.9456	349.4216	355.9914	370.4676	398.4934	430.7466	455.4627	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.1600	10.6334	0.7200	0.7000	0.7700	34.0197	(74)
East	1.2900	19.6403	0.7200	0.7000	0.7700	8.8491	(76)
South	8.1700	46.7521	0.7200	0.7000	0.7700	133.4095	(78)
West	9.6400	19.6403	0.7200	0.7000	0.7700	66.1284	(80)

Solar gains	242.4068	430.1758	630.3396	844.2921	998.5672	1013.3126	967.8957	850.2998	704.4914	487.0910	293.5916	205.2965	(83)
Total gains	712.5443	898.0540	1081.1795	1267.3415	1392.8498	1380.2582	1317.3173	1206.2912	1074.9590	885.5844	724.3383	660.7592	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.4246	45.6723	45.9226	47.2165	47.4841	48.8688	48.8688	49.1555	48.3053	47.4841	46.9519	46.4315	
alpha	4.0283	4.0448	4.0615	4.1478	4.1656	4.2579	4.2579	4.2770	4.2204	4.1656	4.1301	4.0954	
util living area													
	0.9961	0.9899	0.9728	0.9205	0.8069	0.6283	0.4747	0.5319	0.7854	0.9568	0.9920	0.9972	(86)
MIT	19.3652	19.6091	19.9719	20.4305	20.7655	20.9430	20.9863	20.9785	20.8496	20.3828	19.7993	19.3478	(87)
Th 2	19.9016	19.9069	19.9122	19.9388	19.9441	19.9709	19.9709	19.9762	19.9601	19.9441	19.9334	19.9228	(88)
util rest of house													
	0.9951	0.9871	0.9650	0.8979	0.7555	0.5439	0.3693	0.4228	0.7114	0.9400	0.9893	0.9964	(89)
MIT 2	17.7224	18.0807	18.6082	19.2712	19.7107	19.9301	19.9649	19.9659	19.8339	19.2222	18.3772	17.7107	(90)
Living area fraction									fLA = Living area / (4) =			0.1197	(91)
MIT	17.9190	18.2637	18.7714	19.4099	19.8370	20.0514	20.0872	20.0871	19.9555	19.3611	18.5474	17.9066	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9190	18.2637	18.7714	19.4099	19.8370	20.0514	20.0872	20.0871	19.9555	19.3611	18.5474	17.9066	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9920	0.9808	0.9539	0.8841	0.7497	0.5509	0.3816	0.4351	0.7110	0.9275	0.9841	0.9940	(94)
Useful gains	706.8085	880.8175	1031.3122	1120.4113	1044.1551	760.3292	502.6323	524.8191	764.3278	821.3801	712.7883	656.7860	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2134.6831	2083.3067	1902.6011	1584.8451	1220.1011	794.2459	508.0703	534.0691	863.0717	1313.6876	1735.9357	2101.8313	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1062.3387	808.0727	648.2390	334.3923	130.9038	0.0000	0.0000	0.0000	0.0000	366.2767	736.6661	1075.1137	(98)
Space heating												5162.0031	(98)
Space heating per m2											(98) / (4) =	40.2778	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	5532.6936	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1062.3387	808.0727	648.2390	334.3923	130.9038	0.0000	0.0000	0.0000	0.0000	366.2767	736.6661	1075.1137	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	1138.6267	866.1015	694.7899	358.4055	140.3042	0.0000	0.0000	0.0000	0.0000	392.5796	789.5671	1152.3191	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.5875	157.3968	163.1993	143.3820	138.3894	120.6132	112.9508	127.9297	128.9584	148.8217	161.0292	174.2830	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.7610	89.6928	89.5521	89.1886	88.4134	86.7000	86.7000	86.7000	86.7000	89.2295	89.6324	89.7800	(217)
Fuel for water heating, kWh/month													
	200.0728	175.4843	182.2395	160.7627	156.5254	139.1155	130.2777	147.5544	148.7410	166.7852	179.6552	194.1224	(219)
Water heating fuel used												1981.3361	(219)
Annual totals kWh/year													
Space heating fuel - main system												5532.6936	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												465.3539	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.24 * 908 * 1.00) =										-2353.1582		-2353.1582	(233)
Total delivered energy for all uses												5701.2254	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5532.6936	0.2160	1195.0618	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.3361	0.2160	427.9686	(264)
Space and water heating			1623.0304	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	465.3539	0.5190	241.5187	(268)
Energy saving/generation technologies				
PV Unit	-2353.1582	0.5190	-1221.2891	(269)
Total CO2, kg/year			682.1850	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.3200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		5.3200	ZC1
Total Floor Area	TFA	128.1600	
Assumed number of occupants	N	2.8901	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6627	ZC2
CO2 emissions from cooking, equation (L16)		1.4697	ZC3
Total CO2 emissions		20.4524	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		20.4524	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	64.7400	(1b)	x 2.3100	(2b) =	149.5494	(1b) - (3b)
First floor	63.4200	(1c)	x 2.6300	(2c) =	166.7946	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.1600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		316.3440	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.1264	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3764	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3200	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4080	0.4000	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760	(22b)
Effective ac	0.5832	0.5800	0.5768	0.5619	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2800	1.2000	5.1360			(26a)
TER Opening Type (Uw = 1.40)			27.8000	1.3258	36.8561			(27)
Ground floor			64.7400	0.1300	8.4162			(28a)
External Wall	162.6500	32.0800	130.5700	0.1800	23.5026			(29a)
Main Roof	63.4200		63.4200	0.1300	8.2446			(30)
Bay roof	1.3300		1.3300	0.1300	0.1729			(30)
Total net area of external elements Aum(A, m2)			292.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.3284			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.0424	(36)
Total fabric heat loss (33) + (36) =	96.3708	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	60.8844	60.5471	60.2164	58.6633	58.3727	57.0199	57.0199	56.7694	57.5410	58.3727	58.9605	59.5751	(38)
Heat transfer coeff	157.2552	156.9179	156.5872	155.0340	154.7434	153.3907	153.3907	153.1402	153.9117	154.7434	155.3313	155.9459	(39)
Average = Sum(39)m / 12 =												155.0326	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2270	1.2244	1.2218	1.2097	1.2074	1.1969	1.1969	1.1949	1.2009	1.2074	1.2120	1.2168	(40)
HLP (average)												1.2097	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8901 (42)
Average daily hot water use (litres/day)	102.8388 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.1227	109.0092	104.8956	100.7821	96.6685	92.5550	92.5550	96.6685	100.7821	104.8956	109.0092	113.1227	(44)
Energy conte	167.7577	146.7220	151.4040	131.9976	126.6549	109.2935	101.2765	116.2163	117.6043	137.0565	149.6078	162.4644	(45)
Energy content (annual)										Total = Sum(45)m =		1618.0555	(45)
Distribution loss (46)m = 0.15 x (45)m	25.1637	22.0083	22.7106	19.7996	18.9982	16.3940	15.1915	17.4324	17.6406	20.5585	22.4412	24.3697	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.2612	45.6435	47.1650	49.2612	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	218.7167	192.7494	202.3629	181.3127	175.9161	154.9371	148.4415	165.4775	166.9193	188.0154	198.9229	213.4233 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	218.7167	192.7494	202.3629	181.3127	175.9161	154.9371	148.4415	165.4775	166.9193	188.0154	198.9229	213.4233 (64)
								Total per year (kWh/year) = Sum(64)m =				2207.1947 (64)
Heat gains from water heating, kWh/month												
	68.5192	60.2919	63.0815	56.2180	54.4281	47.7510	45.4657	50.9572	51.4322	58.3110	62.0734	66.7591 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	144.5028	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.3663	23.4183	19.0450	14.4183	10.7779	9.0991	9.8319	12.7799	17.1532	21.7799	25.4203	27.0991	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	295.4890	298.5552	290.8284	274.3788	253.6142	234.0984	221.0606	217.9944	225.7212	242.1708	262.9354	282.4512	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	37.4503	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	-115.6023	(71)
Water heating gains (Table 5)													
	92.0957	89.7201	84.7870	78.0805	73.1560	66.3208	61.1098	68.4909	71.4336	78.3750	86.2130	89.7300	(72)
Total internal gains													
	483.3018	481.0445	464.0113	436.2285	406.8989	378.8692	361.3532	368.6160	383.6588	411.6765	443.9196	468.6312	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.0000	10.6334	0.6300	0.7000	0.7700	29.2473	(74)
East	1.2700	19.6403	0.6300	0.7000	0.7700	7.6229	(76)
South	8.0400	46.7521	0.6300	0.7000	0.7700	114.8758	(78)
West	9.4900	19.6403	0.6300	0.7000	0.7700	56.9620	(80)

Solar gains	208.7081	370.3720	542.6964	726.8695	859.6535	872.3306	833.2396	732.0291	606.5287	419.3722	252.7772	176.7568	(83)
Total gains	692.0099	851.4165	1006.7076	1163.0980	1266.5523	1251.1997	1194.5928	1100.6451	990.1876	831.0487	696.6968	645.3880	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5959	56.7176	56.8373	57.4068	57.5146	58.0218	58.0218	58.1167	57.8254	57.5146	57.2969	57.0711	
alpha	4.7731	4.7812	4.7892	4.8271	4.8343	4.8681	4.8681	4.8744	4.8550	4.8343	4.8198	4.8047	
util living area													
	0.9987	0.9963	0.9886	0.9597	0.8769	0.7163	0.5492	0.6118	0.8569	0.9798	0.9971	0.9991	(86)
MIT	19.6016	19.7867	20.0775	20.4493	20.7618	20.9379	20.9863	20.9774	20.8450	20.4234	19.9388	19.5701	(87)
Th 2	19.8984	19.9005	19.9026	19.9123	19.9141	19.9225	19.9225	19.9241	19.9193	19.9141	19.9104	19.9066	(88)
util rest of house													
	0.9983	0.9950	0.9843	0.9440	0.8301	0.6216	0.4227	0.4825	0.7851	0.9692	0.9959	0.9988	(89)
MIT 2	18.0333	18.3051	18.7290	19.2654	19.6807	19.8814	19.9176	19.9149	19.7935	19.2387	18.5349	17.9928	(90)
Living area fraction										fLA = Living area / (4) =		0.1197	(91)
MIT	18.2211	18.4824	18.8904	19.4071	19.8101	20.0078	20.0455	20.0420	19.9194	19.3805	18.7029	18.1816	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2211	18.4824	18.8904	19.4071	19.8101	20.0078	20.0455	20.0420	19.9194	19.3805	18.7029	18.1816	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9925	0.9787	0.9346	0.8248	0.6298	0.4377	0.4975	0.7851	0.9618	0.9937	0.9980	(94)
Useful gains	690.0674	845.0265	985.3089	1086.9744	1044.6203	787.9862	522.8951	547.5426	777.4165	799.2717	692.3013	644.0775	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2189.1583	2131.3238	1940.1828	1628.9540	1254.9791	829.5094	528.5037	557.7423	895.6681	1358.7222	1802.3000	2180.3722	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1115.3236	864.3918	710.4262	390.2253	156.5069	0.0000	0.0000	0.0000	0.0000	416.2312	799.1991	1143.0033	(98)
Space heating												5595.3074	(98)
Space heating per m2											(98) / (4) =	43.6588	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5990.6931	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1115.3236	864.3918	710.4262	390.2253	156.5069	0.0000	0.0000	0.0000	0.0000	416.2312	799.1991	1143.0033	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	1194.1366	925.4730	760.6276	417.8001	167.5663	0.0000	0.0000	0.0000	0.0000	445.6437	855.6735	1223.7723	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	218.7167	192.7494	202.3629	181.3127	175.9161	154.9371	148.4415	165.4775	166.9193	188.0154	198.9229	213.4233	(64)
Efficiency of water heater												80.3000	(216)
(217)m	88.5735	88.3733	87.9476	86.9313	84.7584	80.3000	80.3000	80.3000	80.3000	86.9953	88.1893	88.6457	(217)
Fuel for water heating, kWh/month													
	246.9324	218.1081	230.0948	208.5701	207.5501	192.9478	184.8587	206.0741	207.8697	216.1213	225.5634	240.7600	(219)
Water heating fuel used												2585.4505	(219)
Annual totals kWh/year													
Space heating fuel - main system												5990.6931	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												465.6365	(232)
Total delivered energy for all uses												9116.7801	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5990.6931	0.2160	1293.9897	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.4505	0.2160	558.4573	(264)
Space and water heating			1852.4470	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	465.6365	0.5190	241.6653	(268)
Total CO2, kg/m2/year			2133.0374	(272)
Emissions per m2 for space and water heating			14.4542	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8857	(272b)
Emissions per m2 for pumps and fans			0.3037	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4542 * 1.00) + 1.8857 + 0.3037, rounded to 2 d.p.			16.6400	(273)

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 668 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 668	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 668, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.32	**TER**	16.64
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.91	**TFEE**	56.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2025
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	33.76 m	64.74 m²	2.31 m
1st Storey:	32.26 m	63.42 m²	2.63 m

7.0 Living Area	15.34	m²
8.0 Thermal Mass Parameter	Enter TMP value	
Thermal Mass	200.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.21	162.65	130.11

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
Main Roof	External Plane Roof	0.07	63.42	63.42
Bay roof	External Flat Roof	0.16	1.33	1.33

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Ground floor	Ground Floor - Solid		0.12	64.74

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

Energy & Design

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Opening Type 1	Manufacturer	Window	Double Low-E Hard 0.2			0.72		0.70	1.30
Opening Type 8	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
W1	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W2	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W5	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					3.47	100
W6	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00					0.81	100
W7	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					1.90	100
D1	Half Glazed Door	[1] External Wall	West							2.14	100
W3	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.88	100
W8	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W9	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.31	100
W10	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00					1.88	100
W11	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00					1.41	100
D3 W16	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00					3.80	100

W12	Window	[1] External Wall	South	Dark-coloured curtain or roller blind	0.00	1.41	100
W13	Window	[1] External Wall	East	Dark-coloured curtain or roller blind	0.00	0.48	100
W14	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	2.05	100
D2	Half Glazed Door	[1] External Wall	East			2.14	100
W4	Window	[1] External Wall	West	Dark-coloured curtain or roller blind	0.00	0.81	100
W15	Window	[1] External Wall	North	Dark-coloured curtain or roller blind	0.00	1.41	100

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	

17.0 Thermal Bridging — Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	22.57	0.065	No
Independently assessed	E3 Sill	18.71	0.004	No
Independently assessed	E4 Jamb	51.90	0.005	No
Independently assessed	E5 Ground floor (normal)	33.76	0.051	No
Independently assessed	E6 Intermediate floor within a dwelling	32.26	-0.006	No
Independently assessed	E10 Eaves (insulation at ceiling level)	18.67	0.087	No
Independently assessed	E12 Gable (insulation at ceiling level)	13.59	0.051	No
Independently assessed	E14 Flat roof	3.37	0.029	No
Independently assessed	E16 Corner (normal)	24.36	0.037	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.62	-0.092	No

Y-value	0.021	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	4.50	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes

Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500821
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	
22.0 Lighting		
Internal		
Total number of light fittings	14	
Total number of L.E.L. fittings	14	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	19081	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.3	
In Summer	86.7	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Boiler Compensator	Baxi Heating UK Ltd, Baxi, IFOS	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.24	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£47	A 97	

CODE FOR SUSTAINABLE HOMES
Calculation Type: New Build (As Designed)

Energy & Design

Property Reference	Plot 668 BG	**Issued on Date**	04/04/2025
Assessment Reference	Plot 668	**Prop Type Ref**	As
Property	L467-R - Det SG, Plot 668, Boorley Gardens, Southampton, SO32		

SAP Rating	96 A	**DER**	5.32	**TER**	16.64
Environmental	96 A	**% DER<TER**	68.04		
CO_2 Emissions (t/year)	0.13	**DFEE**	42.91	**TFEE**	56.34
General Requirements Compliance	Pass	**% DFEE<TFEE**	23.84		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

ENE 1 - Dwelling Emission Rate calculation

Total floor area	128.16	m^2	
DER	5.32	$kgCO_2/yr/m^2$	
TER	16.64	$kgCO_2/yr/m^2$	
CO_2 emissions offset from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Residual CO_2 emissions offset from biofuel CHP	0.00	$kgCO_2/yr/m^2$	(ZC5)
Total CO_2 emissions offset from SAP Section 16 allowances	0.00	$kgCO_2/yr/m^2$	
DER accounting for SAP Section 16 allowances	5.32	$kgCO_2/yr/m^2$	
Reduction DER/TER	68.04	%	
CfSH ENE1 credits achieved	6.8		
CfSH ENE1 level achieved	4		

ENE 2 – Fabric Energy Efficiency calculation

Dwelling type	House, Detached		
Fabric energy efficiency (F.E.E.)	42.91	$kWh/m^2/yr$	
CfSH ENE2 credits achieved	7.7		
CfSH ENE1 and 2 overall level achieved	4		

ENE 7 – Low and Zero Carbon Technologies calculation

Standard case CO_2 emissions

Total floor area	128.16	m^2	
DER	16.93	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Standard case total CO_2 emissions	32.06	$kgCO_2/yr/m^2$	(ZC4)
Net Standard case CO_2 emissions	32.06	$kgCO_2/yr/m^2$	(ZC8)

Actual case CO_2 emissions

DER	7.41	$kgCO_2/yr/m^2$	
CO_2 emissions from electrical appliances	13.66	$kgCO_2/yr/m^2$	(ZC2)
CO_2 emissions from cooking	1.47	$kgCO_2/yr/m^2$	(ZC3)
Actual case total CO_2 emissions	22.54	$kgCO_2/yr/m^2$	(ZC4)
CO_2 emissions from Biomass	0.00	$kgCO_2/yr/m^2$	(ZC5)
CO_2 reduction from additional allowable electricity generation	0.00	$kgCO_2/yr/m^2$	(ZC7)
Net Actual case CO_2 emissions	22.54	$kgCO_2/yr/m^2$	(ZC8)
Improvement in net actual/net standard case CO_2 emissions	30	%	

ENE7 credits achieved	2

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 669 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 669 - EPC	**Prop Type Ref**	
Property	21 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	13.50	**TER**	19.05
Environmental	90 B	**% DER<TER**	29.12		
CO_2 Emissions (t/year)	0.76	**DFEE**	47.52	**TFEE**	53.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Ground-floor flat, total floor area 77 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.05 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.5 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.01 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.44 m², No overhang
Windows facing North East: 1.86 m², No overhang
Windows facing South: 3.31 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Thermal bridging y-value 0.034 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3137	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2666	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3399	0.3333	0.3266	0.2933	0.2866	0.2533	0.2533	0.2466	0.2666	0.2866	0.2999	0.3133	(22b)
Effective ac	0.5578	0.5555	0.5533	0.5430	0.5411	0.5321	0.5321	0.5304	0.5355	0.5411	0.5450	0.5491	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5211	(36)
Total fabric heat loss (33) + (36) =	56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5315	32.4007	32.2724	31.6700	31.5573	31.0326	31.0326	30.9354	31.2347	31.5573	31.7853	32.0237	(38)
Heat transfer coeff	88.6226	88.4917	88.3635	87.7610	87.6483	87.1236	87.1236	87.0265	87.3257	87.6483	87.8763	88.1147	(39)
Average = Sum(39)m / 12 =												87.7605	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1583	1.1566	1.1549	1.1471	1.1456	1.1387	1.1387	1.1375	1.1414	1.1456	1.1486	1.1517	(40)
HLP (average)												1.1470	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	364.1615	362.0250	348.8015	327.5572	306.0478	285.3431	271.9259	277.8725	288.8258	310.2780	334.8756	353.2652	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	10.6334	0.7400	0.7000	0.7700	24.5822	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	3.3100	46.7521	0.7400	0.7000	0.7700	55.5510	(78)

Solar gains	87.6667	153.2908	223.3452	304.5769	370.2085	381.2858	361.8045	310.0937	250.7041	172.7897	105.6513	74.6464	(83)
Total gains	451.8282	515.3158	572.1467	632.1341	676.2562	666.6288	633.7303	587.9663	539.5299	483.0678	440.5269	427.9115	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9531	60.0417	60.1289	60.5416	60.6195	60.9845	60.9845	61.0526	60.8434	60.6195	60.4622	60.2986	
alpha	4.9969	5.0028	5.0086	5.0361	5.0413	5.0656	5.0656	5.0702	5.0562	5.0413	5.0308	5.0199	
util living area													
	0.9981	0.9961	0.9902	0.9690	0.9018	0.7528	0.5852	0.6466	0.8774	0.9804	0.9962	0.9986	(86)
MIT	19.7388	19.8826	20.1234	20.4481	20.7478	20.9314	20.9847	20.9752	20.8412	20.4620	20.0391	19.7078	(87)
Th 2	19.9535	19.9549	19.9562	19.9626	19.9638	19.9693	19.9693	19.9704	19.9672	19.9638	19.9614	19.9589	(88)
util rest of house													
	0.9975	0.9947	0.9865	0.9565	0.8617	0.6623	0.4581	0.5184	0.8126	0.9704	0.9946	0.9981	(89)
MIT 2	18.2723	18.4830	18.8343	19.3039	19.7091	19.9220	19.9635	19.9597	19.8340	19.3305	18.7169	18.2308	(90)
Living area fraction										fLA = Living area / (4) =		0.3533	(91)
MIT	18.7904	18.9775	19.2897	19.7081	20.0760	20.2786	20.3243	20.3185	20.1898	19.7302	19.1840	18.7526	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7904	18.9775	19.2897	19.7081	20.0760	20.2786	20.3243	20.3185	20.1898	19.7302	19.1840	18.7526	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9929	0.9834	0.9527	0.8668	0.6916	0.5034	0.5640	0.8288	0.9673	0.9930	0.9973	(94)
Useful gains	450.2410	511.6467	562.6480	602.2369	586.1528	461.0574	319.0477	331.6210	447.1618	467.2905	437.4289	426.7556	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1284.1744	1245.7389	1130.1452	948.5293	734.1466	494.7418	324.4732	341.0124	531.8004	800.2501	1061.8960	1282.2982	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	620.4465	493.3100	422.2179	249.3305	110.1074	0.0000	0.0000	0.0000	0.0000	247.7219	449.6164	636.5237	(98)
Space heating												3229.2744	(98)
Space heating per m2											(98) / (4) =	42.2072	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3476.0757	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	620.4465	493.3100	422.2179	249.3305	110.1074	0.0000	0.0000	0.0000	0.0000	247.7219	449.6164	636.5237	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	667.8649	531.0119	454.4865	268.3859	118.5225	0.0000	0.0000	0.0000	0.0000	266.6544	483.9789	685.1709	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2238	89.1703	89.0563	88.7871	88.1771	86.7000	86.7000	86.7000	86.7000	88.7551	89.1029	89.2528	(217)
Fuel for water heating, kWh/month													
	179.6842	157.6115	163.7250	144.4166	140.4613	124.6671	116.9021	132.1820	133.1766	149.9498	161.4410	174.3676	(219)
Water heating fuel used												1778.5847	(219)
Annual totals kWh/year													
Space heating fuel - main system												3476.0757	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												5057.8808	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3476.0757	0.2160	750.8324	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1778.5847	0.2160	384.1743	(264)
Space and water heating			1135.0067	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			1032.8780	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5000	ZC1
Total Floor Area	TFA	76.5100	
Assumed number of occupants	N	2.3933	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4191	ZC2
CO2 emissions from cooking, equation (L16)		2.3061	ZC3
Total CO2 emissions		32.2251	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.2251	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6100	1.3258	15.3920			(27)
Ground floor			76.5100	0.1300	9.9463			(28a)
External Wall	68.6000	13.7300	54.8700	0.1800	9.8766			(29a)
Communal Wall	15.3800		15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1047	(36)
Total fabric heat loss					(33) + (36) =		51.6321	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	86.8283	86.5940	86.3643	85.2855	85.0836	84.1440	84.1440	83.9700	84.5059	85.0836	85.4920	85.9188	(39)
Average = Sum(39)m / 12 =												85.2845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1349	1.1318	1.1288	1.1147	1.1121	1.0998	1.0998	1.0975	1.1045	1.1121	1.1174	1.1230	(40)
HLP (average)												1.1147	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933	(42)
Average daily hot water use (litres/day)	91.0410	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	44.4181	47.3214	43.9990	43.6099	40.4073	41.7542	43.6099	43.9990	47.3214	47.5908	50.9589	(61)
Total heat required for water heating calculated for each month													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Total per year (kWh/year) = Sum(64)m =												1978.3788	(64)
Heat gains from water heating, kWh/month													
	62.1201	54.2929	56.3969	49.8539	48.1840	42.2729	40.2498	45.1113	45.6172	52.1736	55.9355	60.5620	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	83.4947	80.7930	75.8023	69.2416	64.7634	58.7124	54.0992	60.6335	63.3572	70.1258	77.6882	81.4005	(72)
Total internal gains													
	377.3168	374.5865	360.7466	338.8872	316.7601	295.4390	282.0260	288.5889	300.1618	322.2291	347.4405	366.4229	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	10.6334	0.6300	0.7000	0.7700	20.9281	(74)
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
South	3.3100	46.7521	0.6300	0.7000	0.7700	47.2934	(78)

Solar gains	74.6352	130.5043	190.1452	259.3019	315.1775	324.6082	308.0227	263.9987	213.4373	147.1048	89.9464	63.5503	(83)
Total gains	451.9520	505.0908	550.8918	598.1892	631.9376	620.0471	590.0487	552.5876	513.5990	469.3339	437.3868	429.9731	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1920	61.3576	61.5207	62.2989	62.4467	63.1441	63.1441	63.2749	62.8736	62.4467	62.1485	61.8397	
alpha	5.0795	5.0905	5.1014	5.1533	5.1631	5.2096	5.2096	5.2183	5.1916	5.1631	5.1432	5.1226	
util living area													
	0.9982	0.9964	0.9915	0.9738	0.9159	0.7746	0.6056	0.6626	0.8867	0.9819	0.9963	0.9986	(86)
MIT	19.7704	19.9028	20.1299	20.4447	20.7374	20.9278	20.9840	20.9751	20.8419	20.4759	20.0707	19.7491	(87)
Th 2	19.9725	19.9749	19.9774	19.9888	19.9910	20.0010	20.0010	20.0029	19.9972	19.9910	19.9867	19.9821	(88)
util rest of house													
	0.9975	0.9951	0.9883	0.9631	0.8801	0.6876	0.4792	0.5365	0.8256	0.9725	0.9948	0.9981	(89)
MIT 2	18.3319	18.5269	18.8592	19.3201	19.7208	19.9500	19.9948	19.9919	19.8624	19.3708	18.7810	18.3076	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	18.8401	19.0130	19.3082	19.7174	20.0799	20.2954	20.3443	20.3392	20.2085	19.7612	19.2367	18.8168	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8401	19.0130	19.3082	19.7174	20.0799	20.2954	20.3443	20.3392	20.2085	19.7612	19.2367	18.8168	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9934	0.9855	0.9595	0.8838	0.7154	0.5243	0.5814	0.8406	0.9697	0.9932	0.9973	(94)
Useful gains	450.3768	501.7766	542.8842	573.9478	558.5087	443.5977	309.3548	321.2637	431.7324	455.1041	434.3962	428.8051	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1262.4955	1222.0969	1106.1671	922.5671	712.9950	479.2363	315.0582	330.7780	516.2020	779.4677	1037.5864	1255.8615	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	604.2163	484.0553	419.0825	251.0059	114.9378	0.0000	0.0000	0.0000	0.0000	241.3265	434.2970	615.3300	(98)
Space heating												3164.2512	(98)
Space heating per m2											(98) / (4) =	41.3574	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3387.8493	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	604.2163	484.0553	419.0825	251.0059	114.9378	0.0000	0.0000	0.0000	0.0000	241.3265	434.2970	615.3300	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	646.9125	518.2604	448.6965	268.7429	123.0597	0.0000	0.0000	0.0000	0.0000	258.3796	464.9861	658.8115	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6634	87.4866	87.0914	86.1672	84.2994	80.3000	80.3000	80.3000	80.3000	85.9527	87.1863	87.7463	(217)
Fuel for water heating, kWh/month													
	227.5423	199.2395	208.2365	186.6763	184.7401	170.8126	163.6515	182.4330	184.4478	196.2179	206.4951	221.9867	(219)
Water heating fuel used												2332.4793	(219)
Annual totals kWh/year													
Space heating fuel - main system												3387.8493	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Total delivered energy for all uses												6147.3021	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3387.8493	0.2160	731.7754	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2332.4793	0.2160	503.8155	(264)
Space and water heating			1235.5910	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Total CO2, kg/m2/year			1457.1902	(272)
Emissions per m2 for space and water heating			16.1494	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3876	(272b)
Emissions per m2 for pumps and fans			0.5088	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1494 * 1.00) + 2.3876 + 0.5088, rounded to 2 d.p.			19.0500	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1697	(8)
Pressure test			Yes	
Measured/design AP50			4.0100	
Infiltration rate			0.3702	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3147	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4013	0.3934	0.3855	0.3462	0.3383	0.2990	0.2990	0.2911	0.3147	0.3383	0.3540	0.3698	(22b)
Effective ac	0.5805	0.5774	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5627	0.5684	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5211	(36)
Total fabric heat loss (33) + (36) =	56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.8569	33.6746	33.4959	32.6565	32.4994	31.7684	31.7684	31.6330	32.0500	32.4994	32.8171	33.1493	(38)
Heat transfer coeff	89.9479	89.7656	89.5869	88.7475	88.5905	87.8594	87.8594	87.7240	88.1410	88.5905	88.9082	89.2403	(39)
Average = Sum(39)m / 12 =												88.7468	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1756	1.1733	1.1709	1.1599	1.1579	1.1483	1.1483	1.1466	1.1520	1.1579	1.1620	1.1664	(40)
HLP (average)												1.1599	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.2400	331.8674	320.2271	301.1340	281.0216	262.2828	250.5348	254.3409	264.5322	283.7582	305.8418	323.1018	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	10.6334	0.7400	0.7000	0.7700	24.5822	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	3.3100	46.7521	0.7400	0.7000	0.7700	55.5510	(78)

Solar gains	87.6667	153.2908	223.3452	304.5769	370.2085	381.2858	361.8045	310.0937	250.7041	172.7897	105.6513	74.6464	(83)
Total gains	420.9067	485.1581	543.5723	605.7109	651.2301	643.5685	612.3392	564.4346	515.2363	456.5480	411.4931	397.7481	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0697	59.1896	59.3077	59.8686	59.9748	60.4738	60.4738	60.5671	60.2806	59.9748	59.7605	59.5380	
alpha	4.9380	4.9460	4.9538	4.9912	4.9983	5.0316	5.0316	5.0378	5.0187	4.9983	4.9840	4.9692	
util living area													
	0.9987	0.9970	0.9922	0.9741	0.9144	0.7733	0.6068	0.6716	0.8947	0.9847	0.9972	0.9990	(86)
MIT	19.6783	19.8247	20.0710	20.4072	20.7201	20.9206	20.9816	20.9700	20.8194	20.4217	19.9889	19.6515	(87)
Th 2	19.9395	19.9415	19.9433	19.9522	19.9538	19.9616	19.9616	19.9630	19.9586	19.9538	19.9505	19.9470	(88)
util rest of house													
	0.9982	0.9959	0.9892	0.9635	0.8776	0.6838	0.4759	0.5408	0.8348	0.9765	0.9960	0.9986	(89)
MIT 2	18.7341	18.8817	19.1282	19.4654	19.7581	19.9235	19.9567	19.9540	19.8527	19.4846	19.0531	18.7133	(90)
Living area fraction										fLA = Living area / (4) =		0.3533	(91)
MIT	19.0677	19.2148	19.4613	19.7981	20.0979	20.2758	20.3188	20.3129	20.1942	19.8157	19.3837	19.0447	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0677	19.2148	19.4613	19.7981	20.0979	20.2758	20.3188	20.3129	20.1942	19.8157	19.3837	19.0447	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9950	0.9875	0.9615	0.8835	0.7133	0.5228	0.5877	0.8507	0.9751	0.9952	0.9982	(94)
Useful gains	419.9192	482.7085	536.7667	582.4013	575.3674	459.0578	320.1179	331.7047	438.3228	445.1845	409.5093	397.0429	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1328.3221	1284.9803	1161.1600	967.1831	743.9780	498.6707	326.7289	343.2588	537.1516	816.4199	1092.1254	1324.7482	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.8517	539.1267	464.5486	277.0429	125.4463	0.0000	0.0000	0.0000	0.0000	276.1991	491.4835	690.2127	(98)
Space heating												3539.9116	(98)
Space heating per m2											(98) / (4) =	46.2673	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	825.8786	650.1598	666.7027	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8420	0.9088	0.8789	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	695.4052	590.8584	585.9755	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	841.6993	803.4048	749.0288	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.3318	158.1345	121.3117	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												384.7779	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   26.3329   39.5336   30.3279    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          96.1945 (107)
Space cooling per m2                                                                                                    1.2573 (108)
Energy for space heating                                                                                               46.2673 (99)
Energy for space cooling                                                                                                1.2573 (108)
Total                                                                                                                  47.5246 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                  47.5 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6100	1.3258	15.3920			(27)
Ground floor			76.5100	0.1300	9.9463			(28a)
External Wall	68.6000	13.7300	54.8700	0.1800	9.8766			(29a)
Communal Wall	15.3800		15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1047	(36)
Total fabric heat loss					(33) + (36) =		51.6321	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	86.8283	86.5940	86.3643	85.2855	85.0836	84.1440	84.1440	83.9700	84.5059	85.0836	85.4920	85.9188	(39)
Average = Sum(39)m / 12 =												85.2845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1349	1.1318	1.1288	1.1147	1.1121	1.0998	1.0998	1.0975	1.1045	1.1121	1.1174	1.1230	(40)
HLP (average)												1.1147	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3933 (42)
Average daily hot water use (litres/day)		91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.2400	331.8674	320.2271	301.1340	281.0216	262.2828	250.5348	254.3409	264.5322	283.7582	305.8418	323.1018	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	10.6334	0.6300	0.7000	0.7700	20.9281	(74)
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
South	3.3100	46.7521	0.6300	0.7000	0.7700	47.2934	(78)

Solar gains	74.6352	130.5043	190.1452	259.3019	315.1775	324.6082	308.0227	263.9987	213.4373	147.1048	89.9464	63.5503	(83)
Total gains	407.8751	462.3716	510.3723	560.4359	596.1991	586.8909	558.5575	518.3396	477.9695	430.8630	395.7881	386.6521	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1920	61.3576	61.5207	62.2989	62.4467	63.1441	63.1441	63.2749	62.8736	62.4467	62.1485	61.8397	
alpha	5.0795	5.0905	5.1014	5.1533	5.1631	5.2096	5.2096	5.2183	5.1916	5.1631	5.1432	5.1226	
util living area													
	0.9989	0.9976	0.9939	0.9799	0.9307	0.8008	0.6344	0.6964	0.9093	0.9874	0.9977	0.9991	(86)
MIT	19.7166	19.8510	20.0819	20.4035	20.7078	20.9151	20.9803	20.9687	20.8162	20.4321	20.0202	19.6960	(87)
Th 2	19.9725	19.9749	19.9774	19.9888	19.9910	20.0010	20.0010	20.0029	19.9972	19.9910	19.9867	19.9821	(88)
util rest of house													
	0.9985	0.9967	0.9916	0.9714	0.8993	0.7164	0.5046	0.5685	0.8555	0.9806	0.9967	0.9988	(89)
MIT 2	18.7987	18.9348	19.1667	19.4930	19.7818	19.9589	19.9956	19.9931	19.8864	19.5256	19.1133	18.7858	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.1230	19.2585	19.4900	19.8147	20.1090	20.2967	20.3435	20.3378	20.2149	19.8459	19.4337	19.1074	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1230	19.2585	19.4900	19.8147	20.1090	20.2967	20.3435	20.3378	20.2149	19.8459	19.4337	19.1074	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9959	0.9901	0.9695	0.9037	0.7439	0.5511	0.6144	0.8693	0.9793	0.9959	0.9985	(94)
Useful gains	407.0615	460.4785	505.3264	543.3619	538.7717	436.5763	307.8411	318.4446	415.5157	421.9381	394.1834	386.0674	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1287.0570	1243.3603	1121.8751	930.8654	715.4650	479.3436	314.9934	330.6554	516.7460	786.6704	1054.4338	1280.8238	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	654.7166	526.0966	458.7123	279.0026	131.4599	0.0000	0.0000	0.0000	0.0000	271.3609	475.3803	665.6988	(98)
Space heating												3462.4279	(98)
Space heating per m2											(98) / (4) =	45.2546	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	790.9536	622.6656	638.1720	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8305	0.9021	0.8728	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	656.9209	561.7357	557.0045	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.4527	740.5430	695.1515	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	85.3429	133.0326	102.7814	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												321.1569	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   21.3357   33.2582   25.6953    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                              80.2892 (107)
Space cooling per m2                                                                                                        1.0494 (108)
Energy for space heating                                                                                                   45.2546 (99)
Energy for space cooling                                                                                                    1.0494 (108)
Total                                                                                                                      46.3040 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     53.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3137	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2666	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2799	0.2599	0.2666	0.2533	0.2533	0.2466	0.2400	0.2333	0.2266	0.2466	0.2333	0.2466	(22b)
Effective ac	0.5392	0.5338	0.5355	0.5321	0.5321	0.5304	0.5288	0.5272	0.5257	0.5304	0.5272	0.5304	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.5211 (36)
Total fabric heat loss	(33) + (36) =	56.0911 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.4471	31.1323	31.2347	31.0326	31.0326	30.9354	30.8408	30.7488	30.6594	30.9354	30.7488	30.9354	(38)
Heat transfer coeff	87.5382	87.2234	87.3257	87.1236	87.1236	87.0265	86.9319	86.8399	86.7505	87.0265	86.8399	87.0265	(39)
Average = Sum(39)m / 12 =												87.0647	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1441	1.1400	1.1414	1.1387	1.1387	1.1375	1.1362	1.1350	1.1338	1.1375	1.1350	1.1375	(40)
HLP (average)												1.1380	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
RHI water heating demand												1571	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	13.4839	0.7400	0.7000	0.7700	31.1720	(74)
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
South	3.3100	56.7559	0.7400	0.7000	0.7700	67.4375	(78)

Solar gains	108.3696	161.9855	240.0765	332.8084	386.5937	433.1121	407.5518	356.6403	285.8610	197.5975	130.3164	90.6254	(83)
Total gains	647.5602	696.7806	753.9590	814.3880	835.1988	852.2129	809.4593	766.7535	714.6165	658.8638	627.6454	615.1435	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6957	60.9148	60.8434	60.9845	60.9845	61.0526	61.1191	61.1838	61.2468	61.0526	61.1838	61.0526	
alpha	5.0464	5.0610	5.0562	5.0656	5.0656	5.0702	5.0746	5.0789	5.0831	5.0702	5.0789	5.0702	
util living area													
	0.9892	0.9837	0.9648	0.9084	0.7812	0.5658	0.4159	0.4378	0.7076	0.9169	0.9775	0.9911	(86)
MIT	20.0553	20.1588	20.3913	20.6776	20.8916	20.9830	20.9971	20.9963	20.9497	20.7154	20.3550	20.0369	(87)
Th 2	19.9649	19.9683	19.9672	19.9693	19.9693	19.9704	19.9714	19.9723	19.9733	19.9704	19.9723	19.9704	(88)
util rest of house													
	0.9857	0.9784	0.9533	0.8786	0.7168	0.4710	0.3078	0.3246	0.6146	0.8824	0.9690	0.9881	(89)
MIT 2	18.7403	18.8918	19.2224	19.6152	19.8755	19.9613	19.9706	19.9713	19.9404	19.6740	19.1788	18.7180	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.2049	19.3394	19.6353	19.9905	20.2345	20.3222	20.3332	20.3334	20.2969	20.0419	19.5943	19.1840	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2049	19.3394	19.6353	19.9905	20.2345	20.3222	20.3332	20.3334	20.2969	20.0419	19.5943	19.1840	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9743	0.9487	0.8793	0.7347	0.5043	0.3462	0.3648	0.6457	0.8852	0.9650	0.9851	(94)
Useful gains	636.1328	678.8876	715.2906	716.1060	613.5804	429.7309	280.2122	279.7064	461.4147	583.2473	605.6523	605.9776	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1252.2250	1224.5672	1103.3899	913.9714	673.8588	437.0669	281.0695	280.7916	485.5364	752.0764	1015.5332	1234.3819	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.3726	366.6967	288.7459	142.4631	44.8471	0.0000	0.0000	0.0000	0.0000	125.6089	295.1142	467.5328	(98)
Space heating												2189.3812	(98)
RHI space heating demand												2189	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3137	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2666	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3399	0.3333	0.3266	0.2933	0.2866	0.2533	0.2533	0.2466	0.2666	0.2866	0.2999	0.3133	(22b)
Effective ac	0.5578	0.5555	0.5533	0.5430	0.5411	0.5321	0.5321	0.5304	0.5355	0.5411	0.5450	0.5491	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5211	(36)
Total fabric heat loss (33) + (36) =	56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5315	32.4007	32.2724	31.6700	31.5573	31.0326	31.0326	30.9354	31.2347	31.5573	31.7853	32.0237	(38)
Heat transfer coeff	88.6226	88.4917	88.3635	87.7610	87.6483	87.1236	87.1236	87.0265	87.3257	87.6483	87.8763	88.1147	(39)
Average = Sum(39)m / 12 =												87.7605	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1583	1.1566	1.1549	1.1471	1.1456	1.1387	1.1387	1.1375	1.1414	1.1456	1.1486	1.1517	(40)
HLP (average)												1.1470	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	10.6334	0.7400	0.7000	0.7700	24.5822	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	3.3100	46.7521	0.7400	0.7000	0.7700	55.5510	(78)

Solar gains	87.6667	153.2908	223.3452	304.5769	370.2085	381.2858	361.8045	310.0937	250.7041	172.7897	105.6513	74.6464	(83)
Total gains	626.8573	688.0858	737.2277	786.1565	818.8136	800.3866	763.7120	720.2070	679.4596	634.0561	602.9803	599.1645	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9531	60.0417	60.1289	60.5416	60.6195	60.9845	60.9845	61.0526	60.8434	60.6195	60.4622	60.2986	
alpha	4.9969	5.0028	5.0086	5.0361	5.0413	5.0656	5.0656	5.0702	5.0562	5.0413	5.0308	5.0199	
util living area													
	0.9921	0.9863	0.9723	0.9318	0.8326	0.6585	0.4942	0.5429	0.7810	0.9450	0.9853	0.9936	(86)
MIT	19.9483	20.0853	20.3078	20.5954	20.8361	20.9625	20.9927	20.9885	20.9116	20.6163	20.2297	19.9140	(87)
Th 2	19.9535	19.9549	19.9562	19.9626	19.9638	19.9693	19.9693	19.9704	19.9672	19.9638	19.9614	19.9589	(88)
util rest of house													
	0.9896	0.9819	0.9632	0.9087	0.7794	0.5678	0.3825	0.4279	0.6997	0.9216	0.9798	0.9916	(89)
MIT 2	18.5767	18.7758	19.0960	19.5013	19.8089	19.9454	19.9668	19.9659	19.9007	19.5384	18.9913	18.5310	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.0613	19.2385	19.5241	19.8878	20.1718	20.3047	20.3292	20.3272	20.2579	19.9192	19.4288	19.0196	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0613	19.2385	19.5241	19.8878	20.1718	20.3047	20.3292	20.3272	20.2579	19.9192	19.4288	19.0196	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9780	0.9585	0.9068	0.7912	0.5987	0.4222	0.4688	0.7246	0.9203	0.9760	0.9891	(94)
Useful gains	618.4886	672.9556	706.6498	712.8777	647.8228	479.1635	322.4302	337.6201	492.3668	583.5520	588.5354	592.6113	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1308.1824	1268.8345	1150.8551	964.3035	742.5390	497.0133	324.9037	341.7662	537.7395	816.8153	1083.4102	1305.8226	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	513.1322	400.4306	330.4887	181.0266	70.4689	0.0000	0.0000	0.0000	0.0000	173.5479	356.3099	530.6292	(98)
Space heating												2556.0340	(98)
Space heating per m2											(98) / (4) =	33.4078	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2751.3821	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	513.1322	400.4306	330.4887	181.0266	70.4689	0.0000	0.0000	0.0000	0.0000	173.5479	356.3099	530.6292	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	552.3489	431.0340	355.7468	194.8618	75.8546	0.0000	0.0000	0.0000	0.0000	186.8115	383.5414	571.1832	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1170	89.0462	88.8956	88.5450	87.8338	86.7000	86.7000	86.7000	86.7000	88.4826	88.9557	89.1538	(217)
Fuel for water heating, kWh/month													
	179.8996	157.8312	164.0209	144.8115	141.0104	124.6671	116.9021	132.1820	133.1766	150.4117	161.7080	174.5613	(219)
Water heating fuel used												1781.1823	(219)
Annual totals kWh/year													
Space heating fuel - main system												2751.3821	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												4335.7848	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2751.3821	3.4800	95.7481	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1781.1823	3.4800	61.9851	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	351.9735	13.1900	46.4253	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			334.0510	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1546	(257)
SAP value		83.8926	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2751.3821	0.2160	594.2985	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1781.1823	0.2160	384.7354	(264)
Space and water heating			979.0339	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			876.9053	(272)
CO2 emissions per m2			11.4600	(273)
EI value			90.3296	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8807 = 3.951, stars = 4
Water heating environmental impact	0.216 / 0.8807 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0100	
Infiltration rate		0.3137	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2666	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2799	0.2599	0.2666	0.2533	0.2533	0.2466	0.2400	0.2333	0.2266	0.2466	0.2333	0.2466	(22b)
Effective ac	0.5392	0.5338	0.5355	0.5321	0.5321	0.5304	0.5288	0.5272	0.5257	0.5304	0.5272	0.5304	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5211	(36)
Total fabric heat loss					(33) + (36) =		56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.4471	31.1323	31.2347	31.0326	31.0326	30.9354	30.8408	30.7488	30.6594	30.9354	30.7488	30.9354	(38)
Heat transfer coeff	87.5382	87.2234	87.3257	87.1236	87.1236	87.0265	86.9319	86.8399	86.7505	87.0265	86.8399	87.0265	(39)
Average = Sum(39)m / 12 =												87.0647	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1441	1.1400	1.1414	1.1387	1.1387	1.1375	1.1362	1.1350	1.1338	1.1375	1.1350	1.1375	(40)
HLP (average)												1.1380	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4400	13.4839	0.7400	0.7000	0.7700	31.1720	(74)
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
South	3.3100	56.7559	0.7400	0.7000	0.7700	67.4375	(78)

Solar gains	108.3696	161.9855	240.0765	332.8084	386.5937	433.1121	407.5518	356.6403	285.8610	197.5975	130.3164	90.6254	(83)
Total gains	647.5602	696.7806	753.9590	814.3880	835.1988	852.2129	809.4593	766.7535	714.6165	658.8638	627.6454	615.1435	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6957	60.9148	60.8434	60.9845	60.9845	61.0526	61.1191	61.1838	61.2468	61.0526	61.1838	61.0526	
alpha	5.0464	5.0610	5.0562	5.0656	5.0656	5.0702	5.0746	5.0789	5.0831	5.0702	5.0789	5.0702	
util living area													
	0.9892	0.9837	0.9648	0.9084	0.7812	0.5658	0.4159	0.4378	0.7076	0.9169	0.9775	0.9911	(86)
MIT	20.0553	20.1588	20.3913	20.6776	20.8916	20.9830	20.9971	20.9963	20.9497	20.7154	20.3550	20.0369	(87)
Th 2	19.9649	19.9683	19.9672	19.9693	19.9693	19.9704	19.9714	19.9723	19.9733	19.9704	19.9723	19.9704	(88)
util rest of house													
	0.9857	0.9784	0.9533	0.8786	0.7168	0.4710	0.3078	0.3246	0.6146	0.8824	0.9690	0.9881	(89)
MIT 2	18.7403	18.8918	19.2224	19.6152	19.8755	19.9613	19.9706	19.9713	19.9404	19.6740	19.1788	18.7180	(90)
Living area fraction										fLA = Living area / (4) =		0.3533	(91)
MIT	19.2049	19.3394	19.6353	19.9905	20.2345	20.3222	20.3332	20.3334	20.2969	20.0419	19.5943	19.1840	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2049	19.3394	19.6353	19.9905	20.2345	20.3222	20.3332	20.3334	20.2969	20.0419	19.5943	19.1840	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9824	0.9743	0.9487	0.8793	0.7347	0.5043	0.3462	0.3648	0.6457	0.8852	0.9650	0.9851	(94)
Useful gains	636.1328	678.8876	715.2906	716.1060	613.5804	429.7309	280.2122	279.7064	461.4147	583.2473	605.6523	605.9776	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1252.2250	1224.5672	1103.3899	913.9714	673.8588	437.0669	281.0695	280.7916	485.5364	752.0764	1015.5332	1234.3819	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.3726	366.6967	288.7459	142.4631	44.8471	0.0000	0.0000	0.0000	0.0000	125.6089	295.1142	467.5328	(98)
Space heating												2189.3812	(98)
Space heating per m2											(98) / (4) =	28.6156	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2356.7074	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	458.3726	366.6967	288.7459	142.4631	44.8471	0.0000	0.0000	0.0000	0.0000	125.6089	295.1142	467.5328	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	493.4043	394.7220	310.8137	153.3510	48.2746	0.0000	0.0000	0.0000	0.0000	135.2087	317.6687	503.2646	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0483	88.9899	88.8003	88.3552	87.5282	86.7000	86.7000	86.7000	86.7000	88.2248	88.8256	89.0789	(217)
Fuel for water heating, kWh/month													
	180.0383	157.9309	164.1969	145.1225	141.5026	124.6671	116.9021	132.1820	133.1766	150.8511	161.9448	174.7080	(219)
Water heating fuel used												1783.2229	(219)
Annual totals kWh/year													
Space heating fuel - main system												2356.7074	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =												-692.9382	(233)
Total delivered energy for all uses												3873.9656	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2356.7074	7.3800	173.9250	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1783.2229	7.3800	131.6018	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	351.9735	28.6600	100.8756	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			534.8975	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2356.7074	0.2160	509.0488	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.2229	0.2160	385.1761	(264)
Space and water heating			894.2249	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			756.1892	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2356.7074	1.2200	2875.1830	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.2229	1.2200	2175.5319	(264)
Space and water heating			5050.7150	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	351.9735	3.0700	1080.5586	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			4234.2032	(272)
Primary energy kWh/m2/year			55.3418	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 84
Current environmental impact rating: B 90

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£122	£122	£0
Mains gas	£413	£413	£0
Space heating	£302	£302	£0
Water heating	£132	£132	£0
Lighting	£101	£101	£0
Total cost of fuels	£535	£535	£0
Total cost of uses	£535	£535	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	349.94 (P1)
Transmission heat loss coefficient	56.09 (37)
Summer heat loss coefficient	406.03 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.4400	87.1704	0.7400	0.7000	0.8865	232.0097
North East	1.8600	106.0502	0.7400	0.7000	0.8865	81.5221
South	3.3100	118.5567	0.7400	0.7000	0.8865	162.1829
total:						475.7147

	Jun	Jul	Aug	
Solar gains	514	476	415	(P3)
Internal gains	416	399	407	
Total summer gains	930	875	822	(P5)
Summer gain/loss ratio	2.29	2.15	2.02	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.94	19.70	19.57	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 669 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 669 - EPC	**Prop Type Ref**	
Property	21 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	13.50	**TER**	19.05
Environmental	90 B	**% DER<TER**	29.12		
CO_2 Emissions (t/year)	0.76	**DFEE**	47.52	**TFEE**	53.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.75		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.05	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.50	$kgCO_2/m^2$	Pass
	-5.55 (-29.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.25	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	47.52	$kWh/m^2/yr$	
	-5.7 (-10.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.44 m², No overhang
Windows facing North East	1.86 m², No overhang
Windows facing South	3.31 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.01 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.034	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 670 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 670 - EPC	**Prop Type Ref**	
Property	23 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	85 B	**DER**	11.35	**TER**	16.86
Environmental	92 A	**% DER<TER**	32.68		
CO_2 Emissions (t/year)	0.61	**DFEE**	37.85	**TFEE**	41.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Mid-floor flat, total floor area 77 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.86 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)41.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.08 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.04 m², No overhang
Windows facing North East: 1.86 m², No overhang
Windows facing South: 2.01 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

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10 Key features
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3437	0.3370	0.3302	0.2965	0.2898	0.2561	0.2561	0.2494	0.2696	0.2898	0.3033	0.3168	(22b)
Effective ac	0.5591	0.5568	0.5545	0.5440	0.5420	0.5328	0.5328	0.5311	0.5363	0.5420	0.5460	0.5502	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 8			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1644	(36)
Total fabric heat loss					(33) + (36) =		41.1693	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.6071	32.4734	32.3422	31.7263	31.6110	31.0745	31.0745	30.9752	31.2812	31.6110	31.8442	32.0879	(38)
Heat transfer coeff	73.7764	73.6426	73.5115	72.8955	72.7803	72.2438	72.2438	72.1445	72.4505	72.7803	73.0134	73.2572	(39)
Average = Sum(39)m / 12 =												72.8950	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9643	0.9625	0.9608	0.9528	0.9513	0.9442	0.9442	0.9429	0.9469	0.9513	0.9543	0.9575	(40)
HLP (average)												0.9528	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	364.4262	362.2601	348.9926	327.7020	306.1559	285.4344	272.0246	278.0008	288.9980	310.4966	335.1307	353.5372	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.7400	0.7000	0.7700	26.8725	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	2.0100	46.7521	0.7400	0.7000	0.7700	33.7334	(78)

Solar gains	68.1394	121.9359	185.2667	265.0804	332.6946	346.9245	327.4831	273.9038	212.0995	139.4599	82.6153	57.7032	(83)
Total gains	432.5656	484.1961	534.2594	592.7823	638.8506	632.3589	599.5077	551.9046	501.0975	449.9565	417.7461	411.2404	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0175	72.1484	72.2771	72.8878	73.0032	73.5453	73.5453	73.6466	73.3355	73.0032	72.7701	72.5280	
alpha	5.8012	5.8099	5.8185	5.8592	5.8669	5.9030	5.9030	5.9098	5.8890	5.8669	5.8513	5.8352	
util living area													
	0.9985	0.9967	0.9910	0.9658	0.8779	0.6962	0.5243	0.5891	0.8538	0.9803	0.9967	0.9989	(86)
MIT	19.9834	20.1065	20.3180	20.6059	20.8522	20.9718	20.9954	20.9914	20.9082	20.5977	20.2382	19.9570	(87)
Th 2	20.1132	20.1147	20.1161	20.1229	20.1242	20.1301	20.1301	20.1312	20.1278	20.1242	20.1216	20.1189	(88)
util rest of house													
	0.9980	0.9956	0.9877	0.9532	0.8362	0.6156	0.4238	0.4841	0.7901	0.9707	0.9954	0.9985	(89)
MIT 2	18.7456	18.9264	19.2350	19.6509	19.9770	20.1110	20.1283	20.1274	20.0517	19.6459	19.1243	18.7112	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.2143	19.3733	19.6450	20.0125	20.3084	20.4369	20.4566	20.4546	20.3760	20.0063	19.5461	19.1829	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2143	19.3733	19.6450	20.0125	20.3084	20.4369	20.4566	20.4546	20.3760	20.0063	19.5461	19.1829	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9944	0.9855	0.9512	0.8459	0.6452	0.4620	0.5241	0.8102	0.9690	0.9942	0.9980	(94)
Useful gains	431.3968	481.4852	526.5253	563.8741	540.4159	407.9994	276.9911	289.2464	406.0116	436.0292	415.3434	410.4031	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1100.3250	1065.8491	966.3108	810.0528	626.5221	421.6816	278.6179	292.5142	454.6965	684.5925	908.7317	1097.6044	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	497.6826	392.6925	327.2004	177.2486	64.0630	0.0000	0.0000	0.0000	0.0000	184.9311	355.2396	511.2778	(98)
Space heating												2510.3356	(98)
Space heating per m2											(98) / (4) =	32.8106	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2702.1912	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	497.6826	392.6925	327.2004	177.2486	64.0630	0.0000	0.0000	0.0000	0.0000	184.9311	355.2396	511.2778	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	535.7186	422.7046	352.2071	190.7951	68.9591	0.0000	0.0000	0.0000	0.0000	199.0647	382.3892	550.3528	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0988	89.0339	88.8887	88.5285	87.7650	86.7000	86.7000	86.7000	86.7000	88.5325	88.9537	89.1323	(217)
Fuel for water heating, kWh/month	179.9364	157.8529	164.0336	144.8385	141.1209	124.6671	116.9021	132.1820	133.1766	150.3268	161.7117	174.6033	(219)
Water heating fuel used												1781.3519	(219)
Annual totals kWh/year													
Space heating fuel - main system												2702.1912	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												4291.4375	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2702.1912	0.2160	583.6733	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1781.3519	0.2160	384.7720	(264)
Space and water heating			968.4453	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			868.7425	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.3500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.3500	ZC1
Total Floor Area	TFA	76.5100	
Assumed number of occupants	N	2.3933	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4191	ZC2
CO2 emissions from cooking, equation (L16)		2.3061	ZC3
Total CO2 emissions		30.0751	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.0751	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			10.9100	1.3258	14.4640			(27)
External Wall	68.6000	10.9100	57.6900	0.1800	10.3842			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.1800	2.4462			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0844			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6802	(36)
Total fabric heat loss					(33) + (36) =		36.7646	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	71.9609	71.7266	71.4969	70.4180	70.2162	69.2766	69.2766	69.1026	69.6385	70.2162	70.6245	71.0514	(39)
Average = Sum(39)m / 12 =												70.4171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9405	0.9375	0.9345	0.9204	0.9177	0.9055	0.9055	0.9032	0.9102	0.9177	0.9231	0.9287	(40)
HLP (average)												0.9204	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3933 (42)
Average daily hot water use (litres/day)		91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.4181	47.3214	43.9990	43.6099	40.4073	41.7542	43.6099	43.9990	47.3214	47.5908	50.9589	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852 (64)
								Total per year (kWh/year) = Sum(64)m =				1978.3788 (64)
Heat gains from water heating, kWh/month												
	62.1201	54.2929	56.3969	49.8539	48.1840	42.2729	40.2498	45.1113	45.6172	52.1736	55.9355	60.5620 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	83.4947	80.7930	75.8023	69.2416	64.7634	58.7124	54.0992	60.6335	63.3572	70.1258	77.6882	81.4005	(72)
Total internal gains													
	377.5815	374.8216	360.9378	339.0320	316.8683	295.5303	282.1247	288.7172	300.3339	322.4477	347.6956	366.6949	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.6300	0.7000	0.7700	22.8779	(74)
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
South	2.0100	46.7521	0.6300	0.7000	0.7700	28.7190	(78)

Solar gains	58.0105	103.8103	157.7271	225.6765	283.2400	295.3546	278.8032	233.1883	180.5712	118.7293	70.3347	49.1257	(83)
Total gains	435.5921	478.6320	518.6649	564.7085	600.1083	590.8849	560.9279	521.9055	480.9052	441.1771	418.0303	415.8206	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.8345	74.0757	74.3137	75.4522	75.6691	76.6954	76.6954	76.8885	76.2968	75.6691	75.2316	74.7796	
alpha	5.9223	5.9384	5.9542	6.0301	6.0446	6.1130	6.1130	6.1259	6.0865	6.0446	6.0154	5.9853	
util living area													
	0.9984	0.9969	0.9918	0.9701	0.8916	0.7132	0.5374	0.5973	0.8585	0.9806	0.9966	0.9988	(86)
MIT	20.0214	20.1347	20.3327	20.6103	20.8488	20.9718	20.9956	20.9921	20.9132	20.6185	20.2765	20.0045	(87)
Th 2	20.1332	20.1358	20.1383	20.1502	20.1524	20.1629	20.1629	20.1648	20.1588	20.1524	20.1479	20.1432	(88)
util rest of house													
	0.9979	0.9958	0.9890	0.9589	0.8533	0.6347	0.4384	0.4949	0.7971	0.9713	0.9953	0.9984	(89)
MIT 2	18.8160	18.9833	19.2734	19.6798	19.9995	20.1434	20.1611	20.1613	20.0863	19.6977	19.2000	18.7988	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.2724	19.4193	19.6745	20.0321	20.3211	20.4571	20.4771	20.4759	20.3994	20.0464	19.6076	19.2553	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2724	19.4193	19.6745	20.0321	20.3211	20.4571	20.4771	20.4759	20.3994	20.0464	19.6076	19.2553	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9946	0.9869	0.9570	0.8617	0.6635	0.4761	0.5339	0.8165	0.9698	0.9941	0.9979	(94)
Useful gains	434.3740	476.0630	511.8817	540.4379	517.1405	392.0363	267.0327	278.6541	392.6785	427.8625	415.5724	414.9301	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1077.4279	1041.4185	941.9379	783.9012	605.3418	405.7586	268.5935	281.6547	438.6784	663.2895	883.3448	1069.7030	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	478.4321	379.9189	319.9618	175.2936	65.6217	0.0000	0.0000	0.0000	0.0000	175.1576	336.7961	487.1510	(98)
Space heating												2418.3328	(98)
Space heating per m2											(98) / (4) =	31.6081	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2589.2215	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	478.4321	379.9189	319.9618	175.2936	65.6217	0.0000	0.0000	0.0000	0.0000	175.1576	336.7961	487.1510	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	512.2399	406.7654	342.5716	187.6805	70.2588	0.0000	0.0000	0.0000	0.0000	187.5349	360.5954	521.5750	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.1737	86.9600	86.4657	85.2679	83.0508	80.3000	80.3000	80.3000	80.3000	85.1465	86.6055	87.2649	(217)
Fuel for water heating, kWh/month													
	228.8205	200.4460	209.7434	188.6450	187.5176	170.8126	163.6515	182.4330	184.4478	198.0757	207.8800	223.2115	(219)
Water heating fuel used												2345.6846	(219)
Annual totals kWh/year													
Space heating fuel - main system												2589.2215	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Total delivered energy for all uses												5366.5537	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2589.2215	0.2160	559.2718	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2345.6846	0.2160	506.6679	(264)
Space and water heating			1065.9397	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Total CO2, kg/m2/year			1289.9648	(272)
Emissions per m2 for space and water heating			13.9320	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4193	(272b)
Emissions per m2 for pumps and fans			0.5088	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9320 * 1.00) + 2.4193 + 0.5088, rounded to 2 d.p.			16.8600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3737	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3177	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4050	0.3971	0.3892	0.3494	0.3415	0.3018	0.3018	0.2939	0.3177	0.3415	0.3574	0.3733	(22b)
Effective ac	0.5820	0.5788	0.5757	0.5611	0.5583	0.5455	0.5455	0.5432	0.5505	0.5583	0.5639	0.5697	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 8			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1644	(36)
Total fabric heat loss					(33) + (36) =		41.1693	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.9461	33.7603	33.5782	32.7229	32.5628	31.8179	31.8179	31.6799	32.1048	32.5628	32.8866	33.2250	(38)
Heat transfer coeff	75.1154	74.9296	74.7475	73.8922	73.7321	72.9872	72.9872	72.8492	73.2741	73.7321	74.0559	74.3943	(39)
Average = Sum(39)m / 12 =												73.8914	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9818	0.9793	0.9770	0.9658	0.9637	0.9540	0.9540	0.9522	0.9577	0.9637	0.9679	0.9723	(40)
HLP (average)												0.9658	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.5046	332.1024	320.4183	301.2787	281.1298	262.3741	250.6335	254.4691	264.7044	283.9769	306.0969	323.3738	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.7400	0.7000	0.7700	26.8725	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	2.0100	46.7521	0.7400	0.7000	0.7700	33.7334	(78)

Solar gains	68.1394	121.9359	185.2667	265.0804	332.6946	346.9245	327.4831	273.9038	212.0995	139.4599	82.6153	57.7032	(83)
Total gains	401.6440	454.0384	505.6850	566.3591	613.8244	609.2986	578.1166	528.3729	476.8039	423.4367	388.7123	381.0770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.7338	70.9092	71.0819	71.9047	72.0608	72.7963	72.7963	72.9341	72.5112	72.0608	71.7458	71.4194	
alpha	5.7156	5.7273	5.7388	5.7936	5.8041	5.8531	5.8531	5.8623	5.8341	5.8041	5.7831	5.7613	
util living area													
	0.9990	0.9977	0.9932	0.9728	0.8959	0.7216	0.5474	0.6174	0.8775	0.9855	0.9978	0.9993	(86)
MIT	19.9196	20.0456	20.2629	20.5641	20.8274	20.9650	20.9941	20.9887	20.8891	20.5559	20.1855	19.8976	(87)
Th 2	20.0986	20.1006	20.1026	20.1119	20.1137	20.1219	20.1219	20.1234	20.1187	20.1137	20.1101	20.1064	(88)
util rest of house													
	0.9986	0.9969	0.9908	0.9622	0.8575	0.6403	0.4425	0.5083	0.8184	0.9781	0.9969	0.9990	(89)
MIT 2	19.1037	19.2311	19.4489	19.7519	19.9943	20.1055	20.1203	20.1200	20.0541	19.7487	19.3789	19.0882	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.4127	19.5395	19.7571	20.0594	20.3097	20.4309	20.4511	20.4489	20.3703	20.0543	19.6843	19.3947	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4127	19.5395	19.7571	20.0594	20.3097	20.4309	20.4511	20.4489	20.3703	20.0543	19.6843	19.3947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9962	0.9896	0.9615	0.8670	0.6703	0.4825	0.5500	0.8374	0.9775	0.9963	0.9987	(94)
Useful gains	400.9592	452.3317	500.4150	544.5382	532.1711	408.4067	278.9477	290.6074	399.2687	413.9089	387.2662	380.5960	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1135.1924	1096.9291	990.9363	824.5934	634.8141	425.5834	281.0840	294.9603	459.4474	697.0865	931.9412	1130.3990	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	546.2695	433.1695	364.9478	201.6398	76.3664	0.0000	0.0000	0.0000	0.0000	210.6842	392.1661	557.8534	(98)
Space heating												2783.0967	(98)
Space heating per m2											(98) / (4) =	36.3756	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	686.0793	540.1050	553.6540	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9117	0.9575	0.9364	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	625.4842	517.1285	518.4404	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	801.7651	763.5356	707.0496	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	126.9222	183.3269	140.3252	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												450.5744	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	31.7306	45.8317	35.0813	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												112.6436 (107)
Space cooling per m2												1.4723 (108)
Energy for space heating												36.3756 (99)
Energy for space cooling												1.4723 (108)
Total												37.8479 (109)
Dwelling Fabric Energy Efficiency (DFEE)												37.8 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			10.9100	1.3258	14.4640			(27)
External Wall	68.6000	10.9100	57.6900	0.1800	10.3842			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.1800	2.4462			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0844			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6802	(36)
Total fabric heat loss					(33) + (36) =		36.7646	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	71.9609	71.7266	71.4969	70.4180	70.2162	69.2766	69.2766	69.1026	69.6385	70.2162	70.6245	71.0514	(39)
Average = Sum(39)m / 12 =												70.4171	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9405	0.9375	0.9345	0.9204	0.9177	0.9055	0.9055	0.9032	0.9102	0.9177	0.9231	0.9287	(40)
HLP (average)												0.9204	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3933 (42)
Average daily hot water use (litres/day)		91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.5046	332.1024	320.4183	301.2787	281.1298	262.3741	250.6335	254.4691	264.7044	283.9769	306.0969	323.3738	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.6300	0.7000	0.7700	22.8779	(74)
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
South	2.0100	46.7521	0.6300	0.7000	0.7700	28.7190	(78)

Solar gains	58.0105	103.8103	157.7271	225.6765	283.2400	295.3546	278.8032	233.1883	180.5712	118.7293	70.3347	49.1257	(83)
Total gains	391.5152	435.9128	478.1454	526.9553	564.3698	557.7287	529.4367	487.6575	445.2756	402.7062	376.4316	372.4995	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.8345	74.0757	74.3137	75.4522	75.6691	76.6954	76.6954	76.8885	76.2968	75.6691	75.2316	74.7796	
alpha	5.9223	5.9384	5.9542	6.0301	6.0446	6.1130	6.1130	6.1259	6.0865	6.0446	6.0154	5.9853	
util living area													
	0.9991	0.9981	0.9946	0.9782	0.9125	0.7451	0.5672	0.6345	0.8894	0.9875	0.9981	0.9994	(86)
MIT	19.9656	20.0810	20.2831	20.5688	20.8231	20.9643	20.9942	20.9891	20.8916	20.5737	20.2241	19.9494	(87)
Th 2	20.1332	20.1358	20.1383	20.1502	20.1524	20.1629	20.1629	20.1648	20.1588	20.1524	20.1479	20.1432	(88)
util rest of house													
	0.9988	0.9974	0.9926	0.9696	0.8787	0.6670	0.4638	0.5281	0.8347	0.9812	0.9973	0.9991	(89)
MIT 2	19.1782	19.2955	19.4989	19.7899	20.0274	20.1457	20.1613	20.1614	20.0944	19.7992	19.4487	19.1703	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.4763	19.5929	19.7958	20.0848	20.3287	20.4556	20.4766	20.4748	20.3962	20.0925	19.7423	19.4653	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4763	19.5929	19.7958	20.0848	20.3287	20.4556	20.4766	20.4748	20.3962	20.0925	19.7423	19.4653	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9969	0.9916	0.9688	0.8866	0.6957	0.5033	0.5688	0.8522	0.9806	0.9968	0.9989	(94)
Useful gains	390.9373	434.5582	474.1404	510.5275	500.3745	388.0295	266.4562	277.3827	379.4527	394.9005	375.2222	372.0916	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1092.1013	1053.8731	950.6074	787.6132	605.8717	405.6578	268.5610	281.5821	438.4592	666.5255	892.8563	1084.6223	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	521.6660	416.1796	354.4915	199.5017	78.4899	0.0000	0.0000	0.0000	0.0000	202.0889	372.6965	530.1228	(98)
Space heating												2675.2370	(98)
Space heating per m2											(98) / (4) =	34.9658	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	651.1999	512.6467	525.1796	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9087	0.9570	0.9371	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	591.7323	490.6122	492.1495	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	741.4886	706.6370	659.4601	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	107.8246	160.7225	124.4791	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												393.0261	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	26.9561	40.1806	31.1198	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.2565 (107)
Space cooling per m2												1.2842 (108)
Energy for space heating												34.9658 (99)
Energy for space cooling												1.2842 (108)
Total												36.2501 (109)
Target Fabric Energy Efficiency (TFEE)												41.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2831	0.2628	0.2696	0.2561	0.2561	0.2494	0.2426	0.2359	0.2291	0.2494	0.2359	0.2494	(22b)
Effective ac	0.5401	0.5345	0.5363	0.5328	0.5328	0.5311	0.5294	0.5278	0.5263	0.5311	0.5278	0.5311	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 8			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1644	(36)
Total fabric heat loss					(33) + (36) =		41.1693	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.4984	31.1765	31.2812	31.0745	31.0745	30.9752	30.8785	30.7845	30.6931	30.9752	30.7845	30.9752	(38)
Heat transfer coeff	72.6677	72.3458	72.4505	72.2438	72.2438	72.1445	72.0478	71.9537	71.8623	72.1445	71.9537	72.1445	(39)
Average = Sum(39)m / 12 =												72.1836	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9498	0.9456	0.9469	0.9442	0.9442	0.9429	0.9417	0.9404	0.9393	0.9429	0.9404	0.9429	(40)
HLP (average)												0.9435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
RHI water heating demand												1571	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	13.4839	0.7400	0.7000	0.7700	34.0762	(74)
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
South	2.0100	56.7559	0.7400	0.7000	0.7700	40.9515	(78)

Solar gains	84.7878	129.9758	201.2370	292.4515	350.0206	396.5544	371.4046	317.7978	244.3864	161.0165	102.6411	70.4744	(83)
Total gains	624.6401	665.3586	715.5975	774.3930	798.8962	815.8836	773.5588	728.2318	673.5724	622.8294	600.6080	595.6726	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.1163	73.4416	73.3355	73.5453	73.5453	73.6466	73.7454	73.8418	73.9357	73.6466	73.8418	73.6466	
alpha	5.8744	5.8961	5.8890	5.9030	5.9030	5.9098	5.9164	5.9228	5.9290	5.9098	5.9228	5.9098	
util living area													
	0.9882	0.9819	0.9585	0.8834	0.7237	0.4996	0.3627	0.3845	0.6498	0.8965	0.9737	0.9902	(86)
MIT	20.2959	20.3848	20.5814	20.8129	20.9542	20.9954	20.9994	20.9992	20.9808	20.8288	20.5434	20.2799	(87)
Th 2	20.1254	20.1289	20.1278	20.1301	20.1301	20.1312	20.1322	20.1333	20.1343	20.1312	20.1333	20.1312	(88)
util rest of house													
	0.9845	0.9764	0.9460	0.8515	0.6641	0.4256	0.2823	0.2995	0.5699	0.8601	0.9645	0.9871	(89)
MIT 2	19.2085	19.3388	19.6160	19.9273	20.0914	20.1287	20.1321	20.1330	20.1219	19.9551	19.5707	19.1902	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.6202	19.7348	19.9816	20.2627	20.4181	20.4569	20.4605	20.4610	20.4471	20.2859	19.9390	19.6028	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6202	19.7348	19.9816	20.2627	20.4181	20.4569	20.4605	20.4610	20.4471	20.2859	19.9390	19.6028	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9819	0.9734	0.9436	0.8569	0.6846	0.4536	0.3128	0.3318	0.5996	0.8673	0.9619	0.9848	(94)
Useful gains	613.3355	647.6424	675.2336	663.5478	546.9168	370.0785	241.9427	241.6010	403.9036	540.1958	577.7488	586.5911	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1069.6841	1044.2990	940.5194	777.5358	572.0326	372.0402	242.1151	241.8370	412.9999	641.0703	866.2508	1053.5148	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	339.5234	266.5532	197.3726	82.0713	18.6861	0.0000	0.0000	0.0000	0.0000	75.0507	207.7215	347.3912	(98)
Space heating												1534.3700	(98)
RHI space heating demand												1534	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3437	0.3370	0.3302	0.2965	0.2898	0.2561	0.2561	0.2494	0.2696	0.2898	0.3033	0.3168	(22b)
Effective ac	0.5591	0.5568	0.5545	0.5440	0.5420	0.5328	0.5328	0.5311	0.5363	0.5420	0.5460	0.5502	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 8			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1644	(36)
Total fabric heat loss					(33) + (36) =		41.1693	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.6071	32.4734	32.3422	31.7263	31.6110	31.0745	31.0745	30.9752	31.2812	31.6110	31.8442	32.0879	(38)
Heat transfer coeff	73.7764	73.6426	73.5115	72.8955	72.7803	72.2438	72.2438	72.1445	72.4505	72.7803	73.0134	73.2572	(39)
Average = Sum(39)m / 12 =												72.8950	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9643	0.9625	0.9608	0.9528	0.9513	0.9442	0.9442	0.9429	0.9469	0.9513	0.9543	0.9575	(40)
HLP (average)												0.9528	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	10.6334	0.7400	0.7000	0.7700	26.8725	(74)
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
South	2.0100	46.7521	0.7400	0.7000	0.7700	33.7334	(78)

Solar gains	68.1394	121.9359	185.2667	265.0804	332.6946	346.9245	327.4831	273.9038	212.0995	139.4599	82.6153	57.7032	(83)
Total gains	607.9917	657.3187	699.6272	747.0219	781.5702	766.2537	729.6374	684.3377	641.2855	601.2728	580.5822	582.9014	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.0175	72.1484	72.2771	72.8878	73.0032	73.5453	73.5453	73.6466	73.3355	73.0032	72.7701	72.5280	
alpha	5.8012	5.8099	5.8185	5.8592	5.8669	5.9030	5.9030	5.9098	5.8890	5.8669	5.8513	5.8352	
util living area													
	0.9915	0.9853	0.9686	0.9150	0.7865	0.5909	0.4338	0.4815	0.7312	0.9329	0.9833	0.9932	(86)
MIT	20.2006	20.3162	20.5064	20.7472	20.9209	20.9878	20.9983	20.9970	20.9605	20.7504	20.4349	20.1709	(87)
Th 2	20.1132	20.1147	20.1161	20.1229	20.1242	20.1301	20.1301	20.1312	20.1278	20.1242	20.1216	20.1189	(88)
util rest of house													
	0.9889	0.9808	0.9590	0.8900	0.7343	0.5160	0.3491	0.3924	0.6567	0.9077	0.9775	0.9912	(89)
MIT 2	19.0612	19.2292	19.5016	19.8372	20.0510	20.1223	20.1294	20.1299	20.0986	19.8492	19.4071	19.0226	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.4926	19.6408	19.8821	20.1817	20.3804	20.4500	20.4584	20.4582	20.4250	20.1904	19.7963	19.4574	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4926	19.6408	19.8821	20.1817	20.3804	20.4500	20.4584	20.4582	20.4250	20.1904	19.7963	19.4574	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9866	0.9779	0.9559	0.8919	0.7504	0.5441	0.3812	0.4262	0.6833	0.9099	0.9748	0.9892	(94)
Useful gains	599.8617	642.7815	668.7941	666.2802	586.5181	416.8810	278.1586	291.6658	438.1921	547.0896	565.9515	576.5809	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1120.8554	1085.5497	983.7351	822.3889	631.7602	422.6281	278.7472	292.7780	458.2475	697.9940	926.9993	1117.7127	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	387.6193	297.5402	234.3161	112.3983	33.6602	0.0000	0.0000	0.0000	0.0000	112.2729	259.9544	402.6021	(98)
Space heating												1840.3634	(98)
Space heating per m2											(98) / (4) =	24.0539	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1981.0155	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	387.6193	297.5402	234.3161	112.3983	33.6602	0.0000	0.0000	0.0000	0.0000	112.2729	259.9544	402.6021	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	417.2436	320.2801	252.2240	120.9885	36.2327	0.0000	0.0000	0.0000	0.0000	120.8535	279.8217	433.3715	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9395	88.8480	88.6450	88.1659	87.3645	86.7000	86.7000	86.7000	86.7000	88.1355	88.7333	88.9844	(217)
Fuel for water heating, kWh/month													
	180.2585	158.1833	164.4845	145.4340	141.7678	124.6671	116.9021	132.1820	133.1766	151.0039	162.1134	174.8936	(219)
Water heating fuel used												1785.0667	(219)
Annual totals kWh/year													
Space heating fuel - main system												1981.0155	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												3573.9767	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1981.0155	3.4800	68.9393	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1785.0667	3.4800	62.1203	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	356.6476	13.1900	47.0418	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			307.9940	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0646	(257)
SAP value		85.1491	
SAP rating (Section 12)		85	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1981.0155	0.2160	427.8994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1785.0667	0.2160	385.5744	(264)
Space and water heating			813.4738	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			713.7710	(272)
CO2 emissions per m2			9.3300	(273)
EI value			92.1286	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8788 = 3.960, stars = 4
Water heating environmental impact	0.216 / 0.8788 = 0.2458, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		4.0800	
Infiltration rate		0.3172	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2696	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2831	0.2628	0.2696	0.2561	0.2561	0.2494	0.2426	0.2359	0.2291	0.2494	0.2359	0.2494	(22b)
Effective ac	0.5401	0.5345	0.5363	0.5328	0.5328	0.5311	0.5294	0.5278	0.5263	0.5311	0.5278	0.5311	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 8			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1644	(36)
Total fabric heat loss					(33) + (36) =		41.1693	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.4984	31.1765	31.2812	31.0745	31.0745	30.9752	30.8785	30.7845	30.6931	30.9752	30.7845	30.9752	(38)
Heat transfer coeff	72.6677	72.3458	72.4505	72.2438	72.2438	72.1445	72.0478	71.9537	71.8623	72.1445	71.9537	72.1445	(39)
Average = Sum(39)m / 12 =												72.1836	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9498	0.9456	0.9469	0.9442	0.9442	0.9429	0.9417	0.9404	0.9393	0.9429	0.9404	0.9429	(40)
HLP (average)												0.9435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.0400	13.4839	0.7400	0.7000	0.7700	34.0762	(74)
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
South	2.0100	56.7559	0.7400	0.7000	0.7700	40.9515	(78)

Solar gains	84.7878	129.9758	201.2370	292.4515	350.0206	396.5544	371.4046	317.7978	244.3864	161.0165	102.6411	70.4744	(83)
Total gains	624.6401	665.3586	715.5975	774.3930	798.8962	815.8836	773.5588	728.2318	673.5724	622.8294	600.6080	595.6726	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.1163	73.4416	73.3355	73.5453	73.5453	73.6466	73.7454	73.8418	73.9357	73.6466	73.8418	73.6466	
alpha	5.8744	5.8961	5.8890	5.9030	5.9030	5.9098	5.9164	5.9228	5.9290	5.9098	5.9228	5.9098	
util living area													
	0.9882	0.9819	0.9585	0.8834	0.7237	0.4996	0.3627	0.3845	0.6498	0.8965	0.9737	0.9902	(86)
MIT	20.2959	20.3848	20.5814	20.8129	20.9542	20.9954	20.9994	20.9992	20.9808	20.8288	20.5434	20.2799	(87)
Th 2	20.1254	20.1289	20.1278	20.1301	20.1301	20.1312	20.1322	20.1333	20.1343	20.1312	20.1333	20.1312	(88)
util rest of house													
	0.9845	0.9764	0.9460	0.8515	0.6641	0.4256	0.2823	0.2995	0.5699	0.8601	0.9645	0.9871	(89)
MIT 2	19.2085	19.3388	19.6160	19.9273	20.0914	20.1287	20.1321	20.1330	20.1219	19.9551	19.5707	19.1902	(90)
Living area fraction										fLA = Living area / (4) =		0.3786	(91)
MIT	19.6202	19.7348	19.9816	20.2627	20.4181	20.4569	20.4605	20.4610	20.4471	20.2859	19.9390	19.6028	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6202	19.7348	19.9816	20.2627	20.4181	20.4569	20.4605	20.4610	20.4471	20.2859	19.9390	19.6028	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9819	0.9734	0.9436	0.8569	0.6846	0.4536	0.3128	0.3318	0.5996	0.8673	0.9619	0.9848	(94)
Useful gains	613.3355	647.6424	675.2336	663.5478	546.9168	370.0785	241.9427	241.6010	403.9036	540.1958	577.7488	586.5911	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1069.6841	1044.2990	940.5194	777.5358	572.0326	372.0402	242.1151	241.8370	412.9999	641.0703	866.2508	1053.5148	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	339.5234	266.5532	197.3726	82.0713	18.6861	0.0000	0.0000	0.0000	0.0000	75.0507	207.7215	347.3912	(98)
Space heating												1534.3700	(98)
Space heating per m2											(98) / (4) =	20.0545	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1651.6362	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	339.5234	266.5532	197.3726	82.0713	18.6861	0.0000	0.0000	0.0000	0.0000	75.0507	207.7215	347.3912	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	365.4719	286.9249	212.4570	88.3437	20.1143	0.0000	0.0000	0.0000	0.0000	80.7865	223.5969	373.9410	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.8482	88.7689	88.5120	87.9214	87.1065	86.7000	86.7000	86.7000	86.7000	87.8273	88.5626	88.8850	(217)
Fuel for water heating, kWh/month													
	180.4438	158.3242	164.7317	145.8386	142.1878	124.6671	116.9021	132.1820	133.1766	151.5340	162.4259	175.0891	(219)
Water heating fuel used												1787.5028	(219)
Annual totals kWh/year													
Space heating fuel - main system												1651.6362	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =												-692.9382	(233)
Total delivered energy for all uses												3177.8483	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1651.6362	7.3800	121.8907	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1787.5028	7.3800	131.9177	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	356.6476	28.6600	102.2152	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			484.5187	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1651.6362	0.2160	356.7534	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1787.5028	0.2160	386.1006	(264)
Space and water heating			742.8540	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			607.2442	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1651.6362	1.2200	2014.9961	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1787.5028	1.2200	2180.7534	(264)
Space and water heating			4195.7495	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	356.6476	3.0700	1094.9082	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3393.5873	(272)
Primary energy kWh/m2/year			44.3548	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 85
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£124	£124	£0
Mains gas	£361	£361	£0
Space heating	£250	£250	£0
Water heating	£132	£132	£0
Lighting	£102	£102	£0
Total cost of fuels	£485	£485	£0
Total cost of uses	£484	£484	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	44 kWh/m²	44 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	349.94 (P1)
Transmission heat loss coefficient	41.17 (37)
Summer heat loss coefficient	391.11 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
South	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.0400	87.1704	0.7400	0.7000	0.8865	253.6255
North East	1.8600	106.0502	0.7400	0.7000	0.8865	81.5221
South	2.0100	118.5567	0.7400	0.7000	0.8865	98.4857
total:						433.6333

	Jun	Jul	Aug	
Solar gains	471	434	370	(P3)
Internal gains	416	399	407	
Total summer gains	887	833	777	(P5)
Summer gain/loss ratio	2.27	2.13	1.99	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.92	19.68	19.54	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 670 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 670 - EPC	**Prop Type Ref**	
Property	23 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	85 B	**DER**	11.35	**TER**	16.86
Environmental	92 A	**% DER<TER**	32.68		
CO_2 Emissions (t/year)	0.61	**DFEE**	37.85	**TFEE**	41.69
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.86	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.35	$kgCO_2/m^2$	Pass
	-5.51 (-32.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.69	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	37.85	$kWh/m^2/yr$	
	-3.9 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.08 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	7.04 m², No overhang
Windows facing North East	1.86 m², No overhang
Windows facing South	2.01 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.08 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 671 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 671 - EPC	**Prop Type Ref**	
Property	25 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	85 B	**DER**	11.72	**TER**	16.57
Environmental	92 A	**% DER<TER**	29.26		
CO_2 Emissions (t/year)	0.65	**DFEE**	36.12	**TFEE**	40.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Mid-floor flat, total floor area 77 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.57 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.72 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)40.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)36.1 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.22 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.86 m², No overhang
Windows facing East: 7.04 m², No overhang
Windows facing West: 2.01 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Air permeability 3.2 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.2200	
Infiltration rate		0.2742	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2330	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2971	0.2913	0.2855	0.2563	0.2505	0.2214	0.2214	0.2156	0.2330	0.2505	0.2622	0.2738	(22b)
Effective ac	0.5441	0.5424	0.5407	0.5329	0.5314	0.5245	0.5245	0.5232	0.5272	0.5314	0.5344	0.5375	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 6			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1759	(36)
Total fabric heat loss					(33) + (36) =		41.1807	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.7362	31.6363	31.5383	31.0780	30.9919	30.5911	30.5911	30.5168	30.7455	30.9919	31.1661	31.3482	(38)
Heat transfer coeff	72.9170	72.8170	72.7190	72.2588	72.1727	71.7718	71.7718	71.6976	71.9262	72.1727	72.3469	72.5290	(39)
Average = Sum(39)m / 12 =												72.2584	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9530	0.9517	0.9505	0.9444	0.9433	0.9381	0.9381	0.9371	0.9401	0.9433	0.9456	0.9480	(40)
HLP (average)												0.9444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	364.4262	362.2601	348.9926	327.7020	306.1559	285.4344	272.0246	278.0008	288.9980	310.4966	335.1307	353.5372	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	7.0400	19.6403	0.7400	0.7000	0.7700	49.6344	(76)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	71.3391	140.1520	233.1846	345.1652	428.3969	441.1282	418.8951	356.0672	272.7360	166.8465	89.0372	58.6229	(83)
Total gains	435.7653	502.4121	582.1773	672.8672	734.5528	726.5626	690.9197	634.0680	561.7340	477.3431	424.1680	412.1601	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.8664	72.9664	73.0647	73.5301	73.6178	74.0290	74.0290	74.1057	73.8701	73.6178	73.4406	73.2562	
alpha	5.8578	5.8644	5.8710	5.9020	5.9079	5.9353	5.9353	5.9404	5.9247	5.9079	5.8960	5.8837	
util living area													
	0.9984	0.9960	0.9861	0.9413	0.8140	0.6163	0.4547	0.5150	0.7977	0.9737	0.9964	0.9989	(86)
MIT	20.0036	20.1443	20.3881	20.6927	20.9065	20.9852	20.9979	20.9958	20.9385	20.6355	20.2567	19.9718	(87)
Th 2	20.1227	20.1238	20.1248	20.1299	20.1308	20.1353	20.1353	20.1361	20.1336	20.1308	20.1289	20.1269	(88)
util rest of house													
	0.9979	0.9947	0.9813	0.9221	0.7641	0.5398	0.3666	0.4210	0.7268	0.9616	0.9950	0.9985	(89)
MIT 2	18.7821	18.9882	19.3422	19.7731	20.0427	20.1258	20.1345	20.1343	20.0855	19.7033	19.1569	18.7389	(90)
Living area fraction										fLA = Living area / (4) =		0.3786	(91)
MIT	19.2446	19.4260	19.7383	20.1213	20.3698	20.4512	20.4614	20.4605	20.4085	20.0562	19.5733	19.2058	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2446	19.4260	19.7383	20.1213	20.3698	20.4512	20.4614	20.4605	20.4085	20.0562	19.5733	19.2058	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9933	0.9787	0.9218	0.7788	0.5684	0.4001	0.4567	0.7510	0.9603	0.9938	0.9979	(94)
Useful gains	434.5448	499.0409	569.7751	620.2707	572.0424	412.9467	276.4050	289.5774	421.8505	458.3792	421.5312	411.3134	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1089.7163	1057.7366	962.6727	810.8354	625.7214	419.9496	277.1397	291.1298	453.7454	682.4824	902.4057	1088.3522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	487.4476	375.4435	292.3158	137.2066	39.9371	0.0000	0.0000	0.0000	0.0000	166.7328	346.2297	503.7168	(98)
Space heating												2349.0299	(98)
Space heating per m2											(98) / (4) =	30.7023	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2528.5575	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.4476	375.4435	292.3158	137.2066	39.9371	0.0000	0.0000	0.0000	0.0000	166.7328	346.2297	503.7168	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	524.7014	404.1372	314.6564	147.6928	42.9894	0.0000	0.0000	0.0000	0.0000	179.4756	372.6907	542.2140	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0862	89.0052	88.8091	88.3252	87.4591	86.7000	86.7000	86.7000	86.7000	88.4509	88.9365	89.1236	(217)
Fuel for water heating, kWh/month	179.9617	157.9038	164.1806	145.1718	141.6145	124.6671	116.9021	132.1820	133.1766	150.4656	161.7430	174.6204	(219)
Water heating fuel used												1782.5892	(219)
Annual totals kWh/year													
Space heating fuel - main system												2528.5575	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												4244.6248	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2528.5575	0.2160	546.1684	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1782.5892	0.2160	385.0393	(264)
Space and water heating			931.2077	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total CO2, kg/year			896.6828	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.7200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		11.7200	ZC1
Total Floor Area	TFA	76.5100	
Assumed number of occupants	N	2.3933	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4191	ZC2
CO2 emissions from cooking, equation (L16)		2.3061	ZC3
Total CO2 emissions		30.4451	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.4451	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			10.9100	1.3258	14.4640			(27)
External Wall	68.6000	10.9100	57.6900	0.1800	10.3842			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.1800	2.4462			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0844			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7552	(36)
Total fabric heat loss					(33) + (36) =		36.8396	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	72.0359	71.8016	71.5719	70.4930	70.2912	69.3516	69.3516	69.1776	69.7135	70.2912	70.6995	71.1264	(39)
Average = Sum(39)m / 12 =												70.4921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9415	0.9385	0.9355	0.9214	0.9187	0.9064	0.9064	0.9042	0.9112	0.9187	0.9241	0.9296	(40)
HLP (average)												0.9213	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.4181	47.3214	43.9990	43.6099	40.4073	41.7542	43.6099	43.9990	47.3214	47.5908	50.9589	(61)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month

	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852 (64)
								Total per year (kWh/year) = Sum(64)m =				1978.3788 (64)
Heat gains from water heating, kWh/month												
	62.1201	54.2929	56.3969	49.8539	48.1840	42.2729	40.2498	45.1113	45.6172	52.1736	55.9355	60.5620 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	83.4947	80.7930	75.8023	69.2416	64.7634	58.7124	54.0992	60.6335	63.3572	70.1258	77.6882	81.4005	(72)
Total internal gains													
	377.5815	374.8216	360.9378	339.0320	316.8683	295.5303	282.1247	288.7172	300.3339	322.4477	347.6956	366.6949	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	60.7347	119.3186	198.5220	293.8569	364.7163	375.5551	356.6270	303.1383	232.1942	142.0450	75.8020	49.9087	(83)
Total gains	438.3162	494.1402	559.4598	632.8888	681.5846	671.0854	638.7517	591.8555	532.5281	464.4927	423.4976	416.6036	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7576	73.9983	74.2358	75.3719	75.5883	76.6124	76.6124	76.8052	76.2147	75.5883	75.1518	74.7007	
alpha	5.9172	5.9332	5.9491	6.0248	6.0392	6.1075	6.1075	6.1203	6.0810	6.0392	6.0101	5.9800	
util living area													
	0.9984	0.9963	0.9882	0.9513	0.8394	0.6425	0.4750	0.5320	0.8116	0.9754	0.9964	0.9988	(86)
MIT	20.0234	20.1527	20.3805	20.6786	20.8955	20.9837	20.9977	20.9957	20.9373	20.6438	20.2821	20.0040	(87)
Th 2	20.1323	20.1349	20.1375	20.1494	20.1516	20.1620	20.1620	20.1640	20.1580	20.1516	20.1471	20.1424	(88)
util rest of house													
	0.9978	0.9951	0.9841	0.9347	0.7929	0.5663	0.3860	0.4383	0.7434	0.9640	0.9950	0.9984	(89)
MIT 2	18.8183	19.0089	19.3414	19.7715	20.0509	20.1513	20.1612	20.1622	20.1083	19.7319	19.2076	18.7976	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.2746	19.4420	19.7348	20.1150	20.3707	20.4665	20.4779	20.4778	20.4222	20.0772	19.6145	19.2544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2746	19.4420	19.7348	20.1150	20.3707	20.4665	20.4779	20.4778	20.4222	20.0772	19.6145	19.2544	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9937	0.9817	0.9339	0.8058	0.5947	0.4198	0.4739	0.7665	0.9628	0.9937	0.9978	(94)
Useful gains	437.0518	491.0489	549.2098	591.0857	549.2376	399.0921	268.1485	280.4993	408.1634	447.1933	420.8469	415.7027	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1078.7105	1044.1367	947.2422	790.5785	609.4732	406.8509	268.9407	282.0906	440.7427	666.1628	884.7664	1070.7650	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	477.3941	371.6750	296.1361	143.6348	44.8153	0.0000	0.0000	0.0000	0.0000	162.9133	334.0221	487.3664	(98)
Space heating												2317.9569	(98)
Space heating per m2											(98) / (4) =	30.2961	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2481.7526	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	477.3941	371.6750	296.1361	143.6348	44.8153	0.0000	0.0000	0.0000	0.0000	162.9133	334.0221	487.3664	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	511.1286	397.9390	317.0622	153.7846	47.9821	0.0000	0.0000	0.0000	0.0000	174.4254	357.6254	521.8055	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.1689	86.9101	86.2783	84.7676	82.3561	80.3000	80.3000	80.3000	80.3000	84.9642	86.5858	87.2658	(217)
Fuel for water heating, kWh/month													
	228.8330	200.5612	210.1989	189.7586	189.0992	170.8126	163.6515	182.4330	184.4478	198.5008	207.9271	223.2091	(219)
Water heating fuel used												2349.4326	(219)
Annual totals kWh/year													
Space heating fuel - main system												2481.7526	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Total delivered energy for all uses												5262.8328	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2481.7526	0.2160	536.0586	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2349.4326	0.2160	507.4774	(264)
Space and water heating			1043.5360	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Total CO2, kg/m2/year			1267.5611	(272)
Emissions per m2 for space and water heating			13.6392	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4193	(272b)
Emissions per m2 for pumps and fans			0.5088	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6392 * 1.00) + 2.4193 + 0.5088, rounded to 2 d.p.			16.5700	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1697	(8)
Pressure test			Yes	
Measured/design AP50			3.2200	
Infiltration rate			0.3307	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2811	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3584	0.3514	0.3444	0.3092	0.3022	0.2671	0.2671	0.2600	0.2811	0.3022	0.3163	0.3303	(22b)
Effective ac	0.5642	0.5617	0.5593	0.5478	0.5457	0.5357	0.5357	0.5338	0.5395	0.5457	0.5500	0.5546	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 6			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1759	(36)
Total fabric heat loss					(33) + (36) =		41.1807	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.9085	32.7630	32.6204	31.9506	31.8253	31.2419	31.2419	31.1338	31.4666	31.8253	32.0788	32.3438	(38)
Heat transfer coeff	74.0893	73.9438	73.8012	73.1313	73.0060	72.4226	72.4226	72.3146	72.6473	73.0060	73.2595	73.5246	(39)
Average = Sum(39)m / 12 =												73.1307	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9684	0.9665	0.9646	0.9558	0.9542	0.9466	0.9466	0.9452	0.9495	0.9542	0.9575	0.9610	(40)
HLP (average)												0.9558	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.5046	332.1024	320.4183	301.2787	281.1298	262.3741	250.6335	254.4691	264.7044	283.9769	306.0969	323.3738	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	7.0400	19.6403	0.7400	0.7000	0.7700	49.6344	(76)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	71.3391	140.1520	233.1846	345.1652	428.3969	441.1282	418.8951	356.0672	272.7360	166.8465	89.0372	58.6229	(83)
Total gains	404.8438	472.2545	553.6029	646.4440	709.5267	703.5023	669.5286	610.5364	537.4404	450.8234	395.1342	381.9967	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.7134	71.8545	71.9934	72.6528	72.7775	73.3638	73.3638	73.4734	73.1368	72.7775	72.5256	72.2642	
alpha	5.7809	5.7903	5.7996	5.8435	5.8518	5.8909	5.8909	5.8982	5.8758	5.8518	5.8350	5.8176	
util living area													
	0.9989	0.9971	0.9893	0.9513	0.8346	0.6385	0.4728	0.5378	0.8232	0.9802	0.9976	0.9993	(86)
MIT	19.9427	20.0862	20.3363	20.6565	20.8895	20.9817	20.9973	20.9945	20.9250	20.5960	20.2060	19.9150	(87)
Th 2	20.1098	20.1114	20.1129	20.1203	20.1217	20.1281	20.1281	20.1293	20.1256	20.1217	20.1189	20.1160	(88)
util rest of house													
	0.9986	0.9962	0.9856	0.9345	0.7865	0.5600	0.3808	0.4397	0.7546	0.9706	0.9966	0.9990	(89)
MIT 2	19.1360	19.2804	19.5298	19.8449	20.0494	20.1200	20.1274	20.1277	20.0846	19.7938	19.4065	19.1135	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.4414	19.5855	19.8352	20.1522	20.3675	20.4463	20.4568	20.4559	20.4028	20.0976	19.7093	19.4169	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4414	19.5855	19.8352	20.1522	20.3675	20.4463	20.4568	20.4559	20.4028	20.0976	19.7093	19.4169	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9954	0.9841	0.9352	0.8010	0.5894	0.4158	0.4771	0.7783	0.9703	0.9960	0.9987	(94)
Useful gains	404.1285	470.0968	544.8160	604.5848	568.3429	414.6701	278.3717	291.2722	418.2787	437.4230	393.5360	381.5116	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1121.8179	1085.9006	984.1513	822.8890	632.7816	423.4020	279.3181	293.3036	457.8844	693.3796	923.7485	1118.8194	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	533.9609	413.8201	326.8655	157.1790	47.9424	0.0000	0.0000	0.0000	0.0000	190.4317	381.7530	548.5570	(98)
Space heating												2600.5096	(98)
Space heating per m2											(98) / (4) =	33.9891	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	680.7724	535.9272	549.5907	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9477	0.9771	0.9636	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	645.1826	523.6605	529.6091	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	911.8733	870.3809	803.0848	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	192.0173	257.9599	203.4659	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												653.4431	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   48.0043   64.4900   50.8665    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        163.3608 (107)
Space cooling per m2                                                                                                   2.1352 (108)
Energy for space heating                                                                                              33.9891 (99)
Energy for space cooling                                                                                               2.1352 (108)
Total                                                                                                                 36.1243 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                               36.1 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			10.9100	1.3258	14.4640			(27)
External Wall	68.6000	10.9100	57.6900	0.1800	10.3842			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.1800	2.4462			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.0844			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7552	(36)
Total fabric heat loss					(33) + (36) =		36.8396	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	72.0359	71.8016	71.5719	70.4930	70.2912	69.3516	69.3516	69.1776	69.7135	70.2912	70.6995	71.1264	(39)
Average = Sum(39)m / 12 =												70.4921	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9415	0.9385	0.9355	0.9214	0.9187	0.9064	0.9064	0.9042	0.9112	0.9187	0.9241	0.9296	(40)
HLP (average)												0.9213	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3933 (42)
Average daily hot water use (litres/day)		91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

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Heat gains from water heating, kWh/month

	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.1949	17.9369	14.5873	11.0435	8.2551	6.9693	7.5306	9.7886	13.1382	16.6820	19.4703	20.7561	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.5046	332.1024	320.4183	301.2787	281.1298	262.3741	250.6335	254.4691	264.7044	283.9769	306.0969	323.3738	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
East	7.0400	19.6403	0.6300	0.7000	0.7700	42.2563	(76)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	60.7347	119.3186	198.5220	293.8569	364.7163	375.5551	356.6270	303.1383	232.1942	142.0450	75.8020	49.9087	(83)
Total gains	394.2393	451.4210	518.9403	595.1356	645.8461	637.9292	607.2604	557.6074	496.8986	426.0219	381.8989	373.2825	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7576	73.9983	74.2358	75.3719	75.5883	76.6124	76.6124	76.8052	76.2147	75.5883	75.1518	74.7007	
alpha	5.9172	5.9332	5.9491	6.0248	6.0392	6.1075	6.1075	6.1203	6.0810	6.0392	6.0101	5.9800	
util living area													
	0.9991	0.9977	0.9918	0.9624	0.8631	0.6708	0.4987	0.5626	0.8445	0.9836	0.9979	0.9993	(86)
MIT	19.9676	20.0991	20.3318	20.6411	20.8766	20.9795	20.9971	20.9942	20.9212	20.6002	20.2298	19.9489	(87)
Th 2	20.1323	20.1349	20.1375	20.1494	20.1516	20.1620	20.1620	20.1640	20.1580	20.1516	20.1471	20.1424	(88)
util rest of house													
	0.9988	0.9969	0.9889	0.9489	0.8197	0.5933	0.4058	0.4646	0.7805	0.9756	0.9971	0.9991	(89)
MIT 2	19.1795	19.3129	19.5462	19.8570	20.0688	20.1527	20.1613	20.1623	20.1138	19.8238	19.4537	19.1692	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.4779	19.6106	19.8437	20.1539	20.3746	20.4658	20.4777	20.4773	20.4195	20.1178	19.7476	19.4645	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4779	19.6106	19.8437	20.1539	20.3746	20.4658	20.4777	20.4773	20.4195	20.1178	19.7476	19.4645	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9963	0.9877	0.9490	0.8321	0.6223	0.4411	0.5019	0.8023	0.9752	0.9965	0.9989	(94)
Useful gains	393.6359	449.7492	512.5565	564.7965	537.4230	396.9551	267.8879	279.8886	398.6570	415.4446	380.5790	372.8689	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1093.3563	1056.2450	955.0310	793.3231	609.7511	406.8004	268.9266	282.0565	440.5539	669.0180	894.1771	1085.7071	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	520.5920	407.5652	329.2010	164.5391	53.8121	0.0000	0.0000	0.0000	0.0000	188.6586	369.7907	530.3516	(98)
Space heating												2564.5104	(98)
Space heating per m2											(98) / (4) =	33.5186	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	651.9049	513.2017	525.7496	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9417	0.9748	0.9611	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.8704	500.2538	505.3025	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	835.2294	797.5999	741.2198	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	159.3785	221.2254	175.5225	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												556.1264	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

Intermittency factor (Table 10b)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	39.8446	55.3064	43.8806	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												139.0316 (107)
Space cooling per m2												1.8172 (108)
Energy for space heating												33.5186 (99)
Energy for space cooling												1.8172 (108)
Total												35.3358 (109)
Target Fabric Energy Efficiency (TFEE)												40.6 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.2200	
Infiltration rate		0.2742	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2330	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2447	0.2272	0.2330	0.2214	0.2214	0.2156	0.2097	0.2039	0.1981	0.2156	0.2039	0.2156	(22b)
Effective ac	0.5299	0.5258	0.5272	0.5245	0.5245	0.5232	0.5220	0.5208	0.5196	0.5232	0.5208	0.5232	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 6			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1759	(36)
Total fabric heat loss					(33) + (36) =		41.1807	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.9078	30.6673	30.7455	30.5911	30.5911	30.5168	30.4446	30.3743	30.3060	30.5168	30.3743	30.5168	(38)
Heat transfer coeff	72.0885	71.8480	71.9262	71.7718	71.7718	71.6976	71.6253	71.5550	71.4867	71.6976	71.5550	71.6976	(39)
Average = Sum(39)m / 12 =												71.7268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9422	0.9391	0.9401	0.9381	0.9381	0.9371	0.9362	0.9352	0.9343	0.9371	0.9352	0.9371	(40)
HLP (average)												0.9375	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
RHI water heating demand												1571	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
East	7.0400	25.1925	0.7400	0.7000	0.7700	63.6660	(76)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	91.6035	153.2109	256.5325	380.6462	447.5894	499.9651	471.3206	411.5753	316.4726	196.7133	113.9818	73.9734	(83)
Total gains	631.4558	688.5937	770.8929	862.5877	896.4650	919.2944	873.4748	822.0093	745.6585	658.5262	611.9488	599.1716	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7038	73.9505	73.8701	74.0290	74.0290	74.1057	74.1804	74.2533	74.3242	74.1057	74.2533	74.1057	
alpha	5.9136	5.9300	5.9247	5.9353	5.9353	5.9404	5.9454	5.9502	5.9549	5.9404	5.9502	5.9404	
util living area													
	0.9873	0.9784	0.9429	0.8363	0.6567	0.4425	0.3196	0.3391	0.5917	0.8741	0.9711	0.9898	(86)
MIT	20.3147	20.4201	20.6425	20.8672	20.9728	20.9976	20.9997	20.9996	20.9883	20.8561	20.5617	20.2924	(87)
Th 2	20.1318	20.1344	20.1336	20.1353	20.1353	20.1361	20.1369	20.1377	20.1384	20.1361	20.1377	20.1361	(88)
util rest of house													
	0.9835	0.9721	0.9270	0.7987	0.5981	0.3765	0.2490	0.2644	0.5162	0.8336	0.9611	0.9866	(89)
MIT 2	19.2405	19.3932	19.7035	19.9962	20.1131	20.1348	20.1368	20.1375	20.1311	19.9913	19.5996	19.2120	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.6472	19.7820	20.0590	20.3260	20.4386	20.4615	20.4635	20.4640	20.4557	20.3188	19.9639	19.6211	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6472	19.7820	20.0590	20.3260	20.4386	20.4615	20.4635	20.4640	20.4557	20.3188	19.9639	19.6211	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9690	0.9254	0.8075	0.6191	0.4015	0.2757	0.2927	0.5445	0.8430	0.9586	0.9842	(94)
Useful gains	619.3481	667.2338	713.3804	696.5709	555.0375	369.0745	240.8321	240.5943	406.0220	555.1639	586.6324	589.7231	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1063.1059	1040.5054	939.2869	777.0006	569.7670	370.0696	240.9145	240.7084	411.4562	639.4548	863.2328	1048.2967	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	330.1558	250.8385	168.0745	57.9094	10.9587	0.0000	0.0000	0.0000	0.0000	62.7124	199.1523	341.1788	(98)
Space heating												1420.9804	(98)
RHI space heating demand												1421	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.2200	
Infiltration rate		0.2742	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2330	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2971	0.2913	0.2855	0.2563	0.2505	0.2214	0.2214	0.2156	0.2330	0.2505	0.2622	0.2738	(22b)
Effective ac	0.5441	0.5424	0.5407	0.5329	0.5314	0.5245	0.5245	0.5232	0.5272	0.5314	0.5344	0.5375	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 6			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1759	(36)
Total fabric heat loss					(33) + (36) =		41.1807	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.7362	31.6363	31.5383	31.0780	30.9919	30.5911	30.5911	30.5168	30.7455	30.9919	31.1661	31.3482	(38)
Heat transfer coeff	72.9170	72.8170	72.7190	72.2588	72.1727	71.7718	71.7718	71.6976	71.9262	72.1727	72.3469	72.5290	(39)
Average = Sum(39)m / 12 =												72.2584	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9530	0.9517	0.9505	0.9444	0.9433	0.9381	0.9381	0.9371	0.9401	0.9433	0.9456	0.9480	(40)
HLP (average)												0.9444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	7.0400	19.6403	0.7400	0.7000	0.7700	49.6344	(76)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	71.3391	140.1520	233.1846	345.1652	428.3969	441.1282	418.8951	356.0672	272.7360	166.8465	89.0372	58.6229	(83)
Total gains	611.1914	675.5348	747.5451	827.1067	877.2725	860.4574	821.0494	766.5012	701.9220	628.6594	587.0041	583.8211	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	72.8664	72.9664	73.0647	73.5301	73.6178	74.0290	74.0290	74.1057	73.8701	73.6178	73.4406	73.2562	
alpha	5.8578	5.8644	5.8710	5.9020	5.9079	5.9353	5.9353	5.9404	5.9247	5.9079	5.8960	5.8837	
util living area													
	0.9911	0.9829	0.9574	0.8777	0.7213	0.5278	0.3838	0.4286	0.6778	0.9193	0.9821	0.9931	(86)
MIT	20.2209	20.3526	20.5685	20.8108	20.9509	20.9933	20.9991	20.9984	20.9738	20.7797	20.4529	20.1860	(87)
Th 2	20.1227	20.1238	20.1248	20.1299	20.1308	20.1353	20.1353	20.1361	20.1336	20.1308	20.1289	20.1269	(88)
util rest of house													
	0.9885	0.9779	0.9451	0.8468	0.6670	0.4592	0.3088	0.3490	0.6041	0.8908	0.9760	0.9910	(89)
MIT 2	19.0978	19.2882	19.5945	19.9225	20.0873	20.1312	20.1350	20.1354	20.1150	19.8919	19.4385	19.0507	(90)
Living area fraction									fLA = Living area / (4) =			0.3786	(91)
MIT	19.5231	19.6912	19.9633	20.2588	20.4143	20.4576	20.4622	20.4622	20.4402	20.2281	19.8226	19.4806	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5231	19.6912	19.9633	20.2588	20.4143	20.4576	20.4622	20.4622	20.4402	20.2281	19.8226	19.4806	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9861	0.9748	0.9425	0.8518	0.6853	0.4850	0.3373	0.3792	0.6311	0.8944	0.9733	0.9890	(94)
Useful gains	602.7181	658.5101	704.5397	704.5371	601.2257	417.3265	276.9032	290.6731	442.9549	562.2643	571.3072	577.3827	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1110.0191	1077.0530	979.0364	820.7764	628.9326	420.4117	277.1951	291.2495	456.0239	694.8855	920.4423	1108.2845	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	377.4319	281.2608	204.2256	83.6923	20.6139	0.0000	0.0000	0.0000	0.0000	98.6702	251.3773	394.9909	(98)
Space heating												1712.2631	(98)
Space heating per m2											(98) / (4) =	22.3796	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1843.1249	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	377.4319	281.2608	204.2256	83.6923	20.6139	0.0000	0.0000	0.0000	0.0000	98.6702	251.3773	394.9909	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	406.2776	302.7566	219.8338	90.0886	22.1894	0.0000	0.0000	0.0000	0.0000	106.2112	270.5891	425.1786	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9215	88.8079	88.5388	87.9362	87.1426	86.7000	86.7000	86.7000	86.7000	88.0341	88.7083	88.9718	(217)
Fuel for water heating, kWh/month													
	180.2950	158.2547	164.6819	145.8140	142.1288	124.6671	116.9021	132.1820	133.1766	151.1779	162.1590	174.9182	(219)
Water heating fuel used												1786.3573	(219)
Annual totals kWh/year													
Space heating fuel - main system												1843.1249	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3562.9604	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1843.1249	3.4800	64.1407	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1786.3573	3.4800	62.1652	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	356.6476	13.1900	47.0418	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			303.2403	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0482	(257)
SAP value		85.3783	
SAP rating (Section 12)		85	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1843.1249	0.2160	398.1150	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1786.3573	0.2160	385.8532	(264)
Space and water heating			783.9682	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total kg/year			749.4433	(272)
CO2 emissions per m2			9.8000	(273)
EI value			91.7352	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8782 = 3.963, stars = 4
Water heating environmental impact	0.216 / 0.8782 = 0.2460, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.2200	
Infiltration rate		0.2742	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2330	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2447	0.2272	0.2330	0.2214	0.2214	0.2156	0.2097	0.2039	0.1981	0.2156	0.2039	0.2156	(22b)
Effective ac	0.5299	0.5258	0.5272	0.5245	0.5245	0.5232	0.5220	0.5208	0.5196	0.5232	0.5208	0.5232	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.9100	1.2357	13.4819			(27)
Opening Type 6			1.7900	1.5000	2.6850			(26)
External Wall	68.6000	10.9100	57.6900	0.2700	15.5763			(29a)
Communal Wall	15.3800	1.7900	13.5900	0.2400	3.2616			(29a)
Total net area of external elements Aum(A, m2)			83.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.0048			(33)
Party Floor 1			76.5100					(32d)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.1759	(36)
Total fabric heat loss					(33) + (36) =		41.1807	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.9078	30.6673	30.7455	30.5911	30.5911	30.5168	30.4446	30.3743	30.3060	30.5168	30.3743	30.5168	(38)
Heat transfer coeff	72.0885	71.8480	71.9262	71.7718	71.7718	71.6976	71.6253	71.5550	71.4867	71.6976	71.5550	71.6976	(39)
Average = Sum(39)m / 12 =												71.7268	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9422	0.9391	0.9401	0.9381	0.9381	0.9371	0.9362	0.9352	0.9343	0.9371	0.9352	0.9371	(40)
HLP (average)												0.9375	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	50.4872	44.8422	36.4682	27.6087	20.6379	17.4234	18.8265	24.4715	32.8455	41.7050	48.6758	51.8904	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.8523	535.3828	514.3605	481.9415	448.8756	419.3292	402.1543	410.4340	429.1860	461.8129	497.9669	525.1982	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
East	7.0400	25.1925	0.7400	0.7000	0.7700	63.6660	(76)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	91.6035	153.2109	256.5325	380.6462	447.5894	499.9651	471.3206	411.5753	316.4726	196.7133	113.9818	73.9734	(83)
Total gains	631.4558	688.5937	770.8929	862.5877	896.4650	919.2944	873.4748	822.0093	745.6585	658.5262	611.9488	599.1716	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.7038	73.9505	73.8701	74.0290	74.0290	74.1057	74.1804	74.2533	74.3242	74.1057	74.2533	74.1057	
alpha	5.9136	5.9300	5.9247	5.9353	5.9353	5.9404	5.9454	5.9502	5.9549	5.9404	5.9502	5.9404	
util living area													
	0.9873	0.9784	0.9429	0.8363	0.6567	0.4425	0.3196	0.3391	0.5917	0.8741	0.9711	0.9898	(86)
MIT	20.3147	20.4201	20.6425	20.8672	20.9728	20.9976	20.9997	20.9996	20.9883	20.8561	20.5617	20.2924	(87)
Th 2	20.1318	20.1344	20.1336	20.1353	20.1353	20.1361	20.1369	20.1377	20.1384	20.1361	20.1377	20.1361	(88)
util rest of house													
	0.9835	0.9721	0.9270	0.7987	0.5981	0.3765	0.2490	0.2644	0.5162	0.8336	0.9611	0.9866	(89)
MIT 2	19.2405	19.3932	19.7035	19.9962	20.1131	20.1348	20.1368	20.1375	20.1311	19.9913	19.5996	19.2120	(90)
Living area fraction										fLA = Living area / (4) =		0.3786	(91)
MIT	19.6472	19.7820	20.0590	20.3260	20.4386	20.4615	20.4635	20.4640	20.4557	20.3188	19.9639	19.6211	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6472	19.7820	20.0590	20.3260	20.4386	20.4615	20.4635	20.4640	20.4557	20.3188	19.9639	19.6211	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9690	0.9254	0.8075	0.6191	0.4015	0.2757	0.2927	0.5445	0.8430	0.9586	0.9842	(94)
Useful gains	619.3481	667.2338	713.3804	696.5709	555.0375	369.0745	240.8321	240.5943	406.0220	555.1639	586.6324	589.7231	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1063.1059	1040.5054	939.2869	777.0006	569.7670	370.0696	240.9145	240.7084	411.4562	639.4548	863.2328	1048.2967	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	330.1558	250.8385	168.0745	57.9094	10.9587	0.0000	0.0000	0.0000	0.0000	62.7124	199.1523	341.1788	(98)
Space heating												1420.9804	(98)
Space heating per m2											(98) / (4) =	18.5725	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1529.5806	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	330.1558	250.8385	168.0745	57.9094	10.9587	0.0000	0.0000	0.0000	0.0000	62.7124	199.1523	341.1788	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	355.3884	270.0092	180.9198	62.3352	11.7963	0.0000	0.0000	0.0000	0.0000	67.5053	214.3727	367.2538	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.8283	88.7241	88.3846	87.6709	86.9516	86.7000	86.7000	86.7000	86.7000	87.6998	88.5297	88.8725	(217)
Fuel for water heating, kWh/month													
	180.4841	158.4041	164.9691	146.2553	142.4410	124.6671	116.9021	132.1820	133.1766	151.7541	162.4863	175.1138	(219)
Water heating fuel used												1788.8357	(219)
Annual totals kWh/year													
Space heating fuel - main system												1529.5806	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												356.6476	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 967 * 1.00) =												-564.6053	(233)
Total delivered energy for all uses												3185.4586	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1529.5806	7.3800	112.8831	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1788.8357	7.3800	132.0161	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	356.6476	28.6600	102.2152	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			475.6093	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1529.5806	0.2160	330.3894	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1788.8357	0.2160	386.3885	(264)
Space and water heating			716.7779	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	356.6476	0.5190	185.1001	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	0.5190	-293.0302	(269)
Total kg/year			647.7729	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1529.5806	1.2200	1866.0884	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1788.8357	1.2200	2182.3795	(264)
Space and water heating			4048.4679	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	356.6476	3.0700	1094.9082	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	3.0700	-1733.3383	(269)
Primary energy kWh/year			3640.2877	(272)
Primary energy kWh/m2/year			47.5792	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 85
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£124	£124	£0
Mains gas	£352	£352	£0
Space heating	£241	£241	£0
Water heating	£132	£132	£0
Lighting	£102	£102	£0
Total cost of fuels	£476	£476	£0
Total cost of uses	£475	£475	£0
Delivered energy	42 kWh/m²	42 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	48 kWh/m²	48 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	349.94 (P1)
Transmission heat loss coefficient	41.18 (37)
Summer heat loss coefficient	391.12 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.8600	106.0502	0.7400	0.7000	0.8865	81.5221
East	7.0400	125.2818	0.7400	0.7000	0.8865	364.5118
West	2.0100	125.2818	0.7400	0.7000	0.8865	104.0723
total:						550.1062

	Jun	Jul	Aug	
Solar gains	593	550	479	(P3)
Internal gains	416	399	407	
Total summer gains	1009	949	886	(P5)
Summer gain/loss ratio	2.58	2.43	2.27	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.23	19.98	19.82	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 671 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 671 - EPC	**Prop Type Ref**	
Property	25 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	85 B	**DER**	11.72	**TER**	16.57
Environmental	92 A	**% DER<TER**	29.26		
CO_2 Emissions (t/year)	0.65	**DFEE**	36.12	**TFEE**	40.64
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.10		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.57	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	11.72	$kgCO_2/m^2$	Pass
	-4.85 (-29.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	40.64	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	36.12	$kWh/m^2/yr$	
	-4.5 (-11.1%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.22 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	1.86 m², No overhang
Windows facing East	7.04 m², No overhang
Windows facing West	2.01 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.22 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Air permeability	3.2	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 672 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 672 - EPC	**Prop Type Ref**	
Property	27 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	12.67	**TER**	19.14
Environmental	92 A	**% DER<TER**	33.82		
CO_2 Emissions (t/year)	0.56	**DFEE**	43.00	**TFEE**	48.43
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Top-floor flat, total floor area 63 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.14 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.67 kgCO□/m²OK
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1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)48.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.0 kWh/m²/yrOK
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2 Fabric U-values
Element         Average                 Highest
External wall   0.24 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           (no floor)
Roof            0.15 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.34 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         3.86 (measured in this dwelling)
Maximum                                 10.0                                            OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control               OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                             OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                             OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                                 OK
Based on:
Overshading:                            Average
Windows facing North:                   2.60 m², No overhang
Windows facing North East:              1.30 m², No overhang
Windows facing South:                   1.30 m², No overhang
Windows facing West:                    1.86 m², No overhang
Air change rate:                        6.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
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10 Key features
Thermal bridging y-value                0.038 W/m²K
Air permeability                        3.9 m³/m²h
Photovoltaic array                      0.73 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.8600	
Infiltration rate		0.3509	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3803	0.3728	0.3654	0.3281	0.3206	0.2834	0.2834	0.2759	0.2983	0.3206	0.3356	0.3505	(22b)
Effective ac	0.5723	0.5695	0.5668	0.5538	0.5514	0.5401	0.5401	0.5381	0.5445	0.5514	0.5563	0.5614	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0600	1.2357	8.7243			(27)
Opening Type 7			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	7.0600	25.0900	0.2700	6.7743			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.9315			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9948	(36)
Total fabric heat loss (33) + (36) =	44.9262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.9197	23.8023	23.6873	23.1469	23.0458	22.5752	22.5752	22.4881	22.7565	23.0458	23.2503	23.4642	(38)
Heat transfer coeff	68.8459	68.7285	68.6135	68.0731	67.9721	67.5014	67.5014	67.4143	67.6827	67.9721	68.1766	68.3904	(39)
Average = Sum(39)m / 12 =												68.0727	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0926	1.0908	1.0889	1.0804	1.0788	1.0713	1.0713	1.0699	1.0742	1.0788	1.0820	1.0854	(40)
HLP (average)												1.0803	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7725   10.6219   11.7421   11.3430   11.7063   11.3116   11.6781   11.6964   11.3287   11.7273   11.3725   11.7666 (61)
Total heat required for water heating calculated for each month
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1447.9404 (64)
Heat gains from water heating, kWh/month
               48.0986   42.1487   43.6890   38.3656   37.0183   32.2465   30.1802   34.2061   34.4878   39.8234   43.1132   46.6723 (65)


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5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667  103.2667 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               17.7138   15.7333   12.7952    9.6868    7.2410    6.1131    6.6055    8.5860   11.5241   14.6325   17.0783   18.2062 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              180.4694  182.3421  177.6230  167.5764  154.8945  142.9752  135.0124  133.1397  137.8589  147.9054  160.5874  172.5066 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267   33.3267 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134 (71)
Water heating gains (Table 5)
               64.6486   62.7213   58.7218   53.2856   49.7558   44.7868   40.5648   45.9759   47.8997   53.5260   59.8794   62.7316 (72)
Total internal gains
              319.8119  317.7767  306.1199  287.5288  268.8713  250.8552  239.1627  244.6817  254.2627  273.0440  294.5251  310.4244 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux          g              FF          Access          Gains
                                          m2         Table 6a     Specific data  Specific data    factor           W
                                                       W/m2      or Table 6b    or Table 6c     Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                   2.6000          10.6334        0.7400         0.7000       0.7700       9.9245 (74)
Northeast                               1.3000          11.2829        0.7400         0.7000       0.7700       5.2654 (75)
South                                   1.3000          46.7521        0.7400         0.7000       0.7700      21.8176 (78)
West                                    1.8600          19.6403        0.7400         0.7000       0.7700      13.1136 (80)
South                                   0.6500          47.0123        0.7200         0.7000       1.0000      13.8611 (82)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    63.9822  115.8054  175.4852  244.2243  296.7270  304.4344  289.4319  248.9817  199.2067  132.6871   77.9041   53.9207 (83)
Total gains   383.7941  433.5821  481.6051  531.7531  565.5983  555.2896  528.5946  493.6634  453.4694  405.7311  372.4292  364.3451 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            63.5578   63.6664   63.7731   64.2793   64.3749   64.8237   64.8237   64.9075   64.6501   64.3749   64.1818   63.9811
alpha           5.2372    5.2444    5.2515    5.2853    5.2917    5.3216    5.3216    5.3272    5.3100    5.2917    5.2788    5.2654
util living area
                0.9979    0.9955    0.9885    0.9625    0.8839    0.7209    0.5501    0.6075    0.8536    0.9767    0.9956    0.9984 (86)

MIT            19.8451   19.9831   20.2180   20.5292   20.8004   20.9521   20.9906   20.9845   20.8792   20.5309   20.1294   19.8157 (87)
Th 2           20.0069   20.0084   20.0099   20.0169   20.0182   20.0244   20.0244   20.0255   20.0220   20.0182   20.0156   20.0128 (88)
util rest of house
                0.9972    0.9940    0.9843    0.9483    0.8409    0.6330    0.4343    0.4891    0.7854    0.9652    0.9938    0.9978 (89)
MIT 2          18.4656   18.6680   19.0100   19.4586   19.8196   19.9919   20.0208   20.0190   19.9231   19.4685   18.8873   18.4269 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.4837 (91)
MIT            19.1329   19.3041   19.5943   19.9765   20.2940   20.4564   20.4899   20.4860   20.3856   19.9824   19.4882   19.0987 (92)
Temperature adjustment                                                                                                0.0000
adjusted MIT   19.1329   19.3041   19.5943   19.9765   20.2940   20.4564   20.4899   20.4860   20.3856   19.9824   19.4882   19.0987 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9963    0.9926    0.9821    0.9476    0.8543    0.6738    0.4906    0.5467    0.8135    0.9647    0.9925    0.9971 (94)
Useful gains  382.3667  430.3541  472.9765  503.9013  483.1995  374.1773  259.3455  269.8766  368.8904  391.4164  369.6501  363.3020 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1021.1835  989.9750  898.4487  754.0123  584.1549  395.3131  262.5756  275.4572  425.4278  637.7433  844.5829 1018.9308 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              475.2797  376.0653  316.5513  180.0800   75.1108    0.0000    0.0000    0.0000    0.0000  183.2672  341.9516  487.7878 (98)
Space heating                                                                                                        2436.0937 (98)
Space heating per m2                                                                                    (98) / (4) =     38.6620 (99)


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8c. Space cooling requirement
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2622.2753	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	475.2797	376.0653	316.5513	180.0800	75.1108	0.0000	0.0000	0.0000	0.0000	183.2672	341.9516	487.7878	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	511.6035	404.8065	340.7442	193.8428	80.8513	0.0000	0.0000	0.0000	0.0000	197.2736	368.0857	525.0676	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1206	89.0585	88.9223	88.6041	87.9417	86.7000	86.7000	86.7000	86.7000	88.5889	88.9829	89.1529	(217)
Fuel for water heating, kWh/month													
	165.5939	145.2962	151.0408	133.4021	129.9018	115.0965	108.0335	122.0041	122.8761	138.4816	148.8886	160.7209	(219)
Water heating fuel used												1641.3361	(219)
Annual totals kWh/year													
Space heating fuel - main system												2622.2753	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												312.8320	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												4027.6903	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2622.2753	0.2160	566.4115	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1641.3361	0.2160	354.5286	(264)
Space and water heating			920.9401	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	312.8320	0.5190	162.3598	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total CO2, kg/year			798.4970	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.6700	ZC1
Total Floor Area	TFA	63.0100	
Assumed number of occupants	N	2.0653	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9723	ZC2
CO2 emissions from cooking, equation (L16)		2.6753	ZC3
Total CO2 emissions		32.3175	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.3175	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4079	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3467	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4421	0.4334	0.4247	0.3814	0.3727	0.3294	0.3294	0.3207	0.3467	0.3727	0.3901	0.4074	(22b)
Effective ac	0.5977	0.5939	0.5902	0.5727	0.5695	0.5542	0.5542	0.5514	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			7.0600	1.3258	9.3598			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
External Wall	32.1500	7.0600	25.0900	0.1800	4.5162			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.1800	2.0826			(29a)
Dormer Wall	17.9800		17.9800	0.1800	3.2364			(29a)
Main roof	45.7300		45.7300	0.1300	5.9449			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1300	0.5850			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.2644			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6240	(36)
Total fabric heat loss					(33) + (36) =		41.8884	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9813	24.8227	24.6673	23.9371	23.8005	23.1646	23.1646	23.0468	23.4095	23.8005	24.0769	24.3658	(38)
Heat transfer coeff	66.8697	66.7111	66.5557	65.8256	65.6889	65.0530	65.0530	64.9353	65.2980	65.6889	65.9653	66.2542	(39)
Average = Sum(39)m / 12 =												65.8249	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0613	1.0587	1.0563	1.0447	1.0425	1.0324	1.0324	1.0306	1.0363	1.0425	1.0469	1.0515	(40)
HLP (average)												1.0447	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0653	(42)
Average daily hot water use (litres/day)												83.2517	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)											Total = Sum(45)m =	1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 46.6666 40.6177 43.2726 40.2345 39.8787 36.9501 38.1817 39.8787 40.2345 43.2726 43.5190 46.6666 (61)
Total heat required for water heating calculated for each month
182.4724 159.3944 165.8395 147.0913 142.4103 125.4271 120.1687 133.9599 135.4394 154.2247 164.6318 178.1873 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
182.4724 159.3944 165.8395 147.0913 142.4103 125.4271 120.1687 133.9599 135.4394 154.2247 164.6318 178.1873 (64)
Total per year (kWh/year) = Sum(64)m = 1809.2468 (64)
Heat gains from water heating, kWh/month
56.8221 49.6477 51.5716 45.5885 44.0614 38.6561 36.8061 41.2517 41.7142 47.7097 51.1498 55.3973 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7138	15.7333	12.7952	9.6868	7.2410	6.1131	6.6055	8.5860	11.5241	14.6325	17.0783	18.2062	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)
Water heating gains (Table 5)													
	76.3738	73.8805	69.3167	63.3174	59.2224	53.6891	49.4706	55.4458	57.9364	64.1260	71.0413	74.4587	(72)
Total internal gains													
	331.5371	328.9359	316.7149	297.5606	278.3378	259.7574	248.0685	254.1516	264.2995	283.6439	305.6871	322.1515	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6000	10.6334	0.6300	0.7000	0.7700	8.4492	(74)
Northeast	1.3000	11.2829	0.6300	0.7000	0.7700	4.4827	(75)
South	1.3000	46.7521	0.6300	0.7000	0.7700	18.5745	(78)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)
South	0.6500	47.0123	0.6300	0.7000	1.0000	12.1285	(82)

Solar gains	54.7991	99.1761	150.2553	209.0484	253.9255	260.4919	247.6669	213.0973	170.5467	113.6263	66.7216	46.1824	(83)
Total gains	386.3362	428.1119	466.9702	506.6090	532.2633	520.2493	495.7354	467.2488	434.8461	397.2702	372.4087	368.3339	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.4361	65.5917	65.7449	66.4741	66.6123	67.2635	67.2635	67.3855	67.0112	66.6123	66.3333	66.0440	
alpha	5.3624	5.3728	5.3830	5.4316	5.4408	5.4842	5.4842	5.4924	5.4674	5.4408	5.4222	5.4029	
util living area													
	0.9978	0.9957	0.9895	0.9670	0.8966	0.7386	0.5650	0.6184	0.8600	0.9774	0.9955	0.9983	(86)
MIT	19.8922	20.0182	20.2373	20.5341	20.7968	20.9512	20.9907	20.9851	20.8834	20.5517	20.1703	19.8687	(87)
Th 2	20.0326	20.0347	20.0367	20.0463	20.0481	20.0564	20.0564	20.0579	20.0532	20.0481	20.0444	20.0406	(88)
util rest of house													
	0.9971	0.9942	0.9858	0.9544	0.8571	0.6532	0.4503	0.5022	0.7944	0.9663	0.9937	0.9977	(89)
MIT 2	18.5529	18.7382	19.0581	19.4894	19.8428	20.0227	20.0528	20.0515	19.9566	19.5209	18.9680	18.5246	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.2008	19.3574	19.6285	19.9947	20.3043	20.4718	20.5065	20.5031	20.4050	20.0196	19.5496	19.1748	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2008	19.3574	19.6285	19.9947	20.3043	20.4718	20.5065	20.5031	20.4050	20.0196	19.5496	19.1748	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9929	0.9837	0.9536	0.8689	0.6928	0.5061	0.5587	0.8214	0.9659	0.9924	0.9970	(94)
Useful gains	384.8623	425.0637	459.3750	483.0847	462.5042	360.4185	250.9133	261.0626	357.1617	383.7284	369.5963	367.2364	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	996.4110	964.4674	873.7778	730.3175	565.2047	381.9790	254.1281	266.4384	411.7005	618.7603	821.2427	992.1433	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	454.9922	362.4793	308.3156	178.0076	76.4091	0.0000	0.0000	0.0000	0.0000	174.8638	325.1854	464.9308	(98)
Space heating												2345.1839	(98)
Space heating per m2											(98) / (4) =	37.2192	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2510.9036	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	454.9922	362.4793	308.3156	178.0076	76.4091	0.0000	0.0000	0.0000	0.0000	174.8638	325.1854	464.9308	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	487.1437	388.0934	330.1024	190.5863	81.8085	0.0000	0.0000	0.0000	0.0000	187.2203	348.1643	497.7846	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	182.4724	159.3944	165.8395	147.0913	142.4103	125.4271	120.1687	133.9599	135.4394	154.2247	164.6318	178.1873	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.2584	87.0557	86.5907	85.5325	83.5599	80.3000	80.3000	80.3000	80.3000	85.3680	86.7333	87.3557	(217)
Fuel for water heating, kWh/month													
	209.1174	183.0948	191.5212	171.9713	170.4289	156.1981	149.6497	166.8243	168.6667	180.6587	189.8138	203.9789	(219)
Water heating fuel used												2141.9237	(219)
Annual totals kWh/year													
Space heating fuel - main system												2510.9036	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												312.8320	(232)
Total delivered energy for all uses												5040.6593	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2510.9036	0.2160	542.3552	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2141.9237	0.2160	462.6555	(264)
Space and water heating			1005.0107	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	312.8320	0.5190	162.3598	(268)
Total CO2, kg/m2/year			1206.2955	(272)
Emissions per m2 for space and water heating			15.9500	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5767	(272b)
Emissions per m2 for pumps and fans			0.6178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9500 * 1.00) + 2.5767 + 0.6178, rounded to 2 d.p.			19.1400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.8600	
Infiltration rate		0.3509	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3803	0.3728	0.3654	0.3281	0.3206	0.2834	0.2834	0.2759	0.2983	0.3206	0.3356	0.3505	(22b)
Effective ac	0.5723	0.5695	0.5668	0.5538	0.5514	0.5401	0.5401	0.5381	0.5445	0.5514	0.5563	0.5614	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0600	1.2357	8.7243			(27)
Opening Type 7			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	7.0600	25.0900	0.2700	6.7743			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.9315			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9948	(36)
Total fabric heat loss (33) + (36) =	44.9262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.9197	23.8023	23.6873	23.1469	23.0458	22.5752	22.5752	22.4881	22.7565	23.0458	23.2503	23.4642	(38)
Heat transfer coeff	68.8459	68.7285	68.6135	68.0731	67.9721	67.5014	67.5014	67.4143	67.6827	67.9721	68.1766	68.3904	(39)
Average = Sum(39)m / 12 =												68.0727	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0926	1.0908	1.0889	1.0804	1.0788	1.0713	1.0713	1.0699	1.0742	1.0788	1.0820	1.0854	(40)
HLP (average)												1.0803	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Heat gains from water heating, kWh/month

	28.8587	25.2400	26.0455	22.7071	21.7880	18.8014	17.4222	19.9923	20.2310	23.5773	25.7365	27.9482 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	17.7138	15.7333	12.7952	9.6868	7.2410	6.1131	6.6055	8.5860	11.5241	14.6325	17.0783	18.2062 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134 (71)

Water heating gains (Table 5)

	38.7886	37.5596	35.0073	31.5376	29.2849	26.1130	23.4170	26.8713	28.0987	31.6899	35.7451	37.5647 (72)

Total internal gains

	290.9519	289.6150	279.4055	262.7808	245.4004	229.1814	219.0149	222.5771	231.4617	248.2079	267.3908	282.2575 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6000	10.6334	0.7400	0.7000	0.7700	9.9245	(74)
Northeast	1.3000	11.2829	0.7400	0.7000	0.7700	5.2654	(75)
South	1.3000	46.7521	0.7400	0.7000	0.7700	21.8176	(78)
West	1.8600	19.6403	0.7400	0.7000	0.7700	13.1136	(80)
South	0.6500	47.0123	0.7200	0.7000	1.0000	13.8611	(82)

Solar gains	63.9822	115.8054	175.4852	244.2243	296.7270	304.4344	289.4319	248.9817	199.2067	132.6871	77.9041	53.9207	(83)
Total gains	354.9341	405.4204	454.8907	507.0051	542.1274	533.6158	508.4468	471.5588	430.6684	380.8950	345.2949	336.1782	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.5578	63.6664	63.7731	64.2793	64.3749	64.8237	64.8237	64.9075	64.6501	64.3749	64.1818	63.9811	
alpha	5.2372	5.2444	5.2515	5.2853	5.2917	5.3216	5.3216	5.3272	5.3100	5.2917	5.2788	5.2654	
util living area	0.9985	0.9967	0.9910	0.9690	0.8981	0.7416	0.5698	0.6316	0.8735	0.9821	0.9969	0.9989	(86)
MIT	19.8021	19.9416	20.1799	20.4982	20.7806	20.9451	20.9889	20.9815	20.8628	20.4974	20.0893	19.7736	(87)
Th 2	20.0069	20.0084	20.0099	20.0169	20.0182	20.0244	20.0244	20.0255	20.0220	20.0182	20.0156	20.0128	(88)
util rest of house	0.9980	0.9956	0.9877	0.9568	0.8582	0.6542	0.4509	0.5107	0.8098	0.9730	0.9956	0.9985	(89)
MIT 2	18.9117	19.0520	19.2899	19.6068	19.8670	19.9986	20.0215	20.0200	19.9433	19.6112	19.2055	18.8880	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.3424	19.4823	19.7205	20.0380	20.3089	20.4565	20.4895	20.4851	20.3881	20.0399	19.6330	19.3164	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3424	19.4823	19.7205	20.0380	20.3089	20.4565	20.4895	20.4851	20.3881	20.0399	19.6330	19.3164	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9948	0.9865	0.9571	0.8714	0.6951	0.5088	0.5697	0.8365	0.9733	0.9950	0.9982	(94)
Useful gains	354.0773	403.3169	448.7630	485.2478	472.3870	370.8920	258.7171	268.6433	360.2510	370.7124	343.5666	335.5655	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1035.6059	1002.2215	907.1015	758.1967	585.1669	395.3190	262.5445	275.3950	425.5944	641.6477	854.4595	1033.8150	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	507.0573	402.4639	341.0038	196.5232	83.9083	0.0000	0.0000	0.0000	0.0000	201.5759	367.8429	519.4977	(98)
Space heating												2619.8730	(98)
Space heating per m2											(98) / (4) =	41.5787	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	634.5135	499.5106	512.3486	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8759	0.9339	0.9107	0.0000	0.0000	0.0000	0.0000	(101)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.7986	466.4809	466.5821	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	692.0269	661.5171	620.7930	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	98.0843	145.1070	114.7329	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												357.9242	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	24.5211	36.2767	28.6832	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												89.4811	(107)
Space cooling per m2												1.4201	(108)
Energy for space heating												41.5787	(99)
Energy for space cooling												1.4201	(108)
Total												42.9988	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.0	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4079	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3467	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4421	0.4334	0.4247	0.3814	0.3727	0.3294	0.3294	0.3207	0.3467	0.3727	0.3901	0.4074	(22b)
Effective ac	0.5977	0.5939	0.5902	0.5727	0.5695	0.5542	0.5542	0.5514	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			7.0600	1.3258	9.3598			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
External Wall	32.1500	7.0600	25.0900	0.1800	4.5162			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.1800	2.0826			(29a)
Dormer Wall	17.9800		17.9800	0.1800	3.2364			(29a)
Main roof	45.7300		45.7300	0.1300	5.9449			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1300	0.5850			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.2644			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6240	(36)
Total fabric heat loss					(33) + (36) =		41.8884	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9813	24.8227	24.6673	23.9371	23.8005	23.1646	23.1646	23.0468	23.4095	23.8005	24.0769	24.3658	(38)
Heat transfer coeff	66.8697	66.7111	66.5557	65.8256	65.6889	65.0530	65.0530	64.9353	65.2980	65.6889	65.9653	66.2542	(39)
Average = Sum(39)m / 12 =												65.8249	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0613	1.0587	1.0563	1.0447	1.0425	1.0324	1.0324	1.0306	1.0363	1.0425	1.0469	1.0515	(40)
HLP (average)												1.0447	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0653 (42)
Average daily hot water use (litres/day)		83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Heat gains from water heating, kWh/month
28.8587 25.2400 26.0455 22.7071 21.7880 18.8014 17.4222 19.9923 20.2310 23.5773 25.7365 27.9482 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	17.7138	15.7333	12.7952	9.6868	7.2410	6.1131	6.6055	8.5860	11.5241	14.6325	17.0783	18.2062	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)
Water heating gains (Table 5)													
	38.7886	37.5596	35.0073	31.5376	29.2849	26.1130	23.4170	26.8713	28.0987	31.6899	35.7451	37.5647	(72)
Total internal gains													
	290.9519	289.6150	279.4055	262.7808	245.4004	229.1814	219.0149	222.5771	231.4617	248.2079	267.3908	282.2575	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6000	10.6334	0.6300	0.7000	0.7700	8.4492	(74)
Northeast	1.3000	11.2829	0.6300	0.7000	0.7700	4.4827	(75)
South	1.3000	46.7521	0.6300	0.7000	0.7700	18.5745	(78)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)
South	0.6500	47.0123	0.6300	0.7000	1.0000	12.1285	(82)

Solar gains	54.7991	99.1761	150.2553	209.0484	253.9255	260.4919	247.6669	213.0973	170.5467	113.6263	66.7216	46.1824	(83)
Total gains	345.7511	388.7911	429.6608	471.8292	499.3258	489.6733	466.6818	435.6743	402.0083	361.8342	334.1125	328.4399	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.4361	65.5917	65.7449	66.4741	66.6123	67.2635	67.2635	67.3855	67.0112	66.6123	66.3333	66.0440	
alpha	5.3624	5.3728	5.3830	5.4316	5.4408	5.4842	5.4842	5.4924	5.4674	5.4408	5.4222	5.4029	
util living area													
	0.9987	0.9973	0.9928	0.9754	0.9162	0.7699	0.5964	0.6559	0.8892	0.9849	0.9973	0.9990	(86)
MIT	19.8313	19.9598	20.1835	20.4890	20.7667	20.9401	20.9879	20.9803	20.8583	20.5032	20.1134	19.8087	(87)
Th 2	20.0326	20.0347	20.0367	20.0463	20.0481	20.0564	20.0564	20.0579	20.0532	20.0481	20.0444	20.0406	(88)
util rest of house													
	0.9983	0.9963	0.9902	0.9655	0.8814	0.6859	0.4772	0.5362	0.8308	0.9772	0.9962	0.9987	(89)
MIT 2	18.9617	19.0915	19.3157	19.6236	19.8835	20.0273	20.0531	20.0520	19.9699	19.6420	19.2530	18.9456	(90)
Living area fraction										fLA = Living area / (4) =		0.4837	(91)
MIT	19.3824	19.5115	19.7355	20.0422	20.3107	20.4688	20.5053	20.5010	20.3997	20.0586	19.6692	19.3631	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3824	19.5115	19.7355	20.0422	20.3107	20.4688	20.5053	20.5010	20.3997	20.0586	19.6692	19.3631	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9957	0.9891	0.9655	0.8922	0.7249	0.5354	0.5946	0.8549	0.9773	0.9957	0.9984	(94)
Useful gains	345.0203	387.1113	424.9978	455.5474	445.5225	354.9600	249.8498	259.0735	343.6871	353.6059	332.6642	327.9133	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1008.5530	974.7496	880.8947	733.4432	565.6306	381.7857	254.0539	266.3011	411.3552	621.3267	829.1291	1004.6193	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	493.6683	394.8930	339.1873	200.0850	89.3604	0.0000	0.0000	0.0000	0.0000	199.1843	357.4547	503.4693	(98)
Space heating												2577.3022	(98)
Space heating per m2											(98) / (4) =	40.9031	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	611.4985	481.3924	493.5080	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8655	0.9283	0.9054	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	529.2488	446.8580	446.7983	0.0000	0.0000	0.0000	0.0000	(102)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	641.8356	613.8241	579.8552	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	81.0626	124.2228	98.9943	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												304.2796 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	20.2656	31.0557	24.7486	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.0699 (107)
Space cooling per m2												1.2073 (108)
Energy for space heating												40.9031 (99)
Energy for space cooling												1.2073 (108)
Total												42.1103 (109)
Target Fabric Energy Efficiency (TFEE)												48.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.8600	
Infiltration rate		0.3509	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3132	0.2908	0.2983	0.2834	0.2834	0.2759	0.2685	0.2610	0.2535	0.2759	0.2610	0.2759	(22b)
Effective ac	0.5490	0.5423	0.5445	0.5401	0.5401	0.5381	0.5360	0.5341	0.5321	0.5381	0.5341	0.5381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0600	1.2357	8.7243			(27)
Opening Type 7			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	7.0600	25.0900	0.2700	6.7743			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.9315			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9948	(36)
Total fabric heat loss (33) + (36) =	44.9262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9471	22.6647	22.7565	22.5752	22.5752	22.4881	22.4032	22.3207	22.2406	22.4881	22.3207	22.4881	(38)
Heat transfer coeff	67.8733	67.5909	67.6827	67.5014	67.5014	67.4143	67.3295	67.2470	67.1668	67.4143	67.2470	67.4143	(39)
Average = Sum(39)m / 12 =												67.4486	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0772	1.0727	1.0742	1.0713	1.0713	1.0699	1.0686	1.0672	1.0660	1.0699	1.0672	1.0699	(40)
HLP (average)												1.0704	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:
Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 11.7725 10.6219 11.7421 11.3430 11.7063 11.3116 11.6781 11.6964 11.3287 11.7273 11.3725 11.7666 (61)
Total heat required for water heating calculated for each month
147.5783 129.3986 134.3089 118.1997 114.2379 99.7886 93.6650 105.7776 106.5336 122.6793 132.4854 143.2873 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
147.5783 129.3986 134.3089 118.1997 114.2379 99.7886 93.6650 105.7776 106.5336 122.6793 132.4854 143.2873 (64)
Total per year (kWh/year) = Sum(64)m = 1447.9404 (64)
RHI water heating demand 1448 (64)
Heat gains from water heating, kWh/month
48.0986 42.1487 43.6890 38.3656 37.0183 32.2465 30.1802 34.2061 34.4878 39.8234 43.1132 46.6723 (65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
44.2846 39.3332 31.9879 24.2169 18.1024 15.2828 16.5136 21.4650 28.8103 36.5813 42.6958 45.5154 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
269.3573 272.1524 265.1089 250.1141 231.1858 213.3958 201.5111 198.7160 205.7595 220.7544 239.6827 257.4726 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 49.4573 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 -82.6134 (71)
Water heating gains (Table 5)
64.6486 62.7213 58.7218 53.2856 49.7558 44.7868 40.5648 45.9759 47.8997 53.5260 59.8794 62.7316 (72)
Total internal gains
472.0546 467.9710 449.5826 421.3806 392.8081 367.2295 352.3535 359.9210 376.2336 404.6258 436.0219 459.4836 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6000	13.4839	0.7400	0.7000	0.7700	12.5850	(74)
Northeast	1.3000	14.6176	0.7400	0.7000	0.7700	6.8216	(75)
South	1.3000	56.7559	0.7400	0.7000	0.7700	26.4860	(78)
West	1.8600	25.1925	0.7400	0.7000	0.7700	16.8208	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains 79.9795 123.6232 189.8549 267.1697 309.2338 344.8112 325.1912 286.2358 228.1265 153.1201 97.1552 66.2008 (83)
Total gains 552.0341 591.5942 639.4375 688.5503 702.0419 712.0408 677.5447 646.1569 604.3601 557.7459 533.1771 525.6844 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.4686	64.7379	64.6501	64.8237	64.8237	64.9075	64.9893	65.0690	65.1467	64.9075	65.0690	64.9075	
alpha	5.2979	5.3159	5.3100	5.3216	5.3216	5.3272	5.3326	5.3379	5.3431	5.3272	5.3379	5.3272	
util living area	0.9865	0.9797	0.9560	0.8877	0.7465	0.5302	0.3860	0.4039	0.6653	0.8974	0.9718	0.9887	(86)
MIT	20.1720	20.2719	20.4918	20.7504	20.9248	20.9898	20.9984	20.9981	20.9681	20.7782	20.4510	20.1547	(87)
Th 2	20.0195	20.0232	20.0220	20.0244	20.0244	20.0255	20.0266	20.0277	20.0287	20.0255	20.0277	20.0255	(88)
util rest of house	0.9823	0.9735	0.9425	0.8547	0.6824	0.4440	0.2905	0.3043	0.5770	0.8590	0.9616	0.9852	(89)
MIT 2	18.9489	19.0949	19.4050	19.7543	19.9606	20.0201	20.0262	20.0271	20.0083	19.7986	19.3564	18.9288	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.5405	19.6642	19.9307	20.2361	20.4270	20.4892	20.4965	20.4968	20.4726	20.2725	19.8859	19.5218	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5405	19.6642	19.9307	20.2361	20.4270	20.4892	20.4965	20.4968	20.4726	20.2725	19.8859	19.5218	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9707	0.9410	0.8625	0.7101	0.4856	0.3368	0.3526	0.6187	0.8698	0.9598	0.9828	(94)
Useful gains	540.8615	574.2330	601.6908	593.8989	498.5220	345.7411	228.2211	227.8509	373.9285	485.1494	511.7342	516.6412	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	993.7014	970.8920	875.1873	724.7052	535.0844	349.8236	228.6839	228.4255	387.7250	598.1305	806.0139	978.9757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	336.9128	266.5548	203.4814	94.1805	27.2024	0.0000	0.0000	0.0000	0.0000	84.0579	211.8814	343.9769	(98)
Space heating												1568.2483	(98)
RHI space heating demand												1568	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.8600	
Infiltration rate		0.3509	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3803	0.3728	0.3654	0.3281	0.3206	0.2834	0.2834	0.2759	0.2983	0.3206	0.3356	0.3505	(22b)
Effective ac	0.5723	0.5695	0.5668	0.5538	0.5514	0.5401	0.5401	0.5381	0.5445	0.5514	0.5563	0.5614	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0600	1.2357	8.7243			(27)
Opening Type 7			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	7.0600	25.0900	0.2700	6.7743			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.9315			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9948	(36)
Total fabric heat loss (33) + (36) =	44.9262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.9197	23.8023	23.6873	23.1469	23.0458	22.5752	22.5752	22.4881	22.7565	23.0458	23.2503	23.4642	(38)
Heat transfer coeff	68.8459	68.7285	68.6135	68.0731	67.9721	67.5014	67.5014	67.4143	67.6827	67.9721	68.1766	68.3904	(39)
Average = Sum(39)m / 12 =												68.0727	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0926	1.0908	1.0889	1.0804	1.0788	1.0713	1.0713	1.0699	1.0742	1.0788	1.0820	1.0854	(40)
HLP (average)												1.0803	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7725   10.6219   11.7421   11.3430   11.7063   11.3116   11.6781   11.6964   11.3287   11.7273   11.3725   11.7666 (61)
Total heat required for water heating calculated for each month
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1447.9404 (64)
Heat gains from water heating, kWh/month
               48.0986   42.1487   43.6890   38.3656   37.0183   32.2465   30.1802   34.2061   34.4878   39.8234   43.1132   46.6723 (65)


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5. Internal gains (see Table 5 and 5a)
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Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               44.2846   39.3332   31.9879   24.2169   18.1024   15.2828   16.5136   21.4650   28.8103   36.5813   42.6958   45.5154 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              269.3573  272.1524  265.1089  250.1141  231.1858  213.3958  201.5111  198.7160  205.7595  220.7544  239.6827  257.4726 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134 (71)
Water heating gains (Table 5)
               64.6486   62.7213   58.7218   53.2856   49.7558   44.7868   40.5648   45.9759   47.8997   53.5260   59.8794   62.7316 (72)
Total internal gains
              472.0546  467.9710  449.5826  421.3806  392.8081  367.2295  352.3535  359.9210  376.2336  404.6258  436.0219  459.4836 (73)


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6. Solar gains
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[Jan]                                    Area        Solar flux              g              FF          Access          Gains
                                          m2         Table 6a     Specific data  Specific data      factor           W
                                                        W/m2     or Table 6b    or Table 6c        Table 6d
-------------------------------------------------------------------------------------------------------------------------------
North                                   2.6000          10.6334          0.7400          0.7000          0.7700          9.9245 (74)
Northeast                               1.3000          11.2829          0.7400          0.7000          0.7700          5.2654 (75)
South                                   1.3000          46.7521          0.7400          0.7000          0.7700         21.8176 (78)
West                                    1.8600          19.6403          0.7400          0.7000          0.7700         13.1136 (80)
South                                   0.6500          47.0123          0.7200          0.7000          1.0000         13.8611 (82)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    63.9822  115.8054  175.4852  244.2243  296.7270  304.4344  289.4319  248.9817  199.2067  132.6871   77.9041   53.9207 (83)
Total gains   536.0368  583.7763  625.0678  665.6049  689.5351  671.6639  641.7854  608.9027  575.4403  537.3129  513.9260  513.4043 (84)


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7. Mean internal temperature (heating season)
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Temperature during heating periods in the living area from Table 9, Th1 (C)                                          21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau            63.5578   63.6664   63.7731   64.2793   64.3749   64.8237   64.8237   64.9075   64.6501   64.3749   64.1818   63.9811
alpha           5.2372    5.2444    5.2515    5.2853    5.2917    5.3216    5.3216    5.3272    5.3100    5.2917    5.2788    5.2654
util living area
                0.9901    0.9832    0.9658    0.9157    0.8024    0.6198    0.4586    0.5023    0.7426    0.9316    0.9815    0.9920 (86)

MIT            20.0676   20.1975   20.4103   20.6766   20.8809   20.9763   20.9960   20.9936   20.9401   20.6884   20.3311   20.0352 (87)
Th 2           20.0069   20.0084   20.0099   20.0169   20.0182   20.0244   20.0244   20.0255   20.0220   20.0182   20.0156   20.0128 (88)
util rest of house
                0.9871    0.9780    0.9551    0.8896    0.7476    0.5351    0.3592    0.3995    0.6620    0.9048    0.9749    0.9895 (89)
MIT 2          18.7885   18.9769   19.2814   19.6529   19.9078   20.0094   20.0229   20.0230   19.9780   19.6776   19.1767   18.7461 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.4837 (91)
MIT            19.4073   19.5673   19.8275   20.1481   20.3785   20.4771   20.4936   20.4925   20.4434   20.1665   19.7351   19.3697 (92)
Temperature adjustment                                                                                                 0.0000
adjusted MIT   19.4073   19.5673   19.8275   20.1481   20.3785   20.4771   20.4936   20.4925   20.4434   20.1665   19.7351   19.3697 (93)


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8. Space heating requirement
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                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation     0.9847    0.9752    0.9527    0.8935    0.7690    0.5754    0.4074    0.4494    0.6986    0.9094    0.9725    0.9874 (94)
Useful gains  527.8337  569.2954  595.5037  594.7233  530.2195  386.4925  261.4787  273.6536  402.0194  488.6583  499.8062  506.9396 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
             1040.0744 1008.0647  914.4455  765.6935  589.8961  396.7142  262.8249  275.8925  429.3385  650.2579  861.4168 1037.4598 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              381.1071  294.8530  237.2927  123.0985   44.3994    0.0000    0.0000    0.0000    0.0000  120.2301  260.3596  394.7070 (98)
Space heating                                                                                                         1856.0474 (98)
Space heating per m2                                                                                    (98) / (4) =    29.4564 (99)


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8c. Space cooling requirement
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1997.8982	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	381.1071	294.8530	237.2927	123.0985	44.3994	0.0000	0.0000	0.0000	0.0000	120.2301	260.3596	394.7070	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	410.2337	317.3875	255.4281	132.5065	47.7927	0.0000	0.0000	0.0000	0.0000	129.4188	280.2579	424.8730	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9832	88.8992	88.7165	88.3035	87.5724	86.7000	86.7000	86.7000	86.7000	88.2549	88.7947	89.0249	(217)
Fuel for water heating, kWh/month													
	165.8496	145.5565	151.3911	133.8563	130.4496	115.0965	108.0335	122.0041	122.8761	139.0057	149.2041	160.9520	(219)
Water heating fuel used												1644.2751	(219)
Annual totals kWh/year													
Space heating fuel - main system												1997.8982	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												312.8320	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1068 * 1.00) =												-623.7532	(233)
Total delivered energy for all uses												3406.2522	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1997.8982	3.4800	69.5269	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1644.2751	3.4800	57.2208	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	312.8320	13.1900	41.2625	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			297.9027	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1584	(257)
SAP value		83.8403	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1997.8982	0.2160	431.5460	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1644.2751	0.2160	355.1634	(264)
Space and water heating			786.7094	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	312.8320	0.5190	162.3598	(268)
Energy saving/generation technologies				
PV Unit	-623.7532	0.5190	-323.7279	(269)
Total kg/year			664.2664	(272)
CO2 emissions per m2			10.5400	(273)
EI value			91.7589	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8795 = 3.957, stars = 4
Water heating environmental impact	0.216 / 0.8795 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.8600	
Infiltration rate		0.3509	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2983	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3132	0.2908	0.2983	0.2834	0.2834	0.2759	0.2685	0.2610	0.2535	0.2759	0.2610	0.2759	(22b)
Effective ac	0.5490	0.5423	0.5445	0.5401	0.5401	0.5381	0.5360	0.5341	0.5321	0.5381	0.5341	0.5381	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			7.0600	1.2357	8.7243			(27)
Opening Type 7			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	7.0600	25.0900	0.2700	6.7743			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.9315			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.9948	(36)
Total fabric heat loss (33) + (36) =	44.9262	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.9471	22.6647	22.7565	22.5752	22.5752	22.4881	22.4032	22.3207	22.2406	22.4881	22.3207	22.4881	(38)
Heat transfer coeff	67.8733	67.5909	67.6827	67.5014	67.5014	67.4143	67.3295	67.2470	67.1668	67.4143	67.2470	67.4143	(39)
Average = Sum(39)m / 12 =												67.4486	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0772	1.0727	1.0742	1.0713	1.0713	1.0699	1.0686	1.0672	1.0660	1.0699	1.0672	1.0699	(40)
HLP (average)												1.0704	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653 (42)
Average daily hot water use (litres/day)	83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7725	10.6219	11.7421	11.3430	11.7063	11.3116	11.6781	11.6964	11.3287	11.7273	11.3725	11.7666 (61)

Total heat required for water heating calculated for each month

	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873 (64)
								Total per year (kWh/year) = Sum(64)m =				1447.9404 (64)

Heat gains from water heating, kWh/month

	48.0986	42.1487	43.6890	38.3656	37.0183	32.2465	30.1802	34.2061	34.4878	39.8234	43.1132	46.6723 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	123.9201	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	44.2846	39.3332	31.9879	24.2169	18.1024	15.2828	16.5136	21.4650	28.8103	36.5813	42.6958	45.5154	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	269.3573	272.1524	265.1089	250.1141	231.1858	213.3958	201.5111	198.7160	205.7595	220.7544	239.6827	257.4726	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	49.4573	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)

Water heating gains (Table 5)

	64.6486	62.7213	58.7218	53.2856	49.7558	44.7868	40.5648	45.9759	47.8997	53.5260	59.8794	62.7316	(72)

Total internal gains

	472.0546	467.9710	449.5826	421.3806	392.8081	367.2295	352.3535	359.9210	376.2336	404.6258	436.0219	459.4836	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6000	13.4839	0.7400	0.7000	0.7700	12.5850	(74)
Northeast	1.3000	14.6176	0.7400	0.7000	0.7700	6.8216	(75)
South	1.3000	56.7559	0.7400	0.7000	0.7700	26.4860	(78)
West	1.8600	25.1925	0.7400	0.7000	0.7700	16.8208	(80)
South	0.6500	58.5609	0.7200	0.7000	1.0000	17.2661	(82)

Solar gains	79.9795	123.6232	189.8549	267.1697	309.2338	344.8112	325.1912	286.2358	228.1265	153.1201	97.1552	66.2008	(83)
Total gains	552.0341	591.5942	639.4375	688.5503	702.0419	712.0408	677.5447	646.1569	604.3601	557.7459	533.1771	525.6844	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.4686	64.7379	64.6501	64.8237	64.8237	64.9075	64.9893	65.0690	65.1467	64.9075	65.0690	64.9075	
alpha	5.2979	5.3159	5.3100	5.3216	5.3216	5.3272	5.3326	5.3379	5.3431	5.3272	5.3379	5.3272	
util living area	0.9865	0.9797	0.9560	0.8877	0.7465	0.5302	0.3860	0.4039	0.6653	0.8974	0.9718	0.9887	(86)
MIT	20.1720	20.2719	20.4918	20.7504	20.9248	20.9898	20.9984	20.9981	20.9681	20.7782	20.4510	20.1547	(87)
Th 2	20.0195	20.0232	20.0220	20.0244	20.0244	20.0255	20.0266	20.0277	20.0287	20.0255	20.0277	20.0255	(88)
util rest of house	0.9823	0.9735	0.9425	0.8547	0.6824	0.4440	0.2905	0.3043	0.5770	0.8590	0.9616	0.9852	(89)
MIT 2	18.9489	19.0949	19.4050	19.7543	19.9606	20.0201	20.0262	20.0271	20.0083	19.7986	19.3564	18.9288	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.5405	19.6642	19.9307	20.2361	20.4270	20.4892	20.4965	20.4968	20.4726	20.2725	19.8859	19.5218	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5405	19.6642	19.9307	20.2361	20.4270	20.4892	20.4965	20.4968	20.4726	20.2725	19.8859	19.5218	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9798	0.9707	0.9410	0.8625	0.7101	0.4856	0.3368	0.3526	0.6187	0.8698	0.9598	0.9828	(94)
Useful gains	540.8615	574.2330	601.6908	593.8989	498.5220	345.7411	228.2211	227.8509	373.9285	485.1494	511.7342	516.6412	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	993.7014	970.8920	875.1873	724.7052	535.0844	349.8236	228.6839	228.4255	387.7250	598.1305	806.0139	978.9757	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	336.9128	266.5548	203.4814	94.1805	27.2024	0.0000	0.0000	0.0000	0.0000	84.0579	211.8814	343.9769	(98)
Space heating												1568.2483	(98)
Space heating per m2										(98) / (4) =		24.8889	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1688.1037	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	336.9128	266.5548	203.4814	94.1805	27.2024	0.0000	0.0000	0.0000	0.0000	84.0579	211.8814	343.9769	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000		(210)
Space heating fuel (main heating system)													
	362.6618	286.9266	219.0328	101.3784	29.2814	0.0000	0.0000	0.0000	0.0000	90.4822	228.0747	370.2657	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9005	88.8286	88.5998	88.0905	87.2976	86.7000	86.7000	86.7000	86.7000	87.9732	88.6413	88.9347	(217)
Fuel for water heating, kWh/month													
	166.0039	145.6723	151.5906	134.1799	130.8603	115.0965	108.0335	122.0041	122.8761	139.4508	149.4623	161.1151	(219)
Water heating fuel used												1646.3454	(219)
Annual totals kWh/year													
Space heating fuel - main system												1688.1037	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												312.8320	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 1187 * 1.00) =												-692.9382	(233)
Total delivered energy for all uses												3029.3429	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1688.1037	7.3800	124.5821	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1646.3454	7.3800	121.5003	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	312.8320	28.6600	89.6577	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			464.2350	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1688.1037	0.2160	364.6304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1646.3454	0.2160	355.6106	(264)
Space and water heating			720.2410	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	312.8320	0.5190	162.3598	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	0.5190	-359.6349	(269)
Total kg/year			561.8909	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1688.1037	1.2200	2059.4865	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1646.3454	1.2200	2008.5414	(264)
Space and water heating			4068.0279	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	312.8320	3.0700	960.3943	(268)
Energy saving/generation technologies				
PV Unit	-692.9382	3.0700	-2127.3204	(269)
Primary energy kWh/year			3131.3518	(272)
Primary energy kWh/m2/year			49.6961	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£111	£111	£0
Mains gas	£353	£353	£0
Space heating	£253	£253	£0
Water heating	£122	£122	£0
Lighting	£90	£90	£0
Total cost of fuels	£464	£464	£0
Total cost of uses	£465	£465	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	50 kWh/m²	50 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	250.77 (P1)
Transmission heat loss coefficient	44.93 (37)
Summer heat loss coefficient	295.69 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
North East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
South	0.985	1.00	1.000	0.985 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.6000	87.1704	0.7400	0.7000	0.8865	93.6685
North East	1.3000	106.0502	0.7400	0.7000	0.8865	56.9778
South	1.3000	118.5567	0.7400	0.7000	0.8865	63.6972
West	1.8600	125.2818	0.7400	0.7000	0.8865	96.3057
South	0.6500	202.9386	0.7200	0.7000	0.9850	58.9369
total:						369.5861

	Jun	Jul	Aug	
Solar gains	398	370	324	(P3)
Internal gains	364	349	357	
Total summer gains	763	719	681	(P5)
Summer gain/loss ratio	2.58	2.43	2.30	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.23	19.98	19.85	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 672 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 672 - EPC	**Prop Type Ref**	
Property	27 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	12.67	**TER**	19.14
Environmental	92 A	**% DER<TER**	33.82		
CO_2 Emissions (t/year)	0.56	**DFEE**	43.00	**TFEE**	48.43
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.21		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.14	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	12.67	$kgCO_2/m^2$	Pass
	-6.47 (-33.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.43	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.00	$kWh/m^2/yr$	
	-5.4 (-11.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.86 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	2.60 m², No overhang
Windows facing North East	1.30 m², No overhang
Windows facing South	1.30 m², No overhang
Windows facing West	1.86 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.86 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.038	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 673 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 673 - EPC	**Prop Type Ref**	
Property	29 Kittiwake Place, Boorley Green , Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	16.02	**TER**	19.23
Environmental	89 B	**% DER<TER**	16.68		
CO_2 Emissions (t/year)	0.79	**DFEE**	43.38	**TFEE**	47.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Top-floor flat, total floor area 63 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.23 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.02 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)47.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 3.99 (measured in this dwelling)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage No cylinder

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6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.30 m², No overhang
Windows facing East: 2.60 m², No overhang
Windows facing West: 1.30 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

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10 Key features
Thermal bridging y-value 0.037 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 0.37 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.9900	
Infiltration rate		0.3574	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3873	0.3798	0.3722	0.3342	0.3266	0.2886	0.2886	0.2810	0.3038	0.3266	0.3418	0.3570	(22b)
Effective ac	0.5750	0.5721	0.5693	0.5558	0.5533	0.5416	0.5416	0.5395	0.5461	0.5533	0.5584	0.5637	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.2000	1.2357	6.4259			(27)
Opening Type 5			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	5.2000	26.9500	0.2700	7.2765			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.1352			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8762	(36)
Total fabric heat loss (33) + (36) =	43.0114	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.0327	23.9109	23.7916	23.2310	23.1262	22.6380	22.6380	22.5475	22.8260	23.1262	23.3383	23.5601	(38)
Heat transfer coeff	67.0441	66.9223	66.8030	66.2424	66.1375	65.6493	65.6493	65.5589	65.8374	66.1375	66.3497	66.5715	(39)
Average = Sum(39)m / 12 =												66.2419	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0640	1.0621	1.0602	1.0513	1.0496	1.0419	1.0419	1.0405	1.0449	1.0496	1.0530	1.0565	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7725	10.6219	11.7421	11.3430	11.7063	11.3116	11.6781	11.6964	11.3287	11.7273	11.3725	11.7666 (61)

Total heat required for water heating calculated for each month

	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)

Output from w/h

	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873 (64)
								Total per year (kWh/year) = Sum(64)m =				1447.9404 (64)

Heat gains from water heating, kWh/month

	48.0986	42.1487	43.6890	38.3656	37.0183	32.2465	30.1802	34.2061	34.4878	39.8234	43.1132	46.6723 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	18.7793	16.6796	13.5648	10.2694	7.6765	6.4808	7.0028	9.1025	12.2173	15.5127	18.1056	19.3013	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)

Water heating gains (Table 5)

	64.6486	62.7213	58.7218	53.2856	49.7558	44.7868	40.5648	45.9759	47.8997	53.5260	59.8794	62.7316	(72)

Total internal gains

	320.8774	318.7231	306.8895	288.1114	269.3068	251.2229	239.5600	245.1981	254.9559	273.9242	295.5524	311.5195	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	11.2829	0.7400	0.7000	0.7700	5.2654	(75)
East	2.6000	19.6403	0.7400	0.7000	0.7700	18.3309	(76)
West	1.3000	19.6403	0.7400	0.7000	0.7700	9.1654	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

Solar gains	40.4065	79.8017	133.9508	200.3105	250.5198	258.8278	245.4284	207.3392	157.3142	95.2983	50.5026	33.1600	(83)
Total gains	361.2839	398.5248	440.8404	488.4219	519.8266	510.0507	484.9883	452.5373	412.2701	369.2225	346.0550	344.6795	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.2660	65.3847	65.5015	66.0558	66.1605	66.6525	66.6525	66.7445	66.4622	66.1605	65.9490	65.7292	
alpha	5.3511	5.3590	5.3668	5.4037	5.4107	5.4435	5.4435	5.4496	5.4308	5.4107	5.3966	5.3819	
util living area	0.9984	0.9969	0.9920	0.9720	0.9056	0.7529	0.5807	0.6401	0.8824	0.9837	0.9968	0.9988	(86)
MIT	19.8508	19.9698	20.1949	20.5040	20.7809	20.9451	20.9890	20.9819	20.8625	20.5071	20.1241	19.8262	(87)
Th 2	20.0303	20.0319	20.0335	20.0408	20.0422	20.0486	20.0486	20.0498	20.0461	20.0422	20.0394	20.0365	(88)
util rest of house	0.9979	0.9959	0.9890	0.9609	0.8680	0.6675	0.4628	0.5209	0.8218	0.9754	0.9956	0.9984	(89)
MIT 2	18.4909	18.6658	18.9947	19.4435	19.8187	20.0102	20.0443	20.0418	19.9289	19.4543	18.8971	18.4594	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.1488	19.2966	19.5752	19.9565	20.2841	20.4624	20.5013	20.4966	20.3805	19.9636	19.4906	19.1205	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1488	19.2966	19.5752	19.9565	20.2841	20.4624	20.5013	20.4966	20.3805	19.9636	19.4906	19.1205	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9948	0.9872	0.9597	0.8787	0.7068	0.5203	0.5789	0.8457	0.9745	0.9945	0.9978	(94)
Useful gains	360.2672	396.4560	435.2036	468.7300	456.7663	360.5025	252.3153	261.9833	348.6757	359.7981	344.1686	343.9227	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	995.5212	963.4504	873.4649	732.4089	567.7319	384.8638	256.1173	268.5679	413.4924	619.2858	822.1147	993.2820	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	472.6290	381.0202	326.0664	189.8488	82.5584	0.0000	0.0000	0.0000	0.0000	193.0588	344.1212	483.1233	(98)
Space heating												2472.4261	(98)
Space heating per m2											(98) / (4) =	39.2386	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2661.3844	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	472.6290	381.0202	326.0664	189.8488	82.5584	0.0000	0.0000	0.0000	0.0000	193.0588	344.1212	483.1233	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	508.7502	410.1402	350.9865	204.3582	88.8680	0.0000	0.0000	0.0000	0.0000	207.8136	370.4211	520.0466	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1173	89.0666	88.9423	88.6446	88.0143	86.7000	86.7000	86.7000	86.7000	88.6290	88.9870	89.1474	(217)
Fuel for water heating, kWh/month													
	165.6001	145.2830	151.0068	133.3412	129.7948	115.0965	108.0335	122.0041	122.8761	138.4190	148.8817	160.7309	(219)
Water heating fuel used												1641.0675	(219)
Annual totals kWh/year													
Space heating fuel - main system												2661.3844	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.6488	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4456.6038	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2661.3844	0.2160	574.8590	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1641.0675	0.2160	354.4706	(264)
Space and water heating			929.3296	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.6488	0.5190	172.1257	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total CO2, kg/year			1009.3345	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.0200	ZC1
Total Floor Area	TFA	63.0100	
Assumed number of occupants	N	2.0653	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9723	ZC2
CO2 emissions from cooking, equation (L16)		2.6753	ZC3
Total CO2 emissions		35.6675	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.6675	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4079	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3467	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4421	0.4334	0.4247	0.3814	0.3727	0.3294	0.3294	0.3207	0.3467	0.3727	0.3901	0.4074	(22b)
Effective ac	0.5977	0.5939	0.5902	0.5727	0.5695	0.5542	0.5542	0.5514	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			5.2000	1.3258	6.8939			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
External Wall	32.1500	5.2000	26.9500	0.1800	4.8510			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.1800	2.0826			(29a)
Dormer Wall	17.9800		17.9800	0.1800	3.2364			(29a)
Main roof	45.7300		45.7300	0.1300	5.9449			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1300	0.5850			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.1333			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3500	(36)
Total fabric heat loss					(33) + (36) =		39.4833	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9813	24.8227	24.6673	23.9371	23.8005	23.1646	23.1646	23.0468	23.4095	23.8005	24.0769	24.3658	(38)
Heat transfer coeff	64.4646	64.3060	64.1506	63.4204	63.2838	62.6479	62.6479	62.5302	62.8929	63.2838	63.5602	63.8491	(39)
Average = Sum(39)m / 12 =												63.4198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0231	1.0206	1.0181	1.0065	1.0043	0.9943	0.9943	0.9924	0.9981	1.0043	1.0087	1.0133	(40)
HLP (average)												1.0065	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)
Water storage loss:													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Combi loss 46.6666 40.6177 43.2726 40.2345 39.8787 36.9501 38.1817 39.8787 40.2345 43.2726 43.5190 46.6666 (61)
Total heat required for water heating calculated for each month
182.4724 159.3944 165.8395 147.0913 142.4103 125.4271 120.1687 133.9599 135.4394 154.2247 164.6318 178.1873 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
182.4724 159.3944 165.8395 147.0913 142.4103 125.4271 120.1687 133.9599 135.4394 154.2247 164.6318 178.1873 (64)
Total per year (kWh/year) = Sum(64)m = 1809.2468 (64)
Heat gains from water heating, kWh/month
56.8221 49.6477 51.5716 45.5885 44.0614 38.6561 36.8061 41.2517 41.7142 47.7097 51.1498 55.3973 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7793	16.6796	13.5648	10.2694	7.6765	6.4808	7.0028	9.1025	12.2173	15.5127	18.1056	19.3013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)
Water heating gains (Table 5)													
	76.3738	73.8805	69.3167	63.3174	59.2224	53.6891	49.4706	55.4458	57.9364	64.1260	71.0413	74.4587	(72)
Total internal gains													
	332.6025	329.8822	317.4845	298.1432	278.7734	260.1251	248.4658	254.6680	264.9927	284.5241	306.7143	323.2466	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	11.2829	0.6300	0.7000	0.7700	4.4827	(75)
East	2.6000	19.6403	0.6300	0.7000	0.7700	15.6060	(76)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains 34.5809 68.3010 114.6555 171.4665 214.4524 221.5666 210.0953 177.4857 134.6570 81.5669 43.2223 28.3786 (83)
Total gains 367.1835 398.1832 432.1400 469.6097 493.2258 481.6918 458.5611 432.1537 399.6497 366.0910 349.9366 351.6252 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.8775	68.0449	68.2097	68.9950	69.1439	69.8458	69.8458	69.9773	69.5738	69.1439	68.8433	68.5318	
alpha	5.5252	5.5363	5.5473	5.5997	5.6096	5.6564	5.6564	5.6652	5.6383	5.6096	5.5896	5.5688	
util living area													
	0.9983	0.9969	0.9923	0.9742	0.9127	0.7623	0.5872	0.6418	0.8820	0.9831	0.9966	0.9986	(86)
MIT	19.9167	20.0255	20.2343	20.5257	20.7882	20.9482	20.9902	20.9842	20.8751	20.5434	20.1819	19.8971	(87)
Th 2	20.0641	20.0662	20.0683	20.0779	20.0797	20.0881	20.0881	20.0897	20.0849	20.0797	20.0761	20.0723	(88)
util rest of house													
	0.9977	0.9958	0.9895	0.9640	0.8777	0.6798	0.4727	0.5267	0.8228	0.9746	0.9952	0.9982	(89)
MIT 2	18.6118	18.7723	19.0778	19.5036	19.8613	20.0514	20.0842	20.0827	19.9781	19.5345	19.0084	18.5892	(90)
Living area fraction										fLA = Living area / (4) =		0.4837	(91)
MIT	19.2430	19.3785	19.6373	19.9980	20.3096	20.4852	20.5225	20.5188	20.4120	20.0225	19.5760	19.2219	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2430	19.3785	19.6373	19.9980	20.3096	20.4852	20.5225	20.5188	20.4120	20.0225	19.5760	19.2219	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9948	0.9879	0.9629	0.8876	0.7178	0.5285	0.5827	0.8465	0.9740	0.9942	0.9976	(94)
Useful gains	366.0797	396.1078	426.8955	452.1922	437.7650	345.7609	242.3342	251.8223	338.3020	356.5553	347.9074	350.7906	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	963.2966	931.0556	842.7639	703.8407	544.8515	368.6965	245.7342	257.5488	396.9795	596.2940	792.9801	959.1341	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	444.3294	359.4849	309.4061	181.1870	79.6724	0.0000	0.0000	0.0000	0.0000	178.3656	320.4524	452.6076	(98)
Space heating												2325.5053	(98)
Space heating per m2											(98) / (4) =	36.9069	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2489.8344	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	444.3294	359.4849	309.4061	181.1870	79.6724	0.0000	0.0000	0.0000	0.0000	178.3656	320.4524	452.6076	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	475.7274	384.8875	331.2699	193.9903	85.3024	0.0000	0.0000	0.0000	0.0000	190.9696	343.0968	484.5905	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	182.4724	159.3944	165.8395	147.0913	142.4103	125.4271	120.1687	133.9599	135.4394	154.2247	164.6318	178.1873	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.2068	87.0371	86.5991	85.5771	83.6530	80.3000	80.3000	80.3000	80.3000	85.4180	86.6990	87.2983	(217)
Fuel for water heating, kWh/month													
	209.2410	183.1339	191.5026	171.8816	170.2395	156.1981	149.6497	166.8243	168.6667	180.5528	189.8889	204.1131	(219)
Water heating fuel used												2141.8922	(219)
Annual totals kWh/year													
Space heating fuel - main system												2489.8344	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.6488	(232)
Total delivered energy for all uses												5038.3754	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2489.8344	0.2160	537.8042	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2141.8922	0.2160	462.6487	(264)
Space and water heating			1000.4529	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.6488	0.5190	172.1257	(268)
Total CO2, kg/m2/year			1211.5037	(272)
Emissions per m2 for space and water heating			15.8777	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.7317	(272b)
Emissions per m2 for pumps and fans			0.6178	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8777 * 1.00) + 2.7317 + 0.6178, rounded to 2 d.p.			19.2300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.9900	
Infiltration rate		0.3574	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3873	0.3798	0.3722	0.3342	0.3266	0.2886	0.2886	0.2810	0.3038	0.3266	0.3418	0.3570	(22b)
Effective ac	0.5750	0.5721	0.5693	0.5558	0.5533	0.5416	0.5416	0.5395	0.5461	0.5533	0.5584	0.5637	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.2000	1.2357	6.4259			(27)
Opening Type 5			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	5.2000	26.9500	0.2700	7.2765			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.1352			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8762	(36)
Total fabric heat loss (33) + (36) =	43.0114	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.0327	23.9109	23.7916	23.2310	23.1262	22.6380	22.6380	22.5475	22.8260	23.1262	23.3383	23.5601	(38)
Heat transfer coeff	67.0441	66.9223	66.8030	66.2424	66.1375	65.6493	65.6493	65.5589	65.8374	66.1375	66.3497	66.5715	(39)
Average = Sum(39)m / 12 =												66.2419	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0640	1.0621	1.0602	1.0513	1.0496	1.0419	1.0419	1.0405	1.0449	1.0496	1.0530	1.0565	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653 (42)
Average daily hot water use (litres/day)	83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:
Total storage loss
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)
If cylinder contains dedicated solar storage
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Heat gains from water heating, kWh/month
28.8587 25.2400 26.0455 22.7071 21.7880 18.8014 17.4222 19.9923 20.2310 23.5773 25.7365 27.9482 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7793	16.6796	13.5648	10.2694	7.6765	6.4808	7.0028	9.1025	12.2173	15.5127	18.1056	19.3013	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)
Water heating gains (Table 5)													
	38.7886	37.5596	35.0073	31.5376	29.2849	26.1130	23.4170	26.8713	28.0987	31.6899	35.7451	37.5647	(72)
Total internal gains													
	292.0174	290.5614	280.1751	263.3634	245.8359	229.5491	219.4122	223.0935	232.1549	249.0881	268.4181	283.3526	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	11.2829	0.7400	0.7000	0.7700	5.2654	(75)
East	2.6000	19.6403	0.7400	0.7000	0.7700	18.3309	(76)
West	1.3000	19.6403	0.7400	0.7000	0.7700	9.1654	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	40.4065	79.8017	133.9508	200.3105	250.5198	258.8278	245.4284	207.3392	157.3142	95.2983	50.5026	33.1600	(83)
Total gains	332.4239	370.3631	414.1259	463.6739	496.3557	488.3769	464.8406	430.4327	389.4690	344.3864	318.9207	316.5126	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.2660	65.3847	65.5015	66.0558	66.1605	66.6525	66.6525	66.7445	66.4622	66.1605	65.9490	65.7292	
alpha	5.3511	5.3590	5.3668	5.4037	5.4107	5.4435	5.4435	5.4496	5.4308	5.4107	5.3966	5.3819	
util living area													
	0.9989	0.9979	0.9940	0.9774	0.9190	0.7750	0.6029	0.6671	0.9016	0.9880	0.9979	0.9992	(86)
MIT	19.8075	19.9277	20.1560	20.4713	20.7587	20.9366	20.9869	20.9780	20.8433	20.4723	20.0835	19.7837	(87)
Th 2	20.0303	20.0319	20.0335	20.0408	20.0422	20.0486	20.0486	20.0498	20.0461	20.0422	20.0394	20.0365	(88)
util rest of house													
	0.9986	0.9971	0.9917	0.9682	0.8850	0.6909	0.4820	0.5456	0.8467	0.9817	0.9970	0.9989	(89)
MIT 2	18.9360	19.0574	19.2859	19.6021	19.8714	20.0177	20.0450	20.0430	19.9523	19.6073	19.2192	18.9173	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.3576	19.4784	19.7068	20.0226	20.3006	20.4622	20.5006	20.4953	20.3833	20.0258	19.6373	19.3364	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3576	19.4784	19.7068	20.0226	20.3006	20.4622	20.5006	20.4953	20.3833	20.0258	19.6373	19.3364	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9965	0.9908	0.9680	0.8954	0.7298	0.5410	0.6049	0.8688	0.9815	0.9965	0.9987	(94)
Useful gains	331.8390	369.0809	410.3006	448.8369	444.4305	356.4215	251.4974	260.3844	338.3660	338.0294	317.8046	316.0858	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1009.5213	975.6196	882.2515	736.7851	568.8259	384.8507	256.0748	268.4845	413.6758	623.3963	831.8463	1007.6544	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	504.1956	407.5940	351.1315	207.3227	92.5502	0.0000	0.0000	0.0000	0.0000	212.3129	370.1101	514.5270	(98)
Space heating												2659.7440	(98)
Space heating per m2											(98) / (4) =	42.2115	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	617.1037	485.8051	498.2478	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8600	0.9242	0.8984	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	530.6974	448.9629	447.6081	0.0000	0.0000	0.0000	0.0000	(102)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	640.3394	611.8566	574.5467	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	78.9422	121.1929	94.4423	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												294.5774	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	19.7355	30.2982	23.6106	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												73.6443	(107)
Space cooling per m2												1.1688	(108)
Energy for space heating												42.2115	(99)
Energy for space cooling												1.1688	(108)
Total												43.3802	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.4	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4079	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3467	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4421	0.4334	0.4247	0.3814	0.3727	0.3294	0.3294	0.3207	0.3467	0.3727	0.3901	0.4074	(22b)
Effective ac	0.5977	0.5939	0.5902	0.5727	0.5695	0.5542	0.5542	0.5514	0.5601	0.5695	0.5761	0.5830	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.7900	1.0000	1.7900			(26)
TER Opening Type (Uw = 1.40)			5.2000	1.3258	6.8939			(27)
TER Room Window (Uw = 1.70)			0.6500	1.5918	1.0346			(27a)
External Wall	32.1500	5.2000	26.9500	0.1800	4.8510			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.1800	2.0826			(29a)
Dormer Wall	17.9800		17.9800	0.1800	3.2364			(29a)
Main roof	45.7300		45.7300	0.1300	5.9449			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1300	0.5850			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.1333			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3500	(36)
Total fabric heat loss					(33) + (36) =		39.4833	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9813	24.8227	24.6673	23.9371	23.8005	23.1646	23.1646	23.0468	23.4095	23.8005	24.0769	24.3658	(38)
Heat transfer coeff	64.4646	64.3060	64.1506	63.4204	63.2838	62.6479	62.6479	62.5302	62.8929	63.2838	63.5602	63.8491	(39)
Average = Sum(39)m / 12 =												63.4198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0231	1.0206	1.0181	1.0065	1.0043	0.9943	0.9943	0.9924	0.9981	1.0043	1.0087	1.0133	(40)
HLP (average)												1.0065	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653	(42)
Average daily hot water use (litres/day)	83.2517	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

28.8587	25.2400	26.0455	22.7071	21.7880	18.8014	17.4222	19.9923	20.2310	23.5773	25.7365	27.9482	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	103.2667	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

18.7793	16.6796	13.5648	10.2694	7.6765	6.4808	7.0028	9.1025	12.2173	15.5127	18.1056	19.3013	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

180.4694	182.3421	177.6230	167.5764	154.8945	142.9752	135.0124	133.1397	137.8589	147.9054	160.5874	172.5066	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	33.3267	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	-82.6134	(71)

Water heating gains (Table 5)

38.7886	37.5596	35.0073	31.5376	29.2849	26.1130	23.4170	26.8713	28.0987	31.6899	35.7451	37.5647	(72)

Total internal gains

292.0174	290.5614	280.1751	263.3634	245.8359	229.5491	219.4122	223.0935	232.1549	249.0881	268.4181	283.3526	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	11.2829	0.6300	0.7000	0.7700	4.4827	(75)
East	2.6000	19.6403	0.6300	0.7000	0.7700	15.6060	(76)
West	1.3000	19.6403	0.6300	0.7000	0.7700	7.8030	(80)
West	0.6500	25.9287	0.6300	0.7000	1.0000	6.6892	(82)

Solar gains	34.5809	68.3010	114.6555	171.4665	214.4524	221.5666	210.0953	177.4857	134.6570	81.5669	43.2223	28.3786	(83)
Total gains	326.5983	358.8624	394.8306	434.8299	460.2883	451.1157	429.5075	400.5792	366.8119	330.6550	311.6404	311.7312	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.8775	68.0449	68.2097	68.9950	69.1439	69.8458	69.8458	69.9773	69.5738	69.1439	68.8433	68.5318	
alpha	5.5252	5.5363	5.5473	5.5997	5.6096	5.6564	5.6564	5.6652	5.6383	5.6096	5.5896	5.5688	
util living area	0.9990	0.9981	0.9950	0.9816	0.9316	0.7955	0.6220	0.6832	0.9108	0.9894	0.9981	0.9993	(86)
MIT	19.8553	19.9664	20.1794	20.4788	20.7555	20.9354	20.9870	20.9786	20.8469	20.4932	20.1242	19.8365	(87)
Th 2	20.0641	20.0662	20.0683	20.0779	20.0797	20.0881	20.0881	20.0897	20.0849	20.0797	20.0761	20.0723	(88)
util rest of house	0.9987	0.9975	0.9932	0.9739	0.9018	0.7155	0.5032	0.5650	0.8601	0.9838	0.9973	0.9990	(89)
MIT 2	19.0113	19.1239	19.3378	19.6411	19.9033	20.0558	20.0845	20.0829	19.9915	19.6593	19.2898	18.9992	(90)
Living area fraction									fLA = Living area / (4) =			0.4837	(91)
MIT	19.4195	19.5314	19.7449	20.0463	20.3155	20.4813	20.5211	20.5162	20.4053	20.0627	19.6934	19.4042	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4195	19.5314	19.7449	20.0463	20.3155	20.4813	20.5211	20.5162	20.4053	20.0627	19.6934	19.4042	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9970	0.9923	0.9736	0.9105	0.7524	0.5613	0.6228	0.8804	0.9837	0.9969	0.9988	(94)
Useful gains	326.0813	357.7919	391.7999	423.3528	419.1112	339.4190	241.0761	249.4622	322.9390	325.2567	310.6622	311.3523	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	974.6755	940.8896	849.6706	706.9026	545.2240	368.4528	245.6460	257.3856	396.5583	598.8337	800.4410	970.7776	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	482.5541	391.8417	340.6558	204.1559	93.8280	0.0000	0.0000	0.0000	0.0000	203.5413	352.6407	490.6124	(98)
Space heating												2559.8299	(98)
Space heating per m2											(98) / (4) =	40.6258	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	588.8904	463.5946	475.2292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8561	0.9231	0.8989	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	504.1621	427.9587	427.1679	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	597.8701	571.5841	540.5162	0.0000	0.0000	0.0000	0.0000	(103)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	67.4697	106.8573	84.3311	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												258.6582 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	16.8674	26.7143	21.0828	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												64.6645 (107)
Space cooling per m2												1.0263 (108)
Energy for space heating												40.6258 (99)
Energy for space cooling												1.0263 (108)
Total												41.6520 (109)
Target Fabric Energy Efficiency (TFEE)												47.9 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.9900	
Infiltration rate		0.3574	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3190	0.2962	0.3038	0.2886	0.2886	0.2810	0.2734	0.2658	0.2582	0.2810	0.2658	0.2810	(22b)
Effective ac	0.5509	0.5439	0.5461	0.5416	0.5416	0.5395	0.5374	0.5353	0.5333	0.5395	0.5353	0.5395	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.2000	1.2357	6.4259			(27)
Opening Type 5			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	5.2000	26.9500	0.2700	7.2765			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.1352			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8762	(36)
Total fabric heat loss (33) + (36) =	43.0114	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0237	22.7308	22.8260	22.6380	22.6380	22.5475	22.4595	22.3740	22.2908	22.5475	22.3740	22.5475	(38)
Heat transfer coeff	66.0351	65.7422	65.8374	65.6493	65.6493	65.5589	65.4709	65.3853	65.3022	65.5589	65.3853	65.5589	(39)
Average = Sum(39)m / 12 =												65.5945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0480	1.0434	1.0449	1.0419	1.0419	1.0405	1.0391	1.0377	1.0364	1.0405	1.0377	1.0405	(40)
HLP (average)												1.0410	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653 (42)
Average daily hot water use (litres/day)	83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7725   10.6219   11.7421   11.3430   11.7063   11.3116   11.6781   11.6964   11.3287   11.7273   11.3725   11.7666 (61)
Total heat required for water heating calculated for each month
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m = 1447.9404 (64)
RHI water heating demand                                                                                                    1448 (64)
Heat gains from water heating, kWh/month
               48.0986   42.1487   43.6890   38.3656   37.0183   32.2465   30.1802   34.2061   34.4878   39.8234   43.1132   46.6723 (65)
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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               46.9483   41.6991   33.9120   25.6735   19.1913   16.2021   17.5069   22.7562   30.5433   38.7817   45.2640   48.2532 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              269.3573  272.1524  265.1089  250.1141  231.1858  213.3958  201.5111  198.7160  205.7595  220.7544  239.6827  257.4726 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573 (69)
Pumps, fans     3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134 (71)
Water heating gains (Table 5)
               64.6486   62.7213   58.7218   53.2856   49.7558   44.7868   40.5648   45.9759   47.8997   53.5260   59.8794   62.7316 (72)
Total internal gains
              474.7183  470.3369  451.5067  422.8372  393.8969  368.1488  353.3468  361.2121  377.9665  406.8261  438.5900  462.2213 (73)
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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	14.6176	0.7400	0.7000	0.7700	6.8216	(75)
East	2.6000	25.1925	0.7400	0.7000	0.7700	23.5130	(76)
West	1.3000	25.1925	0.7400	0.7000	0.7700	11.7565	(80)
West	0.6500	33.4886	0.7200	0.7000	1.0000	9.8738	(82)

```
Solar gains    51.9649   87.4011  147.6823  221.3842  262.2605  293.8811  276.6657  240.1695  182.9457  112.5835   64.7584   41.9036 (83)
Total gains   526.6832  557.7380  599.1890  644.2215  656.1574  662.0299  630.0125  601.3817  560.9122  519.4097  503.3484  504.1250 (84)
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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           66.2632   66.5584   66.4622   66.6525   66.6525   66.7445   66.8342   66.9216   67.0069   66.7445   66.9216   66.7445
alpha          5.4175    5.4372    5.4308    5.4435    5.4435    5.4496    5.4556    5.4614    5.4671    5.4496    5.4614    5.4496
util living area
               0.9886    0.9835    0.9640    0.9034    0.7692    0.5533    0.4035    0.4218    0.6920    0.9136    0.9766    0.9903 (86)

MIT           20.1762   20.2649   20.4771   20.7370   20.9189   20.9888   20.9983   20.9979   20.9646   20.7645   20.4447   20.1640 (87)
Th 2          20.0435   20.0474   20.0461   20.0486   20.0486   20.0498   20.0509   20.0520   20.0531   20.0498   20.0520   20.0498 (88)
util rest of house
               0.9851    0.9784    0.9525    0.8736    0.7073    0.4662    0.3063    0.3205    0.6046    0.8795    0.9680    0.9872 (89)
MIT 2         18.9732   19.1037   19.4047   19.7598   19.9785   20.0437   20.0504   20.0514   20.0299   19.8042   19.3672   18.9606 (90)
Living area fraction                                                                                 fLA = Living area / (4) =    0.4837 (91)
MIT           19.5551   19.6654   19.9235   20.2325   20.4334   20.5008   20.5090   20.5093   20.4820   20.2687   19.8884   19.5427 (92)
Temperature adjustment                                                                                                      0.0000
adjusted MIT  19.5551   19.6654   19.9235   20.2325   20.4334   20.5008   20.5090   20.5093   20.4820   20.2687   19.8884   19.5427 (93)
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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9828    0.9758    0.9508    0.8800    0.7336    0.5082    0.3535    0.3696    0.6458    0.8884    0.9662    0.9851 (94)
Useful gains 517.6104  544.2536  569.7046  566.9202  481.3661  336.4532  222.6861  222.2957  362.2127  461.4402  486.3460  496.6289 (95)
Ext temp.      4.9000    5.3000    7.0000    9.5000   12.5000   15.3000   17.1000   17.1000   14.7000   11.4000    7.9000    5.0000 (96)
Heat loss rate W
              967.7515  944.4147  850.8475  704.5797  520.8228  340.9619  223.1879  222.9177  377.5795  581.4252  783.8650  953.4063 (97)
Month fracti   1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
              334.9050  268.9083  209.1703   99.1149   29.3557    0.0000    0.0000    0.0000    0.0000   89.2688  214.2137  339.8424 (98)
Space heating                                                                                                              1584.7790 (98)
RHI space heating demand                                                                                                      1585 (98)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.9900	
Infiltration rate		0.3574	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3873	0.3798	0.3722	0.3342	0.3266	0.2886	0.2886	0.2810	0.3038	0.3266	0.3418	0.3570	(22b)
Effective ac	0.5750	0.5721	0.5693	0.5558	0.5533	0.5416	0.5416	0.5395	0.5461	0.5533	0.5584	0.5637	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.2000	1.2357	6.4259			(27)
Opening Type 5			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	5.2000	26.9500	0.2700	7.2765			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.1352			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8762	(36)
Total fabric heat loss (33) + (36) =	43.0114	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.0327	23.9109	23.7916	23.2310	23.1262	22.6380	22.6380	22.5475	22.8260	23.1262	23.3383	23.5601	(38)
Heat transfer coeff	67.0441	66.9223	66.8030	66.2424	66.1375	65.6493	65.6493	65.5589	65.8374	66.1375	66.3497	66.5715	(39)
Average = Sum(39)m / 12 =												66.2419	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0640	1.0621	1.0602	1.0513	1.0496	1.0419	1.0419	1.0405	1.0449	1.0496	1.0530	1.0565	(40)
HLP (average)												1.0513	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653 (42)
Average daily hot water use (litres/day)	83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (57)
Combi loss     11.7725   10.6219   11.7421   11.3430   11.7063   11.3116   11.6781   11.6964   11.3287   11.7273   11.3725   11.7666 (61)
Total heat required for water heating calculated for each month
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (62)
Solar input     0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000    0.0000 (63)
                                                                                    Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              147.5783  129.3986  134.3089  118.1997  114.2379   99.7886   93.6650  105.7776  106.5336  122.6793  132.4854  143.2873 (64)
                                                                                      Total per year (kWh/year) = Sum(64)m =   1447.9404 (64)
Heat gains from water heating, kWh/month
               48.0986   42.1487   43.6890   38.3656   37.0183   32.2465   30.1802   34.2061   34.4878   39.8234   43.1132   46.6723 (65)
```

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5. Internal gains (see Table 5 and 5a)

```
Metabolic gains (Table 5), Watts
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
(66)m         123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201  123.9201 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                46.9483   41.6991   33.9120   25.6735   19.1913   16.2021   17.5069   22.7562   30.5433   38.7817   45.2640   48.2532 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               269.3573  272.1524  265.1089  250.1141  231.1858  213.3958  201.5111  198.7160  205.7595  220.7544  239.6827  257.4726 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573   49.4573 (69)
Pumps, fans      3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000    3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
               -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134  -82.6134 (71)
Water heating gains (Table 5)
                64.6486   62.7213   58.7218   53.2856   49.7558   44.7868   40.5648   45.9759   47.8997   53.5260   59.8794   62.7316 (72)
Total internal gains
               474.7183  470.3369  451.5067  422.8372  393.8969  368.1488  353.3468  361.2121  377.9665  406.8261  438.5900  462.2213 (73)
```

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3000	11.2829	0.7400	0.7000	0.7700	5.2654	(75)
East	2.6000	19.6403	0.7400	0.7000	0.7700	18.3309	(76)
West	1.3000	19.6403	0.7400	0.7000	0.7700	9.1654	(80)
West	0.6500	25.9287	0.7200	0.7000	1.0000	7.6448	(82)

```
Solar gains     40.4065   79.8017  133.9508  200.3105  250.5198  258.8278  245.4284  207.3392  157.3142   95.2983   50.5026   33.1600 (83)
Total gains    515.1248  550.1386  585.4575  623.1477  644.4167  626.9766  598.7752  568.5513  535.2807  502.1245  489.0926  495.3813 (84)
```

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7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
tau           65.2660   65.3847   65.5015   66.0558   66.1605   66.6525   66.6525   66.7445   66.4622   66.1605   65.9490   65.7292
alpha          5.3511    5.3590    5.3668    5.4037    5.4107    5.4435    5.4435    5.4496    5.4308    5.4107    5.3966    5.3819
util living area
                0.9915    0.9865    0.9724    0.9287    0.8237    0.6431    0.4776    0.5224    0.7679    0.9433    0.9844    0.9930 (86)

MIT           20.0780   20.1900   20.3948   20.6618   20.8720   20.9742   20.9957   20.9931   20.9343   20.6748   20.3312   20.0501 (87)
Th 2          20.0303   20.0319   20.0335   20.0408   20.0422   20.0486   20.0486   20.0498   20.0461   20.0422   20.0394   20.0365 (88)
util rest of house
                0.9888    0.9823    0.9635    0.9057    0.7719    0.5586    0.3769    0.4187    0.6899    0.9200    0.9788    0.9908 (89)
MIT 2         18.8211   18.9841   19.2789   19.6548   19.9214   20.0320   20.0470   20.0470   19.9967   19.6808   19.1953   18.7852 (90)
Living area fraction                                                                                 fLA = Living area / (4) =     0.4837 (91)
MIT           19.4291   19.5674   19.8187   20.1419   20.3812   20.4878   20.5059   20.5046   20.4502   20.1616   19.7448   19.3971 (92)
Temperature adjustment                                                                                                        0.0000
adjusted MIT  19.4291   19.5674   19.8187   20.1419   20.3812   20.4878   20.5059   20.5046   20.4502   20.1616   19.7448   19.3971 (93)
```

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8. Space heating requirement

```
                Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec
Utilisation    0.9867    0.9797    0.9611    0.9084    0.7915    0.5987    0.4258    0.4690    0.7249    0.9234    0.9766    0.9889 (94)
Useful gains  508.2808  538.9954  562.6875  566.0872  510.0556  375.3826  254.9637  266.6718  388.0279  463.6643  477.6425  489.9062 (95)
Ext temp.       4.3000    4.9000    6.5000    8.9000   11.7000   14.6000   16.6000   16.4000   14.1000   10.6000    7.1000    4.2000 (96)
Heat loss rate W
              1014.3148  981.5790  889.7296  744.6932  574.1560  386.5285  256.4195  269.0962  418.0826  632.3827  838.9772 1011.6911 (97)
Month fracti    1.0000    1.0000    1.0000    1.0000    1.0000    0.0000    0.0000    0.0000    0.0000    1.0000    1.0000    1.0000 (97a)
Space heating kWh
               376.4893  297.4162  243.3193  128.5963   47.6908    0.0000    0.0000    0.0000    0.0000  125.5265  260.1610  388.2080 (98)
Space heating                                                                                                              1867.4074 (98)
Space heating per m2                                                                                                (98) / (4) =    29.6367 (99)
```

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2010.1264	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	376.4893	297.4162	243.3193	128.5963	47.6908	0.0000	0.0000	0.0000	0.0000	125.5265	260.1610	388.2080	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	405.2630	320.1466	261.9153	138.4244	51.3356	0.0000	0.0000	0.0000	0.0000	135.1200	280.0441	417.8773	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.9752	88.9052	88.7352	88.3384	87.6185	86.7000	86.7000	86.7000	86.7000	88.2894	88.7942	89.0143	(217)
Fuel for water heating, kWh/month													
	165.8645	145.5468	151.3593	133.8033	130.3810	115.0965	108.0335	122.0041	122.8761	138.9514	149.2050	160.9712	(219)
Water heating fuel used												1644.0927	(219)
Annual totals kWh/year													
Space heating fuel - main system												2010.1264	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.6488	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												3808.3710	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2010.1264	3.4800	69.9524	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1644.0927	3.4800	57.2144	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	331.6488	13.1900	43.7445	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			300.8038	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1697	(257)
SAP value		83.6829	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2010.1264	0.2160	434.1873	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1644.0927	0.2160	355.1240	(264)
Space and water heating			789.3113	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.6488	0.5190	172.1257	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total kg/year			869.3162	(272)
CO2 emissions per m2			13.8000	(273)
EI value			89.2150	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8796 = 3.957, stars = 4
Water heating environmental impact	0.216 / 0.8796 = 0.2456, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0100 (1b)	x	2.0100 (2b)	=	126.6501	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.6501	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1579	(8)
Pressure test		Yes	
Measured/design AP50		3.9900	
Infiltration rate		0.3574	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3038	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3190	0.2962	0.3038	0.2886	0.2886	0.2810	0.2734	0.2658	0.2582	0.2810	0.2658	0.2810	(22b)
Effective ac	0.5509	0.5439	0.5461	0.5416	0.5416	0.5395	0.5374	0.5353	0.5333	0.5395	0.5353	0.5395	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			5.2000	1.2357	6.4259			(27)
Opening Type 5			1.7900	1.5000	2.6850			(26)
Opening Type 6 (Uw = 1.30)			0.6500	1.2357	0.8032			(27a)
External Wall	32.1500	5.2000	26.9500	0.2700	7.2765			(29a)
Communal Wall	13.3600	1.7900	11.5700	0.2400	2.7768			(29a)
Dormer Wall	17.9800		17.9800	0.1900	3.4162			(29a)
Main roof	45.7300		45.7300	0.1600	7.3168			(30)
Sloping Roof	44.6100	0.6500	43.9600	0.1300	5.7148			(30)
Dormer Roof	4.5000		4.5000	0.1600	0.7200			(30)
Total net area of external elements Aum(A, m2)			158.3300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.1352			(33)
Party Floor 1			63.0100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8762	(36)
Total fabric heat loss (33) + (36) =	43.0114	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0237	22.7308	22.8260	22.6380	22.6380	22.5475	22.4595	22.3740	22.2908	22.5475	22.3740	22.5475	(38)
Heat transfer coeff	66.0351	65.7422	65.8374	65.6493	65.6493	65.5589	65.4709	65.3853	65.3022	65.5589	65.3853	65.5589	(39)
Average = Sum(39)m / 12 =												65.5945	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0480	1.0434	1.0449	1.0419	1.0419	1.0405	1.0391	1.0377	1.0364	1.0405	1.0377	1.0405	(40)
HLP (average)												1.0410	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0653 (42)
Average daily hot water use (litres/day)	83.2517 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.5769	88.2468	84.9167	81.5867	78.2566	74.9265	74.9265	78.2566	81.5867	84.9167	88.2468	91.5769	(44)
Energy conte	135.8059	118.7767	122.5669	106.8568	102.5316	88.4770	81.9869	94.0812	95.2048	110.9521	121.1129	131.5207	(45)
Energy content (annual)										Total = Sum(45)m =		1309.8734	(45)
Distribution loss (46)m = 0.15 x (45)m	20.3709	17.8165	18.3850	16.0285	15.3797	13.2715	12.2980	14.1122	14.2807	16.6428	18.1669	19.7281	(46)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

```
Water storage loss:
Total storage loss
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss     11.7725    10.6219    11.7421    11.3430    11.7063    11.3116    11.6781    11.6964    11.3287    11.7273    11.3725    11.7666 (61)
Total heat required for water heating calculated for each month
              147.5783   129.3986   134.3089   118.1997   114.2379    99.7886    93.6650   105.7776   106.5336   122.6793   132.4854   143.2873 (62)
Solar input     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                                 Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
              147.5783   129.3986   134.3089   118.1997   114.2379    99.7886    93.6650   105.7776   106.5336   122.6793   132.4854   143.2873 (64)
                                                                                                   Total per year (kWh/year) = Sum(64)m =   1447.9404 (64)
Heat gains from water heating, kWh/month
               48.0986    42.1487    43.6890    38.3656    37.0183    32.2465    30.1802    34.2061    34.4878    39.8234    43.1132    46.6723 (65)


-------------------------------------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
-------------------------------------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m         123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201   123.9201 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
               46.9483    41.6991    33.9120    25.6735    19.1913    16.2021    17.5069    22.7562    30.5433    38.7817    45.2640    48.2532 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
              269.3573   272.1524   265.1089   250.1141   231.1858   213.3958   201.5111   198.7160   205.7595   220.7544   239.6827   257.4726 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
               49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573    49.4573 (69)
Pumps, fans     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000     3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134   -82.6134 (71)
Water heating gains (Table 5)
               64.6486    62.7213    58.7218    53.2856    49.7558    44.7868    40.5648    45.9759    47.8997    53.5260    59.8794    62.7316 (72)
Total internal gains
              474.7183   470.3369   451.5067   422.8372   393.8969   368.1488   353.3468   361.2121   377.9665   406.8261   438.5900   462.2213 (73)


-------------------------------------------------------------------------------------------------------------------------------
6. Solar gains
-------------------------------------------------------------------------------------------------------------------------------

[Jan]                                    Area          Solar flux              g                FF            Access            Gains
                                           m2           Table 6a      Specific data    Specific data        factor                W
                                                           W/m2      or Table 6b      or Table 6c      Table 6d
-------------------------------------------------------------------------------------------------------------------------------
Northeast                                1.3000           14.6176           0.7400           0.7000           0.7700           6.8216 (75)
East                                     2.6000           25.1925           0.7400           0.7000           0.7700          23.5130 (76)
West                                     1.3000           25.1925           0.7400           0.7000           0.7700          11.7565 (80)
West                                     0.6500           33.4886           0.7200           0.7000           1.0000           9.8738 (82)
-------------------------------------------------------------------------------------------------------------------------------

Solar gains    51.9649    87.4011   147.6823   221.3842   262.2605   293.8811   276.6657   240.1695   182.9457   112.5835    64.7584    41.9036 (83)
Total gains   526.6832   557.7380   599.1890   644.2215   656.1574   662.0299   630.0125   601.3817   560.9122   519.4097   503.3484   504.1250 (84)


-------------------------------------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
-------------------------------------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                  21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau           66.2632    66.5584    66.4622    66.6525    66.6525    66.7445    66.8342    66.9216    67.0069    66.7445    66.9216    66.7445
alpha          5.4175     5.4372     5.4308     5.4435     5.4435     5.4496     5.4556     5.4614     5.4671     5.4496     5.4614     5.4496
util living area
               0.9886     0.9835     0.9640     0.9034     0.7692     0.5533     0.4035     0.4218     0.6920     0.9136     0.9766     0.9903 (86)

MIT           20.1762    20.2649    20.4771    20.7370    20.9189    20.9888    20.9983    20.9979    20.9646    20.7645    20.4447    20.1640 (87)
Th 2          20.0435    20.0474    20.0461    20.0486    20.0486    20.0498    20.0509    20.0520    20.0531    20.0498    20.0520    20.0498 (88)
util rest of house
               0.9851     0.9784     0.9525     0.8736     0.7073     0.4662     0.3063     0.3205     0.6046     0.8795     0.9680     0.9872 (89)
MIT 2         18.9732    19.1037    19.4047    19.7598    19.9785    20.0437    20.0504    20.0514    20.0299    19.8042    19.3672    18.9606 (90)
Living area fraction                                                                                    fLA = Living area / (4) =      0.4837 (91)
MIT           19.5551    19.6654    19.9235    20.2325    20.4334    20.5008    20.5090    20.5093    20.4820    20.2687    19.8884    19.5427 (92)
Temperature adjustment                                                                                                         0.0000
adjusted MIT  19.5551    19.6654    19.9235    20.2325    20.4334    20.5008    20.5090    20.5093    20.4820    20.2687    19.8884    19.5427 (93)


-------------------------------------------------------------------------------------------------------------------------------
8. Space heating requirement
-------------------------------------------------------------------------------------------------------------------------------

                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation    0.9828     0.9758     0.9508     0.8800     0.7336     0.5082     0.3535     0.3696     0.6458     0.8884     0.9662     0.9851 (94)
Useful gains 517.6104   544.2536   569.7046   566.9202   481.3661   336.4532   222.6861   222.2957   362.2127   461.4402   486.3460   496.6289 (95)
Ext temp.      4.9000     5.3000     7.0000     9.5000    12.5000    15.3000    17.1000    17.1000    14.7000    11.4000     7.9000     5.0000 (96)
Heat loss rate W
              967.7515   944.4147   850.8475   704.5797   520.8228   340.9619   223.1879   222.9177   377.5795   581.4252   783.8650   953.4063 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
              334.9050   268.9083   209.1703    99.1149    29.3557     0.0000     0.0000     0.0000     0.0000    89.2688   214.2137   339.8424 (98)
Space heating                                                                                                                 1584.7790 (98)
Space heating per m2                                                                                                 (98) / (4) =     25.1512 (99)


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8c. Space cooling requirement
-------------------------------------------------------------------------------------------------------------------------------
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1705.8978	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	334.9050	268.9083	209.1703	99.1149	29.3557	0.0000	0.0000	0.0000	0.0000	89.2688	214.2137	339.8424	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	360.5005	289.4599	225.1564	106.6898	31.5993	0.0000	0.0000	0.0000	0.0000	96.0913	230.5852	365.8153	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.5783	129.3986	134.3089	118.1997	114.2379	99.7886	93.6650	105.7776	106.5336	122.6793	132.4854	143.2873	(64)
Efficiency of water heater												86.7000	(216)
(217)m	88.8964	88.8348	88.6210	88.1308	87.3355	86.7000	86.7000	86.7000	86.7000	88.0196	88.6497	88.9266	(217)
Fuel for water heating, kWh/month													
	166.0116	145.6621	151.5543	134.1186	130.8035	115.0965	108.0335	122.0041	122.8761	139.3773	149.4482	161.1299	(219)
Water heating fuel used												1646.1157	(219)
Annual totals kWh/year													
Space heating fuel - main system												1705.8978	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.6488	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 967 * 1.00) =												-286.1698	(233)
Total delivered energy for all uses												3472.4924	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1705.8978	7.3800	125.8953	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1646.1157	7.3800	121.4833	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	331.6488	28.6600	95.0505	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			470.9241	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1705.8978	0.2160	368.4739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1646.1157	0.2160	355.5610	(264)
Space and water heating			724.0349	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.6488	0.5190	172.1257	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	0.5190	-148.5221	(269)
Total kg/year			786.5635	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1705.8978	1.2200	2081.1953	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1646.1157	1.2200	2008.2611	(264)
Space and water heating			4089.4564	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	331.6488	3.0700	1018.1618	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	3.0700	-878.5413	(269)
Primary energy kWh/year			4459.3269	(272)
Primary energy kWh/m2/year			70.7717	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£117	£117	£0
Mains gas	£354	£354	£0
Space heating	£254	£254	£0
Water heating	£121	£121	£0
Lighting	£95	£95	£0
Total cost of fuels	£471	£471	£0
Total cost of uses	£470	£470	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	71 kWh/m²	71 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable



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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	250.77 (P1)
Transmission heat loss coefficient	43.01 (37)
Summer heat loss coefficient	293.78 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)
West	0.985	1.00	1.000	0.985 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.3000	106.0502	0.7400	0.7000	0.8865	56.9778
East	2.6000	125.2818	0.7400	0.7000	0.8865	134.6208
West	1.3000	125.2818	0.7400	0.7000	0.8865	67.3104
West	0.6500	188.6220	0.7200	0.7000	0.9850	54.7791
total:						313.6882

	Jun	Jul	Aug	
Solar gains	339	314	271	(P3)
Internal gains	365	350	358	
Total summer gains	704	664	630	(P5)
Summer gain/loss ratio	2.40	2.26	2.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.05	19.81	19.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 673 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 673 - EPC	**Prop Type Ref**	
Property	29 Kittiwake Place, Boorley Green , Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	16.02	**TER**	19.23
Environmental	89 B	**% DER<TER**	16.68		
CO_2 Emissions (t/year)	0.79	**DFEE**	43.38	**TFEE**	47.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	9.44		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.23	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.02	$kgCO_2/m^2$	Pass
	-3.21 (-16.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.90	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	43.38	$kWh/m^2/yr$	
	-4.5 (-9.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.99 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	1.30 m², No overhang
Windows facing East	2.60 m², No overhang
Windows facing West	1.30 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.99 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.037	W/m²K
Air permeability	4.0	m³/m²h
Photovoltaic array	0.37	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 674 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 674 - EPC	**Prop Type Ref**	
Property	31 Kittiwake Place, Boorley Green , Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	15.73	**TER**	18.91
Environmental	88 B	**% DER<TER**	16.81		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.56	**TFEE**	52.93
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Ground-floor flat, total floor area 77 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.91 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.73 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.06 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 36 COMBI
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.86 m², No overhang
Windows facing East: 6.44 m², No overhang
Windows facing West: 3.31 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Thermal bridging y-value 0.034 W/m²K
Air permeability 3.1 m³/m²h
Photovoltaic array 0.37 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.0600	
Infiltration rate		0.2662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2262	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2885	0.2828	0.2771	0.2489	0.2432	0.2149	0.2149	0.2093	0.2262	0.2432	0.2545	0.2658	(22b)
Effective ac	0.5416	0.5400	0.5384	0.5310	0.5296	0.5231	0.5231	0.5219	0.5256	0.5296	0.5324	0.5353	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.5700			(33)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5211	(36)
Total fabric heat loss					(33) + (36) =		56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5882	31.4940	31.4016	30.9678	30.8867	30.5089	30.5089	30.4389	30.6544	30.8867	31.0509	31.2225	(38)
Heat transfer coeff	87.6792	87.5850	87.4927	87.0589	86.9777	86.5999	86.5999	86.5299	86.7454	86.9777	87.1419	87.3136	(39)
Average = Sum(39)m / 12 =												87.0585	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1460	1.1448	1.1435	1.1379	1.1368	1.1319	1.1319	1.1310	1.1338	1.1368	1.1390	1.1412	(40)
HLP (average)												1.1379	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	364.1615	362.0250	348.8015	327.5572	306.0478	285.3431	271.9259	277.8725	288.8258	310.2780	334.8756	353.2652	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	6.4400	19.6403	0.7400	0.7000	0.7700	45.4042	(76)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	76.2744	149.8064	249.0840	368.3535	456.8150	470.2192	446.5910	379.8575	291.2277	178.3022	95.1909	62.6814	(83)
Total gains	440.4359	511.8314	597.8855	695.9107	762.8628	755.5623	718.5169	657.7300	580.0535	488.5802	430.0665	415.9466	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5981	60.6633	60.7273	61.0299	61.0868	61.3533	61.3533	61.4030	61.2504	61.0868	60.9717	60.8519	
alpha	5.0399	5.0442	5.0485	5.0687	5.0725	5.0902	5.0902	5.0935	5.0834	5.0725	5.0648	5.0568	
util living area													
	0.9984	0.9962	0.9880	0.9548	0.8588	0.6860	0.5202	0.5858	0.8484	0.9793	0.9966	0.9988	(86)
MIT	19.7415	19.8939	20.1669	20.5215	20.8108	20.9557	20.9911	20.9843	20.8690	20.4757	20.0373	19.7073	(87)
Th 2	19.9635	19.9645	19.9654	19.9700	19.9709	19.9749	19.9749	19.9756	19.9733	19.9709	19.9691	19.9673	(88)
util rest of house													
	0.9978	0.9948	0.9837	0.9381	0.8099	0.5949	0.4043	0.4650	0.7771	0.9687	0.9952	0.9984	(89)
MIT 2	18.2832	18.5064	18.9035	19.4098	19.7879	19.9460	19.9717	19.9692	19.8674	19.3550	18.7199	18.2360	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	18.7984	18.9966	19.3498	19.8025	20.1492	20.3027	20.3318	20.3278	20.2213	19.7509	19.1853	18.7558	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7984	18.9966	19.3498	19.8025	20.1492	20.3027	20.3318	20.3278	20.2213	19.7509	19.1853	18.7558	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9931	0.9803	0.9347	0.8193	0.6255	0.4455	0.5079	0.7966	0.9657	0.9936	0.9976	(94)
Useful gains	439.0560	508.2854	586.0787	650.4945	625.0419	472.6221	320.1051	334.0816	462.0766	471.8431	427.3278	414.9593	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1271.2089	1234.6476	1124.2640	949.1631	734.8965	493.8550	323.1743	339.8743	530.9928	795.9253	1053.1397	1270.9195	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	619.1217	488.1154	400.4099	215.0414	81.7318	0.0000	0.0000	0.0000	0.0000	241.1172	450.5846	636.8343	(98)
Space heating												3132.9563	(98)
Space heating per m2											(98) / (4) =	40.9483	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3372.3965	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	619.1217	488.1154	400.4099	215.0414	81.7318	0.0000	0.0000	0.0000	0.0000	241.1172	450.5846	636.8343	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	666.4389	525.4203	431.0117	231.4762	87.9783	0.0000	0.0000	0.0000	0.0000	259.5448	485.0211	685.5052	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2227	89.1643	89.0229	88.6774	87.9445	86.7000	86.7000	86.7000	86.7000	88.7352	89.1041	89.2531	(217)
Fuel for water heating, kWh/month													
	179.6865	157.6221	163.7863	144.5952	140.8328	124.6671	116.9021	132.1820	133.1766	149.9835	161.4387	174.3671	(219)
Water heating fuel used												1779.2400	(219)
Annual totals kWh/year													
Space heating fuel - main system												3372.3965	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												5326.1131	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3372.3965	0.2160	728.4376	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1779.2400	0.2160	384.3158	(264)
Space and water heating			1112.7535	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total CO2, kg/year			1203.3068	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.7300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.7300	ZC1
Total Floor Area	TFA	76.5100	
Assumed number of occupants	N	2.3933	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.4191	ZC2
CO2 emissions from cooking, equation (L16)		2.3061	ZC3
Total CO2 emissions		34.4551	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.4551	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6100	1.3258	15.3920			(27)
Ground floor			76.5100	0.1300	9.9463			(28a)
External Wall	68.6000	13.7300	54.8700	0.1800	9.8766			(29a)
Communal Wall	15.3800		15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1047	(36)
Total fabric heat loss					(33) + (36) =		51.6321	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	86.8283	86.5940	86.3643	85.2855	85.0836	84.1440	84.1440	83.9700	84.5059	85.0836	85.4920	85.9188	(39)
Average = Sum(39)m / 12 =												85.2845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1349	1.1318	1.1288	1.1147	1.1121	1.0998	1.0998	1.0975	1.1045	1.1121	1.1174	1.1230	(40)
HLP (average)												1.1147	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933	(42)
Average daily hot water use (litres/day)	91.0410	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	44.4181	47.3214	43.9990	43.6099	40.4073	41.7542	43.6099	43.9990	47.3214	47.5908	50.9589	(61)
Total heat required for water heating calculated for each month													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Total per year (kWh/year) = Sum(64)m =												1978.3788	(64)
Heat gains from water heating, kWh/month													
	62.1201	54.2929	56.3969	49.8539	48.1840	42.2729	40.2498	45.1113	45.6172	52.1736	55.9355	60.5620	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	83.4947	80.7930	75.8023	69.2416	64.7634	58.7124	54.0992	60.6335	63.3572	70.1258	77.6882	81.4005	(72)
Total internal gains													
	377.3168	374.5865	360.7466	338.8872	316.7601	295.4390	282.0260	288.5889	300.1618	322.2291	347.4405	366.4229	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
East	6.4400	19.6403	0.6300	0.7000	0.7700	38.6549	(76)
West	3.3100	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	64.9363	127.5379	212.0580	313.5983	388.9101	400.3218	380.2058	323.3922	247.9371	151.7978	81.0409	53.3639	(83)
Total gains	442.2531	502.1244	572.8046	652.4855	705.6702	695.7607	662.2319	611.9811	548.0988	474.0269	428.4813	419.7867	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1920	61.3576	61.5207	62.2989	62.4467	63.1441	63.1441	63.2749	62.8736	62.4467	62.1485	61.8397	
alpha	5.0795	5.0905	5.1014	5.1533	5.1631	5.2096	5.2096	5.2183	5.1916	5.1631	5.1432	5.1226	
util living area													
	0.9983	0.9965	0.9899	0.9632	0.8817	0.7162	0.5468	0.6088	0.8633	0.9811	0.9966	0.9987	(86)
MIT	19.7586	19.8992	20.1556	20.5015	20.7910	20.9501	20.9900	20.9830	20.8639	20.4811	20.0599	19.7366	(87)
Th 2	19.9725	19.9749	19.9774	19.9888	19.9910	20.0010	20.0010	20.0029	19.9972	19.9910	19.9867	19.9821	(88)
util rest of house													
	0.9978	0.9952	0.9862	0.9490	0.8376	0.6267	0.4290	0.4879	0.7961	0.9714	0.9952	0.9983	(89)
MIT 2	18.3147	18.5217	18.8962	19.3980	19.7840	19.9675	19.9973	19.9958	19.8848	19.3781	18.7654	18.2894	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	18.8248	19.0083	19.3411	19.7879	20.1397	20.3147	20.3480	20.3445	20.2307	19.7678	19.2227	18.8006	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8248	19.0083	19.3411	19.7879	20.1397	20.3147	20.3480	20.3445	20.2307	19.7678	19.2227	18.8006	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9936	0.9831	0.9455	0.8450	0.6565	0.4709	0.5309	0.8140	0.9686	0.9937	0.9976	(94)
Useful gains	440.8496	498.9096	563.1119	616.9499	596.2624	456.7505	311.8710	324.9130	446.1423	459.1248	425.7944	418.7607	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1261.1640	1221.6957	1109.0114	928.5782	718.0828	480.8561	315.3691	331.2237	518.0800	780.0278	1036.3949	1254.4709	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	610.3139	485.7122	406.1492	224.3724	90.6344	0.0000	0.0000	0.0000	0.0000	238.7518	439.6323	621.7683	(98)
Space heating												3117.3346	(98)
Space heating per m2											(98) / (4) =	40.7441	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3337.6174	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	610.3139	485.7122	406.1492	224.3724	90.6344	0.0000	0.0000	0.0000	0.0000	238.7518	439.6323	621.7683	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	653.4410	520.0345	434.8493	240.2274	97.0390	0.0000	0.0000	0.0000	0.0000	255.6229	470.6984	665.7049	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	199.4713	174.3079	181.3561	160.8537	155.7348	137.1625	131.4121	146.4937	148.1116	168.6545	180.0354	194.7852	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6834	87.4937	87.0213	85.8891	83.7419	80.3000	80.3000	80.3000	80.3000	85.9260	87.2130	87.7667	(217)
Fuel for water heating, kWh/month													
	227.4905	199.2234	208.4043	187.2806	185.9699	170.8126	163.6515	182.4330	184.4478	196.2789	206.4319	221.9353	(219)
Water heating fuel used												2334.3597	(219)
Annual totals kWh/year													
Space heating fuel - main system												3337.6174	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Total delivered energy for all uses												6098.9505	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3337.6174	0.2160	720.9254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2334.3597	0.2160	504.2217	(264)
Space and water heating			1225.1470	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Total CO2, kg/m2/year			1446.7463	(272)
Emissions per m2 for space and water heating			16.0129	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3876	(272b)
Emissions per m2 for pumps and fans			0.5088	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0129 * 1.00) + 2.3876 + 0.5088, rounded to 2 d.p.			18.9100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		3.0600	
Infiltration rate		0.3227	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2743	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3498	0.3429	0.3361	0.3018	0.2949	0.2606	0.2606	0.2538	0.2743	0.2949	0.3086	0.3223	(22b)
Effective ac	0.5612	0.5588	0.5565	0.5455	0.5435	0.5340	0.5340	0.5322	0.5376	0.5435	0.5476	0.5520	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5211	(36)
Total fabric heat loss (33) + (36) =	56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.7295	32.5909	32.4551	31.8173	31.6980	31.1425	31.1425	31.0396	31.3564	31.6980	31.9394	32.1918	(38)
Heat transfer coeff	88.8205	88.6820	88.5462	87.9084	87.7890	87.2335	87.2335	87.1306	87.4475	87.7890	88.0304	88.2828	(39)
Average = Sum(39)m / 12 =												87.9078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1609	1.1591	1.1573	1.1490	1.1474	1.1402	1.1402	1.1388	1.1430	1.1474	1.1506	1.1539	(40)
HLP (average)												1.1490	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.2400	331.8674	320.2271	301.1340	281.0216	262.2828	250.5348	254.3409	264.5322	283.7582	305.8418	323.1018	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	6.4400	19.6403	0.7400	0.7000	0.7700	45.4042	(76)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	76.2744	149.8064	249.0840	368.3535	456.8150	470.2192	446.5910	379.8575	291.2277	178.3022	95.1909	62.6814	(83)
Total gains	409.5143	481.6738	569.3111	669.4875	737.8367	732.5020	697.1257	634.1984	555.7599	462.0605	401.0327	385.7832	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8195	59.9129	60.0048	60.4401	60.5223	60.9077	60.9077	60.9796	60.7587	60.5223	60.3563	60.1838	
alpha	4.9880	4.9942	5.0003	5.0293	5.0348	5.0605	5.0605	5.0653	5.0506	5.0348	5.0238	5.0123	
util living area													
	0.9988	0.9971	0.9904	0.9615	0.8735	0.7054	0.5382	0.6077	0.8671	0.9837	0.9975	0.9991	(86)
MIT	19.6839	19.8389	20.1173	20.4844	20.7888	20.9488	20.9894	20.9811	20.8506	20.4370	19.9892	19.6535	(87)
Th 2	19.9514	19.9529	19.9543	19.9610	19.9623	19.9682	19.9682	19.9693	19.9659	19.9623	19.9597	19.9571	(88)
util rest of house													
	0.9984	0.9961	0.9868	0.9467	0.8271	0.6136	0.4184	0.4835	0.7996	0.9751	0.9965	0.9988	(89)
MIT 2	18.7492	18.9049	19.1826	19.5454	19.8210	19.9450	19.9655	19.9639	19.8816	19.5063	19.0608	18.7234	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.0795	19.2349	19.5128	19.8771	20.1629	20.2997	20.3272	20.3233	20.2240	19.8351	19.3888	19.0520	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0795	19.2349	19.5128	19.8771	20.1629	20.2997	20.3272	20.3233	20.2240	19.8351	19.3888	19.0520	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9951	0.9849	0.9453	0.8372	0.6448	0.4611	0.5279	0.8189	0.9738	0.9957	0.9985	(94)
Useful gains	408.6693	479.3172	560.7065	632.8438	617.6892	472.3483	321.4468	334.7848	455.0943	449.9356	399.3025	385.1914	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1312.7195	1271.2440	1152.2348	964.9819	742.9500	497.2020	325.1393	341.8366	535.5245	810.7379	1081.7854	1311.1762	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	672.6133	532.1748	440.0970	239.1394	93.1941	0.0000	0.0000	0.0000	0.0000	268.4369	491.3877	688.9327	(98)
Space heating												3425.9759	(98)
Space heating per m2											(98) / (4) =	44.7781	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	819.9950	645.5280	662.1928	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8884	0.9399	0.9139	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	728.4628	606.7159	605.1476	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	945.6474	902.5059	830.5709	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	156.3729	220.0677	167.7150	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												544.1556	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	39.0932	55.0169	41.9287	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												136.0389 (107)
Space cooling per m2												1.7781 (108)
Energy for space heating												44.7781 (99)
Energy for space cooling												1.7781 (108)
Total												46.5562 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1697	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4197	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3568	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4549	0.4460	0.4371	0.3925	0.3835	0.3389	0.3389	0.3300	0.3568	0.3835	0.4014	0.4192	(22b)
Effective ac	0.6035	0.5994	0.5955	0.5770	0.5736	0.5574	0.5574	0.5545	0.5636	0.5736	0.5806	0.5879	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.6100	1.3258	15.3920			(27)
Ground floor			76.5100	0.1300	9.9463			(28a)
External Wall	68.6000	13.7300	54.8700	0.1800	9.8766			(29a)
Communal Wall	15.3800		15.3800	0.1800	2.7684			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5273			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1047	(36)
Total fabric heat loss					(33) + (36) =		51.6321	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1962	34.9619	34.7322	33.6534	33.4516	32.5119	32.5119	32.3379	32.8739	33.4516	33.8599	34.2868	(38)
Heat transfer coeff	86.8283	86.5940	86.3643	85.2855	85.0836	84.1440	84.1440	83.9700	84.5059	85.0836	85.4920	85.9188	(39)
Average = Sum(39)m / 12 =												85.2845	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1349	1.1318	1.1288	1.1147	1.1121	1.0998	1.0998	1.0975	1.1045	1.1121	1.1174	1.1230	(40)
HLP (average)												1.1147	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3933 (42)
Average daily hot water use (litres/day)		91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	31.5589	27.6016	28.4824	24.8316	23.8265	20.5605	19.0523	21.8628	22.1239	25.7833	28.1445	30.5631	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	119.6654	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.9302	17.7018	14.3961	10.8988	8.1470	6.8780	7.4319	9.6603	12.9660	16.4634	19.2152	20.4841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	211.9923	214.1921	208.6487	196.8473	181.9501	167.9489	158.5953	156.3955	161.9389	173.7403	188.6374	202.6386	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	34.9665	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	42.4178	41.0738	38.2828	34.4884	32.0249	28.5562	25.6079	29.3855	30.7277	34.6550	39.0896	41.0794	(72)
Total internal gains													
	333.2400	331.8674	320.2271	301.1340	281.0216	262.2828	250.5348	254.3409	264.5322	283.7582	305.8418	323.1018	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.6300	0.7000	0.7700	6.4137	(75)
East	6.4400	19.6403	0.6300	0.7000	0.7700	38.6549	(76)
West	3.3100	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	64.9363	127.5379	212.0580	313.5983	388.9101	400.3218	380.2058	323.3922	247.9371	151.7978	81.0409	53.3639	(83)
Total gains	398.1762	459.4052	532.2851	614.7323	669.9317	662.6045	630.7406	577.7331	512.4693	435.5561	386.8827	376.4657	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1920	61.3576	61.5207	62.2989	62.4467	63.1441	63.1441	63.2749	62.8736	62.4467	62.1485	61.8397	
alpha	5.0795	5.0905	5.1014	5.1533	5.1631	5.2096	5.2096	5.2183	5.1916	5.1631	5.1432	5.1226	
util living area													
	0.9990	0.9976	0.9926	0.9708	0.8988	0.7414	0.5713	0.6391	0.8874	0.9868	0.9979	0.9992	(86)
MIT	19.7048	19.8474	20.1080	20.4624	20.7662	20.9414	20.9877	20.9789	20.8412	20.4375	20.0093	19.6835	(87)
Th 2	19.9725	19.9749	19.9774	19.9888	19.9910	20.0010	20.0010	20.0029	19.9972	19.9910	19.9867	19.9821	(88)
util rest of house													
	0.9986	0.9968	0.9899	0.9591	0.8586	0.6524	0.4496	0.5150	0.8265	0.9797	0.9970	0.9990	(89)
MIT 2	18.7869	18.9312	19.1924	19.5489	19.8300	19.9736	19.9978	19.9967	19.9046	19.5308	19.1025	18.7733	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.1112	19.2549	19.5158	19.8716	20.1608	20.3155	20.3476	20.3437	20.2355	19.8511	19.4229	19.0949	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1112	19.2549	19.5158	19.8716	20.1608	20.3155	20.3476	20.3437	20.2355	19.8511	19.4229	19.0949	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9960	0.9883	0.9574	0.8663	0.6824	0.4931	0.5593	0.8433	0.9784	0.9963	0.9987	(94)
Useful gains	397.4631	457.5761	526.0353	588.5620	580.3606	452.1570	311.0175	323.1535	432.1874	426.1464	385.4632	375.9616	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1286.0283	1243.0492	1124.1027	935.7173	719.8721	480.9250	315.3346	331.1487	518.4853	787.1196	1053.5085	1279.7503	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	661.0925	527.8379	444.9621	249.9518	103.7965	0.0000	0.0000	0.0000	0.0000	268.5641	480.9927	672.4188	(98)
Space heating												3409.6164	(98)
Space heating per m2											(98) / (4) =	44.5643	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	790.9536	622.6656	638.1720	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8736	0.9314	0.9046	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	690.9666	579.9511	577.2924	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	863.9491	824.9129	764.5725	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	124.5474	182.2515	139.3364	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												446.1353	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   31.1369   45.5629   34.8341    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          111.5338 (107)
Space cooling per m2                                                                                                     1.4578 (108)
Energy for space heating                                                                                                44.5643 (99)
Energy for space cooling                                                                                                 1.4578 (108)
Total                                                                                                                   46.0221 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                     52.9 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.0600	
Infiltration rate		0.2662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2262	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2375	0.2206	0.2262	0.2149	0.2149	0.2093	0.2036	0.1980	0.1923	0.2093	0.1980	0.2093	(22b)
Effective ac	0.5282	0.5243	0.5256	0.5231	0.5231	0.5219	0.5207	0.5196	0.5185	0.5219	0.5196	0.5219	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.5211	(36)
Total fabric heat loss (33) + (36) =	56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8074	30.5807	30.6544	30.5089	30.5089	30.4389	30.3708	30.3046	30.2402	30.4389	30.3046	30.4389	(38)
Heat transfer coeff	86.8984	86.6717	86.7454	86.5999	86.5999	86.5299	86.4618	86.3956	86.3312	86.5299	86.3956	86.5299	(39)
Average = Sum(39)m / 12 =												86.5575	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1358	1.1328	1.1338	1.1319	1.1319	1.1310	1.1301	1.1292	1.1284	1.1310	1.1292	1.1310	(40)
HLP (average)												1.1313	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3933 (42)
Average daily hot water use (litres/day)	91.0410 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
RHI water heating demand												1571	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
East	6.4400	25.1925	0.7400	0.7000	0.7700	58.2399	(76)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	97.9339	163.7448	273.9728	406.1290	477.1784	532.8285	502.3779	438.9774	337.8604	210.1884	121.8492	79.0905	(83)
Total gains	637.1245	698.5398	787.8553	887.7087	925.7835	951.9294	904.2854	849.0907	766.6159	671.4547	619.1782	603.6087	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1426	61.3025	61.2504	61.3533	61.3533	61.4030	61.4513	61.4984	61.5443	61.4030	61.4984	61.4030	
alpha	5.0762	5.0868	5.0834	5.0902	5.0902	5.0935	5.0968	5.0999	5.1030	5.0935	5.0999	5.0935	
util living area													
	0.9899	0.9833	0.9581	0.8799	0.7277	0.5092	0.3714	0.3947	0.6687	0.9108	0.9786	0.9917	(86)
MIT	20.0543	20.1703	20.4341	20.7354	20.9232	20.9895	20.9983	20.9977	20.9615	20.7301	20.3520	20.0320	(87)
Th 2	19.9717	19.9741	19.9733	19.9749	19.9749	19.9756	19.9763	19.9771	19.9777	19.9756	19.9771	19.9756	(88)
util rest of house													
	0.9866	0.9780	0.9447	0.8447	0.6608	0.4219	0.2747	0.2923	0.5767	0.8747	0.9704	0.9890	(89)
MIT 2	18.7440	18.9125	19.2862	19.6912	19.9108	19.9702	19.9759	19.9764	19.9533	19.6964	19.1783	18.7148	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.2069	19.3569	19.6917	20.0601	20.2685	20.3303	20.3371	20.3373	20.3094	20.0616	19.5930	19.1801	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2069	19.3569	19.6917	20.0601	20.2685	20.3303	20.3371	20.3373	20.3094	20.0616	19.5930	19.1801	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9739	0.9403	0.8480	0.6810	0.4526	0.3090	0.3286	0.6079	0.8782	0.9664	0.9861	(94)
Useful gains	626.5079	680.3277	740.8209	752.7539	630.5019	430.8478	279.3948	279.0333	466.0545	589.6702	598.3872	595.2295	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1243.2480	1218.3332	1100.9513	914.5048	672.7476	435.2744	279.8852	279.6850	484.2707	749.4885	1010.2235	1227.0061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.8546	361.5397	267.9370	116.4607	31.4308	0.0000	0.0000	0.0000	0.0000	118.9048	296.5222	470.0418	(98)
Space heating												2121.6915	(98)
RHI space heating demand												2122	(98)

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.0600	
Infiltration rate		0.2662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2262	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2885	0.2828	0.2771	0.2489	0.2432	0.2149	0.2149	0.2093	0.2262	0.2432	0.2545	0.2658	(22b)
Effective ac	0.5416	0.5400	0.5384	0.5310	0.5296	0.5231	0.5231	0.5219	0.5256	0.5296	0.5324	0.5353	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5211	(36)
Total fabric heat loss					(33) + (36) =		56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5882	31.4940	31.4016	30.9678	30.8867	30.5089	30.5089	30.4389	30.6544	30.8867	31.0509	31.2225	(38)
Heat transfer coeff	87.6792	87.5850	87.4927	87.0589	86.9777	86.5999	86.5999	86.5299	86.7454	86.9777	87.1419	87.3136	(39)
Average = Sum(39)m / 12 =												87.0585	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1460	1.1448	1.1435	1.1379	1.1368	1.1319	1.1319	1.1310	1.1338	1.1368	1.1390	1.1412	(40)
HLP (average)												1.1379	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	11.2829	0.7400	0.7000	0.7700	7.5335	(75)
East	6.4400	19.6403	0.7400	0.7000	0.7700	45.4042	(76)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	76.2744	149.8064	249.0840	368.3535	456.8150	470.2192	446.5910	379.8575	291.2277	178.3022	95.1909	62.6814	(83)
Total gains	615.4650	684.6015	762.9665	849.9332	905.4201	889.3201	848.4985	789.9708	719.9832	639.5685	592.5199	587.1995	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5981	60.6633	60.7273	61.0299	61.0868	61.3533	61.3533	61.4030	61.2504	61.0868	60.9717	60.8519	
alpha	5.0399	5.0442	5.0485	5.0687	5.0725	5.0902	5.0902	5.0935	5.0834	5.0725	5.0648	5.0568	
util living area													
	0.9926	0.9864	0.9679	0.9106	0.7849	0.6008	0.4448	0.4961	0.7501	0.9425	0.9862	0.9941	(86)
MIT	19.9518	20.0971	20.3485	20.6562	20.8792	20.9755	20.9956	20.9925	20.9280	20.6287	20.2289	19.9142	(87)
Th 2	19.9635	19.9645	19.9654	19.9700	19.9709	19.9749	19.9749	19.9756	19.9733	19.9709	19.9691	19.9673	(88)
util rest of house													
	0.9903	0.9821	0.9576	0.8829	0.7270	0.5140	0.3435	0.3896	0.6670	0.9183	0.9810	0.9922	(89)
MIT 2	18.5891	18.8000	19.1600	19.5857	19.8607	19.9598	19.9734	19.9728	19.9206	19.5605	18.9960	18.5374	(90)
Living area fraction									fLA = Living area / (4) =			0.3533	(91)
MIT	19.0705	19.2582	19.5799	19.9639	20.2205	20.3186	20.3345	20.3330	20.2765	19.9379	19.4315	19.0238	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0705	19.2582	19.5799	19.9639	20.2205	20.3186	20.3345	20.3330	20.2765	19.9379	19.4315	19.0238	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9875	0.9782	0.9529	0.8828	0.7421	0.5440	0.3794	0.4274	0.6934	0.9174	0.9774	0.9899	(94)
Useful gains	607.7786	669.7066	727.0278	750.2810	671.8779	483.7586	321.9270	337.6503	499.2015	586.7329	579.1225	581.2553	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1295.0673	1257.5670	1144.3916	963.2102	741.0923	495.2298	323.4070	340.3228	535.7835	812.1862	1074.5946	1294.3223	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	511.3428	395.0422	310.5186	153.3090	51.4955	0.0000	0.0000	0.0000	0.0000	167.7372	356.7399	530.5219	(98)
Space heating												2476.7072	(98)
Space heating per m2											(98) / (4) =	32.3710	(99)

8c. Space cooling requirement

Not applicable

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9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2665.9926	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	511.3428	395.0422	310.5186	153.3090	51.4955	0.0000	0.0000	0.0000	0.0000	167.7372	356.7399	530.5219	(98)
Space heating efficiency (main heating system 1)													
	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)													
	550.4228	425.2338	334.2504	165.0258	55.4311	0.0000	0.0000	0.0000	0.0000	180.5568	384.0042	571.0677	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1149	89.0376	88.8521	88.4138	87.6159	86.7000	86.7000	86.7000	86.7000	88.4556	88.9565	89.1537	(217)
Fuel for water heating, kWh/month													
	179.9038	157.8463	164.1011	145.0264	141.3611	124.6671	116.9021	132.1820	133.1766	150.4575	161.7066	174.5615	(219)
Water heating fuel used												1781.8919	(219)
Annual totals kWh/year													
Space heating fuel - main system												2665.9926	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4622.3612	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2665.9926	3.4800	92.7765	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1781.8919	3.4800	62.0098	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	351.9735	13.1900	46.4253	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			331.1042	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1445	(257)
SAP value		84.0347	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2665.9926	0.2160	575.8544	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1781.8919	0.2160	384.8887	(264)
Space and water heating			960.7431	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total kg/year			1051.2964	(272)
CO2 emissions per m2			13.7400	(273)
EI value			88.4064	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.8990 = 3.871, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.8990 = 0.2403, stars = 4
Water heating energy efficiency	3.48 / 0.8803 = 3.953, stars = 4
Water heating environmental impact	0.216 / 0.8803 = 0.2454, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.5100 (1b)	x	2.3100 (2b)	=	176.7381	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	176.7381	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1132	(8)
Pressure test		Yes	
Measured/design AP50		3.0600	
Infiltration rate		0.2662	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2262	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.2375	0.2206	0.2262	0.2149	0.2149	0.2093	0.2036	0.1980	0.1923	0.2093	0.1980	0.2093	(22b)
Effective ac	0.5282	0.5243	0.5256	0.5231	0.5231	0.5219	0.5207	0.5196	0.5185	0.5219	0.5196	0.5219	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.6100	1.2357	14.3470			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Ground floor			76.5100	0.1900	14.5369			(28a)
External Wall	68.6000	13.7300	54.8700	0.2700	14.8149			(29a)
Communal Wall	15.3800		15.3800	0.2400	3.6912			(29a)
Total net area of external elements Aum(A, m2)			160.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.5700			(33)
Party Ceiling 1			76.5100					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5211	(36)
Total fabric heat loss					(33) + (36) =		56.0911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8074	30.5807	30.6544	30.5089	30.5089	30.4389	30.3708	30.3046	30.2402	30.4389	30.3046	30.4389	(38)
Heat transfer coeff	86.8984	86.6717	86.7454	86.5999	86.5999	86.5299	86.4618	86.3956	86.3312	86.5299	86.3956	86.5299	(39)
Average = Sum(39)m / 12 =												86.5575	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1358	1.1328	1.1338	1.1319	1.1319	1.1310	1.1301	1.1292	1.1284	1.1310	1.1292	1.1310	(40)
HLP (average)												1.1313	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3933	(42)
Average daily hot water use (litres/day)												91.0410	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.1451	96.5035	92.8619	89.2202	85.5786	81.9369	81.9369	85.5786	89.2202	92.8619	96.5035	100.1451	(44)
Energy conte	148.5124	129.8899	134.0347	116.8547	112.1249	96.7552	89.6579	102.8838	104.1126	121.3332	132.4446	143.8263	(45)
Energy content (annual)										Total = Sum(45)m =		1432.4301	(45)
Distribution loss (46)m = 0.15 x (45)m	22.2769	19.4835	20.1052	17.5282	16.8187	14.5133	13.4487	15.4326	15.6169	18.2000	19.8667	21.5739	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.8087	10.6527	11.7726	11.3686	11.7299	11.3311	11.6961	11.7180	11.3515	11.7549	11.4039	11.8017	(61)
Total heat required for water heating calculated for each month													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
								Total per year (kWh/year) = Sum(64)m =				1570.8200	(64)
Heat gains from water heating, kWh/month													
	52.3325	45.8516	47.5097	41.6963	40.2140	35.0039	32.7353	37.1384	37.4553	43.2820	46.8888	50.7727	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	143.5984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.8255	44.2546	35.9902	27.2469	20.3674	17.1950	18.5798	24.1507	32.4151	41.1584	48.0379	51.2103	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	316.4064	319.6897	311.4159	293.8019	271.5674	250.6701	236.7094	233.4261	241.6999	259.3139	281.5484	302.4457	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	51.7531	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	-95.7323	(71)
Water heating gains (Table 5)													
	70.3394	68.2315	63.8571	57.9116	54.0511	48.6165	43.9991	49.9172	52.0213	58.1747	65.1234	68.2428	(72)
Total internal gains													
	539.1906	534.7951	513.8825	481.5797	448.6051	419.1009	401.9075	410.1133	428.7555	461.2663	497.3290	524.5181	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.8600	14.6176	0.7400	0.7000	0.7700	9.7601	(75)
East	6.4400	25.1925	0.7400	0.7000	0.7700	58.2399	(76)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	97.9339	163.7448	273.9728	406.1290	477.1784	532.8285	502.3779	438.9774	337.8604	210.1884	121.8492	79.0905	(83)
Total gains	637.1245	698.5398	787.8553	887.7087	925.7835	951.9294	904.2854	849.0907	766.6159	671.4547	619.1782	603.6087	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.1426	61.3025	61.2504	61.3533	61.3533	61.4030	61.4513	61.4984	61.5443	61.4030	61.4984	61.4030	
alpha	5.0762	5.0868	5.0834	5.0902	5.0902	5.0935	5.0968	5.0999	5.1030	5.0935	5.0999	5.0935	
util living area													
	0.9899	0.9833	0.9581	0.8799	0.7277	0.5092	0.3714	0.3947	0.6687	0.9108	0.9786	0.9917	(86)
MIT	20.0543	20.1703	20.4341	20.7354	20.9232	20.9895	20.9983	20.9977	20.9615	20.7301	20.3520	20.0320	(87)
Th 2	19.9717	19.9741	19.9733	19.9749	19.9749	19.9756	19.9763	19.9771	19.9777	19.9756	19.9771	19.9756	(88)
util rest of house													
	0.9866	0.9780	0.9447	0.8447	0.6608	0.4219	0.2747	0.2923	0.5767	0.8747	0.9704	0.9890	(89)
MIT 2	18.7440	18.9125	19.2862	19.6912	19.9108	19.9702	19.9759	19.9764	19.9533	19.6964	19.1783	18.7148	(90)
Living area fraction										fLA = Living area / (4) =		0.3533	(91)
MIT	19.2069	19.3569	19.6917	20.0601	20.2685	20.3303	20.3371	20.3373	20.3094	20.0616	19.5930	19.1801	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2069	19.3569	19.6917	20.0601	20.2685	20.3303	20.3371	20.3373	20.3094	20.0616	19.5930	19.1801	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9739	0.9403	0.8480	0.6810	0.4526	0.3090	0.3286	0.6079	0.8782	0.9664	0.9861	(94)
Useful gains	626.5079	680.3277	740.8209	752.7539	630.5019	430.8478	279.3948	279.0333	466.0545	589.6702	598.3872	595.2295	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1243.2480	1218.3332	1100.9513	914.5048	672.7476	435.2744	279.8852	279.6850	484.2707	749.4885	1010.2235	1227.0061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.8546	361.5397	267.9370	116.4607	31.4308	0.0000	0.0000	0.0000	0.0000	118.9048	296.5222	470.0418	(98)
Space heating												2121.6915	(98)
Space heating per m2											(98) / (4) =	27.7309	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.9000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2283.8445	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	458.8546	361.5397	267.9370	116.4607	31.4308	0.0000	0.0000	0.0000	0.0000	118.9048	296.5222	470.0418	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	493.9232	389.1708	288.4145	125.3613	33.8329	0.0000	0.0000	0.0000	0.0000	127.9923	319.1842	505.9653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	160.3211	140.5426	145.8073	128.2233	123.8547	108.0864	101.3541	114.6018	115.4641	133.0881	143.8486	155.6280	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.0490	88.9807	88.7457	88.1942	87.3292	86.7000	86.7000	86.7000	86.7000	88.1811	88.8290	89.0822	(217)
Fuel for water heating, kWh/month	180.0369	157.9473	164.2980	145.3875	141.8252	124.6671	116.9021	132.1820	133.1766	150.9259	161.9387	174.7016	(219)
Water heating fuel used												1783.9887	(219)
Annual totals kWh/year													
Space heating fuel - main system												2283.8445	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9735	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 967 * 1.00) =												-286.1698	(233)
Total delivered energy for all uses												4208.6369	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2283.8445	7.3800	168.5477	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1783.9887	7.3800	131.6584	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	351.9735	28.6600	100.8756	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			529.5767	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2283.8445	0.2160	493.3104	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.9887	0.2160	385.3416	(264)
Space and water heating			878.6520	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	351.9735	0.5190	182.6742	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	0.5190	-148.5221	(269)
Total kg/year			951.7291	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2283.8445	1.2200	2786.2903	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1783.9887	1.2200	2176.4663	(264)
Space and water heating			4962.7566	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	351.9735	3.0700	1080.5586	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	3.0700	-878.5413	(269)
Primary energy kWh/year			5395.0238	(272)
Primary energy kWh/m2/year			70.5140	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 84
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£122	£122	£0
Mains gas	£407	£407	£0
Space heating	£297	£297	£0
Water heating	£132	£132	£0
Lighting	£101	£101	£0
Total cost of fuels	£529	£529	£0
Total cost of uses	£530	£530	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	71 kWh/m²	71 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	349.94 (P1)
Transmission heat loss coefficient	56.09 (37)
Summer heat loss coefficient	406.03 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.8600	106.0502	0.7400	0.7000	0.8865	81.5221
East	6.4400	125.2818	0.7400	0.7000	0.8865	333.4455
West	3.3100	125.2818	0.7400	0.7000	0.8865	171.3827
total:						586.3503

	Jun	Jul	Aug	
Solar gains	632	586	511	(P3)
Internal gains	416	399	407	
Total summer gains	1048	985	918	(P5)
Summer gain/loss ratio	2.58	2.43	2.26	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.23	19.98	19.81	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 674 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 674 - EPC	**Prop Type Ref**	
Property	31 Kittiwake Place, Boorley Green , Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	15.73	**TER**	18.91
Environmental	88 B	**% DER<TER**	16.81		
CO_2 Emissions (t/year)	0.95	**DFEE**	46.56	**TFEE**	52.93
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.03		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.91	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.73	$kgCO_2/m^2$	Pass
	-3.18 (-16.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.93	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.56	$kWh/m^2/yr$	
	-6.3 (-11.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.06 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 36 COMBI Combi boiler Efficiency: 89.0% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	1.86 m², No overhang
Windows facing East	6.44 m², No overhang
Windows facing West	3.31 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.06 (measured in this dwelling)	
Maximum	10.0	Pass

10 Key features

Thermal bridging y-value	0.034	W/m²K
Air permeability	3.1	m³/m²h
Photovoltaic array	0.37	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 675 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 675 - EPC	**Prop Type Ref**	
Property	33 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	17.40	**TER**	21.34
Environmental	89 B	**% DER<TER**	18.47		
CO_2 Emissions (t/year)	0.72	**DFEE**	51.19	**TFEE**	57.43
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Ground-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.34 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.40 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.21 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing East: 4.58 m², No overhang
Windows facing South: 1.08 m², No overhang
Windows facing West: 3.31 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 0.37 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3188	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4065	0.3985	0.3905	0.3507	0.3427	0.3029	0.3029	0.2949	0.3188	0.3427	0.3587	0.3746	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5587	0.5459	0.5459	0.5435	0.5508	0.5587	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	55.5100	10.0500	45.4600	0.2700	12.2742			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8375			(33)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.7596 (36)
Total fabric heat loss	(33) + (36) =	45.5971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.3655	23.2368	23.1107	22.5184	22.4076	21.8917	21.8917	21.7962	22.0904	22.4076	22.6318	22.8662	(38)
Heat transfer coeff	68.9625	68.8339	68.7078	68.1155	68.0046	67.4887	67.4887	67.3932	67.6875	68.0046	68.2288	68.4632	(39)
Average = Sum(39)m / 12 =												68.1149	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3108	1.3084	1.3060	1.2947	1.2926	1.2828	1.2828	1.2810	1.2866	1.2926	1.2969	1.3013	(40)
HLP (average)												1.2947	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	279.8918	278.1712	268.1774	252.1890	236.2165	220.6121	210.3395	215.2481	223.3420	239.5043	258.0610	271.7285	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438	(83)
Total gains	357.7669	424.5528	498.5864	577.7945	630.0308	622.3777	593.3381	547.0350	487.3652	410.0226	353.9920	336.5723	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9776	53.0766	53.1741	53.6365	53.7239	54.1345	54.1345	54.2113	53.9756	53.7239	53.5473	53.3640	
alpha	4.5318	4.5384	4.5449	4.5758	4.5816	4.6090	4.6090	4.6141	4.5984	4.5816	4.5698	4.5576	
util living area													
	0.9965	0.9920	0.9780	0.9317	0.8224	0.6487	0.4900	0.5481	0.8035	0.9637	0.9930	0.9974	(86)
MIT	19.6210	19.8079	20.1171	20.5028	20.8011	20.9509	20.9891	20.9822	20.8685	20.4569	19.9623	19.5850	(87)
Th 2	19.8324	19.8343	19.8361	19.8450	19.8466	19.8543	19.8543	19.8557	19.8514	19.8466	19.8433	19.8398	(88)
util rest of house													
	0.9954	0.9893	0.9703	0.9076	0.7644	0.5506	0.3678	0.4209	0.7189	0.9460	0.9902	0.9965	(89)
MIT 2	18.0160	18.2893	18.7365	19.2817	19.6621	19.8239	19.8507	19.8491	19.7520	19.2326	18.5218	17.9687	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	18.8016	19.0326	19.4123	19.8794	20.2196	20.3755	20.4079	20.4037	20.2985	19.8319	19.2269	18.7598	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8016	19.0326	19.4123	19.8794	20.2196	20.3755	20.4079	20.4037	20.2985	19.8319	19.2269	18.7598	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9868	0.9667	0.9084	0.7848	0.5971	0.4279	0.4835	0.7549	0.9457	0.9881	0.9953	(94)
Useful gains	355.5809	418.9417	481.9932	524.8899	494.4578	371.6118	253.8819	264.4764	367.9304	387.7590	349.7715	334.9869	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1000.0644	972.7989	887.1727	747.8650	579.3709	389.7811	256.9905	269.8211	419.5598	627.8096	827.4008	996.8112	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	479.4957	372.1921	301.4535	160.5420	63.1754	0.0000	0.0000	0.0000	0.0000	178.5976	343.8931	492.3973	(98)
Space heating												2391.7468	(98)
Space heating per m2											(98) / (4) =	45.4618	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2563.5014	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	479.4957	372.1921	301.4535	160.5420	63.1754	0.0000	0.0000	0.0000	0.0000	178.5976	343.8931	492.3973	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	513.9290	398.9197	323.1013	172.0708	67.7121	0.0000	0.0000	0.0000	0.0000	191.4230	368.5886	527.7570	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4790	89.3991	89.2212	88.8082	88.0144	86.7000	86.7000	86.7000	86.7000	88.8684	89.3278	89.5139	(217)
Fuel for water heating, kWh/month													
	151.9906	133.4121	138.8142	122.8227	119.8432	106.3715	99.9420	112.7293	113.4942	127.3881	136.7483	147.5439	(219)
Water heating fuel used												1511.0999	(219)
Annual totals kWh/year													
Space heating fuel - main system												2563.5014	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4142.6148	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2563.5014	0.2160	553.7163	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1511.0999	0.2160	326.3976	(264)
Space and water heating			880.1139	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total CO2, kg/year			915.4129	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.4000	ZC1
Total Floor Area	TFA	52.6100	
Assumed number of occupants	N	1.7671	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3468	ZC2
CO2 emissions from cooking, equation (L16)		3.0680	ZC3
Total CO2 emissions		37.8149	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.8149	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			10.0500	1.3258	13.3239			(27)
Ground floor			52.6100	0.1300	6.8393			(28a)
External Wall	55.5100	10.0500	45.4600	0.1800	8.1828			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.7134			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6947	(36)
Total fabric heat loss					(33) + (36) =		42.4080	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	66.5081	66.3509	66.1969	65.4732	65.3378	64.7076	64.7076	64.5908	64.9503	65.3378	65.6117	65.8981	(39)
Average = Sum(39)m / 12 =												65.4726	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2642	1.2612	1.2583	1.2445	1.2419	1.2299	1.2299	1.2277	1.2346	1.2419	1.2471	1.2526	(40)
HLP (average)												1.2445	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671	(42)
Average daily hot water use (litres/day)	76.1678	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	42.6957	37.1615	39.5905	36.8109	36.4854	33.8060	34.9328	36.4854	36.8109	39.5905	39.8159	42.6957	(61)
Total heat required for water heating calculated for each month													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
									Total per year (kWh/year) = Sum(64)m =			1655.2968	(64)
Heat gains from water heating, kWh/month													
	51.9871	45.4231	47.1834	41.7094	40.3122	35.3668	33.6742	37.7415	38.1647	43.6501	46.7974	50.6835	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	69.8751	67.5939	63.4185	57.9297	54.1831	49.1206	45.2611	50.7279	53.0066	58.6694	64.9964	68.1230	(72)
Total internal gains													
	290.2903	288.0529	277.5445	261.0427	244.5543	228.4351	218.1667	223.5898	232.2015	248.8773	267.9461	282.1294	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	3.1100	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	66.2991	124.6222	196.1590	277.2046	335.2743	342.0436	326.0663	282.4673	224.7764	145.1710	81.6710	55.2049	(83)
Total gains	356.5894	412.6751	473.7035	538.2474	579.8286	570.4788	544.2331	506.0571	456.9780	394.0483	349.6171	337.3342	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9327	55.0628	55.1910	55.8010	55.9166	56.4613	56.4613	56.5633	56.2502	55.9166	55.6832	55.4413	
alpha	4.6622	4.6709	4.6794	4.7201	4.7278	4.7641	4.7641	4.7709	4.7500	4.7278	4.7122	4.6961	
util living area													
	0.9966	0.9927	0.9811	0.9419	0.8442	0.6746	0.5115	0.5671	0.8179	0.9666	0.9932	0.9974	(86)
MIT	19.6791	19.8477	20.1332	20.4994	20.7925	20.9484	20.9888	20.9822	20.8692	20.4757	20.0094	19.6495	(87)
Th 2	19.8690	19.8714	19.8737	19.8846	19.8866	19.8961	19.8961	19.8979	19.8924	19.8866	19.8825	19.8782	(88)
util rest of house													
	0.9954	0.9903	0.9743	0.9209	0.7905	0.5784	0.3891	0.4411	0.7375	0.9503	0.9905	0.9965	(89)
MIT 2	18.1260	18.3729	18.7872	19.3100	19.6898	19.8633	19.8922	19.8909	19.7915	19.2892	18.6175	18.0892	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	18.8862	19.0948	19.4460	19.8921	20.2296	20.3944	20.4290	20.4250	20.3190	19.8699	19.2987	18.8529	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8862	19.0948	19.4460	19.8921	20.2296	20.3944	20.4290	20.4250	20.3190	19.8699	19.2987	18.8529	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9880	0.9711	0.9210	0.8087	0.6238	0.4493	0.5031	0.7715	0.9500	0.9885	0.9953	(94)
Useful gains	354.4599	407.7162	460.0102	495.7375	468.8883	355.8410	244.5510	254.5952	352.5743	374.3265	345.6076	335.7580	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	970.1002	941.8363	856.9851	719.6914	557.3027	374.9419	247.7632	259.9803	403.9250	605.6759	800.3802	965.5980	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.0364	358.9287	295.3493	161.2468	65.7803	0.0000	0.0000	0.0000	0.0000	172.1239	327.4363	468.6010	(98)
Space heating												2307.5028	(98)
Space heating per m2											(98) / (4) =	43.8605	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2470.5598	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	458.0364	358.9287	295.3493	161.2468	65.7803	0.0000	0.0000	0.0000	0.0000	172.1239	327.4363	468.6010	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	490.4030	384.2920	316.2198	172.6411	70.4286	0.0000	0.0000	0.0000	0.0000	184.2869	350.5742	501.7141	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4615	87.2302	86.6991	85.5074	83.4271	80.3000	80.3000	80.3000	80.3000	85.5525	86.9541	87.5575	(217)
Fuel for water heating, kWh/month													
	190.8792	167.1800	175.0054	157.3844	156.1754	142.9071	136.9159	152.6291	154.3147	164.9298	173.2216	186.1921	(219)
Water heating fuel used												1957.7346	(219)
Annual totals kWh/year													
Space heating fuel - main system												2470.5598	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Total delivered energy for all uses												4748.8047	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2470.5598	0.2160	533.6409	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1957.7346	0.2160	422.8707	(264)
Space and water heating			956.5116	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Total CO2, kg/m2/year			1122.8565	(272)
Emissions per m2 for space and water heating			18.1812	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4220	(272b)
Emissions per m2 for pumps and fans			0.7399	(272c)
Target Carbon Dioxide Emission Rate (TER) = (18.1812 * 1.00) + 2.4220 + 0.7399, rounded to 2 d.p.			21.3400	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3188	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4065	0.3985	0.3905	0.3507	0.3427	0.3029	0.3029	0.2949	0.3188	0.3427	0.3587	0.3746	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5587	0.5459	0.5459	0.5435	0.5508	0.5587	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	55.5100	10.0500	45.4600	0.2700	12.2742			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8375			(33)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.7596 (36)
Total fabric heat loss	(33) + (36) =	45.5971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.3655	23.2368	23.1107	22.5184	22.4076	21.8917	21.8917	21.7962	22.0904	22.4076	22.6318	22.8662	(38)
Heat transfer coeff	68.9625	68.8339	68.7078	68.1155	68.0046	67.4887	67.4887	67.3932	67.6875	68.0046	68.2288	68.4632	(39)
Average = Sum(39)m / 12 =												68.1149	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3108	1.3084	1.3060	1.2947	1.2926	1.2828	1.2828	1.2810	1.2866	1.2926	1.2969	1.3013	(40)
HLP (average)												1.2947	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	252.9033	251.8226	243.1545	228.9671	214.1642	200.2055	191.3301	194.4467	201.9027	216.2013	232.6532	245.3747	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438	(83)
Total gains	330.7784	398.2042	473.5635	554.5725	607.9785	601.9711	574.3286	526.2337	465.9258	386.7196	328.5842	310.2185	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9776	53.0766	53.1741	53.6365	53.7239	54.1345	54.1345	54.2113	53.9756	53.7239	53.5473	53.3640	
alpha	4.5318	4.5384	4.5449	4.5758	4.5816	4.6090	4.6090	4.6141	4.5984	4.5816	4.5698	4.5576	
util living area													
	0.9975	0.9938	0.9818	0.9400	0.8366	0.6656	0.5048	0.5669	0.8224	0.9705	0.9948	0.9981	(86)
MIT	19.5749	19.7638	20.0778	20.4732	20.7846	20.9455	20.9877	20.9796	20.8539	20.4224	19.9195	19.5398	(87)
Th 2	19.8324	19.8343	19.8361	19.8450	19.8466	19.8543	19.8543	19.8557	19.8514	19.8466	19.8433	19.8398	(88)
util rest of house													
	0.9966	0.9917	0.9753	0.9181	0.7807	0.5668	0.3796	0.4368	0.7407	0.9555	0.9927	0.9975	(89)
MIT 2	18.5464	18.7358	19.0473	19.4339	19.7085	19.8310	19.8515	19.8504	19.7744	19.3955	18.8987	18.5172	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.0498	19.2390	19.5517	19.9426	20.2352	20.3765	20.4076	20.4031	20.3028	19.8981	19.3983	19.0177	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0498	19.2390	19.5517	19.9426	20.2352	20.3765	20.4076	20.4031	20.3028	19.8981	19.3983	19.0177	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9902	0.9733	0.9203	0.8013	0.6139	0.4413	0.5009	0.7761	0.9564	0.9916	0.9969	(94)
Useful gains	329.4022	394.3183	460.9238	510.3684	487.1745	369.5220	253.4463	263.6124	361.6229	369.8463	325.8140	309.2445	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1017.1816	987.0058	896.7523	752.1707	580.4356	389.8463	256.9723	269.7829	419.8489	632.3152	839.1000	1014.4672	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	511.7078	398.2860	324.2564	174.0977	69.3863	0.0000	0.0000	0.0000	0.0000	195.2769	369.5659	524.6857	(98)
Space heating												2567.2627	(98)
Space heating per m2											(98) / (4) =	48.7980	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	634.3942	499.4167	512.1884	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8913	0.9395	0.9167	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	565.4259	469.1926	469.5441	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	770.2977	736.7195	681.5228	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	147.5077	199.0400	157.7122	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												504.2599 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	36.8769	49.7600	39.4280	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												126.0650 (107)
Space cooling per m2												2.3962 (108)
Energy for space heating												48.7980 (99)
Energy for space cooling												2.3962 (108)
Total												51.1942 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.2 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			10.0500	1.3258	13.3239			(27)
Ground floor			52.6100	0.1300	6.8393			(28a)
External Wall	55.5100	10.0500	45.4600	0.1800	8.1828			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.7134			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	9.6947	(36)
Total fabric heat loss (33) + (36) =	42.4080	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	66.5081	66.3509	66.1969	65.4732	65.3378	64.7076	64.7076	64.5908	64.9503	65.3378	65.6117	65.8981	(39)
Average = Sum(39)m / 12 =												65.4726	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2642	1.2612	1.2583	1.2445	1.2419	1.2299	1.2299	1.2277	1.2346	1.2419	1.2471	1.2526	(40)
HLP (average)												1.2445	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	252.9033	251.8226	243.1545	228.9671	214.1642	200.2055	191.3301	194.4467	201.9027	216.2013	232.6532	245.3747	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	3.3100	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	66.2991	124.6222	196.1590	277.2046	335.2743	342.0436	326.0663	282.4673	224.7764	145.1710	81.6710	55.2049	(83)
Total gains	319.2024	376.4448	439.3135	506.1717	549.4386	542.2492	517.3964	476.9140	426.6791	361.3722	314.3242	300.5796	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9327	55.0628	55.1910	55.8010	55.9166	56.4613	56.4613	56.5633	56.2502	55.9166	55.6832	55.4413	
alpha	4.6622	4.6709	4.6794	4.7201	4.7278	4.7641	4.7641	4.7709	4.7500	4.7278	4.7122	4.6961	
util living area													
	0.9979	0.9950	0.9858	0.9528	0.8642	0.7004	0.5354	0.5967	0.8457	0.9757	0.9957	0.9984	(86)
MIT	19.6147	19.7863	20.0778	20.4560	20.7668	20.9395	20.9865	20.9779	20.8465	20.4260	19.9492	19.5858	(87)
Th 2	19.8690	19.8714	19.8737	19.8846	19.8866	19.8961	19.8961	19.8979	19.8924	19.8866	19.8825	19.8782	(88)
util rest of house													
	0.9971	0.9933	0.9807	0.9348	0.8142	0.6039	0.4086	0.4666	0.7704	0.9632	0.9938	0.9978	(89)
MIT 2	18.6148	18.7875	19.0781	19.4528	19.7329	19.8693	19.8929	19.8919	19.8089	19.4324	18.9593	18.5933	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.1042	19.2764	19.5674	19.9439	20.2389	20.3931	20.4281	20.4234	20.3168	19.9187	19.4438	19.0791	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1042	19.2764	19.5674	19.9439	20.2389	20.3931	20.4281	20.4234	20.3168	19.9187	19.4438	19.0791	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9921	0.9789	0.9360	0.8317	0.6496	0.4712	0.5308	0.8025	0.9637	0.9929	0.9973	(94)
Useful gains	318.0702	373.4671	430.0389	473.7525	456.9518	352.2316	243.7890	253.1453	342.4307	348.2414	312.0905	299.7703	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	984.6002	953.8851	865.0214	723.0768	557.9158	374.8588	247.7092	259.8780	403.7815	608.8656	809.8995	980.5027	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	495.8983	390.0409	323.6270	179.5136	75.1172	0.0000	0.0000	0.0000	0.0000	193.9044	358.4225	506.4649	(98)
Space heating												2522.9888	(98)
Space heating per m2											(98) / (4) =	47.9564	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	608.2510	478.8359	490.8904	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8793	0.9328	0.9094	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	534.8464	446.6418	446.3940	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	700.4929	670.1753	623.8764	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	119.2655	166.3089	132.0469	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												417.6213	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   29.8164   41.5772   33.0117    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          104.4053 (107)
Space cooling per m2                                                                                                     1.9845 (108)
Energy for space heating                                                                                                47.9564 (99)
Energy for space cooling                                                                                                 1.9845 (108)
Total                                                                                                                   49.9410 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                  57.4 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3188	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3347	0.3108	0.3188	0.3029	0.3029	0.2949	0.2869	0.2790	0.2710	0.2949	0.2790	0.2949	(22b)
Effective ac	0.5560	0.5483	0.5508	0.5459	0.5459	0.5435	0.5412	0.5389	0.5367	0.5435	0.5389	0.5435	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	55.5100	10.0500	45.4600	0.2700	12.2742			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8375			(33)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.7596 (36)
Total fabric heat loss	(33) + (36) =	45.5971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.2993	21.9898	22.0904	21.8917	21.8917	21.7962	21.7032	21.6127	21.5248	21.7962	21.6127	21.7962	(38)
Heat transfer coeff	67.8964	67.5868	67.6875	67.4887	67.4887	67.3932	67.3002	67.2098	67.1219	67.3932	67.2098	67.3932	(39)
Average = Sum(39)m / 12 =												67.4308	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2906	1.2847	1.2866	1.2828	1.2828	1.2810	1.2792	1.2775	1.2758	1.2810	1.2775	1.2810	(40)
HLP (average)												1.2817	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
RHI water heating demand												1336	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	98.5843	157.8956	250.6619	356.1887	409.1467	453.2756	428.7700	380.8380	303.3225	198.5098	121.0948	80.6585	(83)
Total gains	508.3880	564.4343	641.7645	723.4210	752.1969	774.3838	736.8383	695.3593	631.3799	550.6115	499.9628	479.5316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8095	54.0560	53.9756	54.1345	54.1345	54.2113	54.2862	54.3592	54.4304	54.2113	54.3592	54.2113	
alpha	4.5873	4.6037	4.5984	4.6090	4.6090	4.6141	4.6191	4.6239	4.6287	4.6141	4.6239	4.6141	
util living area													
	0.9838	0.9736	0.9394	0.8493	0.6962	0.4860	0.3543	0.3744	0.6311	0.8812	0.9671	0.9867	(86)
MIT	19.9679	20.1087	20.3995	20.7182	20.9129	20.9864	20.9975	20.9969	20.9574	20.7179	20.3075	19.9449	(87)
Th 2	19.8482	19.8529	19.8514	19.8543	19.8543	19.8557	19.8571	19.8585	19.8598	19.8557	19.8585	19.8557	(88)
util rest of house													
	0.9786	0.9654	0.9208	0.8072	0.6233	0.3931	0.2515	0.2662	0.5326	0.8357	0.9548	0.9823	(89)
MIT 2	18.5292	18.7334	19.1398	19.5611	19.7841	19.8491	19.8565	19.8577	19.8341	19.5756	19.0245	18.5019	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2334	19.4065	19.7563	20.1274	20.3366	20.4058	20.4150	20.4153	20.3839	20.1347	19.6525	19.2082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2334	19.4065	19.7563	20.1274	20.3366	20.4058	20.4150	20.4153	20.3839	20.1347	19.6525	19.2082	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9614	0.9190	0.8182	0.6553	0.4384	0.3019	0.3193	0.5796	0.8482	0.9520	0.9790	(94)
Useful gains	495.7015	542.6681	589.7881	591.8785	492.9280	339.5166	222.4738	222.0327	365.9371	467.0212	475.9895	469.4773	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	973.1826	953.4142	863.4442	717.2322	528.8798	344.0942	223.0985	222.8188	381.5159	588.6594	789.8810	957.5351	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	355.2460	276.0214	203.6002	90.2547	26.7481	0.0000	0.0000	0.0000	0.0000	90.4988	226.0019	363.1150	(98)
Space heating												1631.4860	(98)
RHI space heating demand												1631	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3188	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4065	0.3985	0.3905	0.3507	0.3427	0.3029	0.3029	0.2949	0.3188	0.3427	0.3587	0.3746	(22b)
Effective ac	0.5826	0.5794	0.5763	0.5615	0.5587	0.5459	0.5459	0.5435	0.5508	0.5587	0.5643	0.5702	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	55.5100	10.0500	45.4600	0.2700	12.2742			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8375			(33)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.7596	(36)
Total fabric heat loss (33) + (36) =	45.5971	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.3655	23.2368	23.1107	22.5184	22.4076	21.8917	21.8917	21.7962	22.0904	22.4076	22.6318	22.8662	(38)
Heat transfer coeff	68.9625	68.8339	68.7078	68.1155	68.0046	67.4887	67.4887	67.3932	67.6875	68.0046	68.2288	68.4632	(39)
Average = Sum(39)m / 12 =												68.1149	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3108	1.3084	1.3060	1.2947	1.2926	1.2828	1.2828	1.2810	1.2866	1.2926	1.2969	1.3013	(40)
HLP (average)												1.2947	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438	(83)
Total gains	487.6788	552.9203	621.5116	692.8378	736.8644	722.8737	691.0668	646.3082	592.0806	522.6200	474.7990	463.7169	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.9776	53.0766	53.1741	53.6365	53.7239	54.1345	54.1345	54.2113	53.9756	53.7239	53.5473	53.3640	
alpha	4.5318	4.5384	4.5449	4.5758	4.5816	4.6090	4.6090	4.6141	4.5984	4.5816	4.5698	4.5576	
util living area													
	0.9882	0.9782	0.9525	0.8839	0.7530	0.5738	0.4247	0.4711	0.7127	0.9199	0.9784	0.9904	(86)
MIT	19.8384	20.0156	20.2982	20.6316	20.8651	20.9701	20.9939	20.9904	20.9215	20.6059	20.1588	19.7997	(87)
Th 2	19.8324	19.8343	19.8361	19.8450	19.8466	19.8543	19.8543	19.8557	19.8514	19.8466	19.8433	19.8398	(88)
util rest of house													
	0.9844	0.9714	0.9376	0.8494	0.6884	0.4810	0.3167	0.3583	0.6213	0.8876	0.9704	0.9874	(89)
MIT 2	18.3309	18.5868	18.9882	19.4449	19.7276	19.8367	19.8524	19.8523	19.7967	19.4263	18.8025	18.2803	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.0687	19.2861	19.6294	20.0257	20.2843	20.3914	20.4111	20.4093	20.3472	20.0037	19.4663	19.0240	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0687	19.2861	19.6294	20.0257	20.2843	20.3914	20.4111	20.4093	20.3472	20.0037	19.4663	19.0240	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9812	0.9673	0.9345	0.8554	0.7144	0.5256	0.3697	0.4137	0.6630	0.8927	0.9671	0.9845	(94)
Useful gains	478.4916	534.8611	580.7995	592.6387	526.4129	379.9593	255.5031	267.3688	392.5457	466.5604	459.1600	456.5325	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1018.4906	990.2516	902.0902	757.8334	583.7730	390.8572	257.2071	270.2017	422.8573	639.4944	843.7399	1014.8985	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	401.7592	306.0224	239.0403	118.9402	42.6759	0.0000	0.0000	0.0000	0.0000	128.6629	276.8975	415.4243	(98)
Space heating												1929.4227	(98)
Space heating per m2											(98) / (4) =	36.6741	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2067.9772	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	401.7592	306.0224	239.0403	118.9402	42.6759	0.0000	0.0000	0.0000	0.0000	128.6629	276.8975	415.4243	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	430.6101	327.9983	256.2061	127.4814	45.7405	0.0000	0.0000	0.0000	0.0000	137.9023	296.7819	445.2565	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3616	89.2606	89.0382	88.5413	87.7072	86.7000	86.7000	86.7000	86.7000	88.5785	89.1666	89.4045	(217)
Fuel for water heating, kWh/month													
	152.1903	133.6192	139.0994	123.1929	120.2629	106.3715	99.9420	112.7293	113.4942	127.8050	136.9955	147.7245	(219)
Water heating fuel used												1513.4266	(219)
Annual totals kWh/year													
Space heating fuel - main system												2067.9772	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												3649.4172	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2067.9772	3.4800	71.9656	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1513.4266	3.4800	52.6672	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	245.5103	13.1900	32.3828	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			286.9082	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2345	(257)
SAP value		82.7785	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2067.9772	0.2160	446.6831	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1513.4266	0.2160	326.9001	(264)
Space and water heating			773.5832	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total kg/year			808.8822	(272)
CO2 emissions per m2			15.3800	(273)
EI value			88.8956	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8815 = 3.948, stars = 4
Water heating environmental impact	0.216 / 0.8815 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.2100	
Infiltration rate		0.3751	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3188	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3347	0.3108	0.3188	0.3029	0.3029	0.2949	0.2869	0.2790	0.2710	0.2949	0.2790	0.2949	(22b)
Effective ac	0.5560	0.5483	0.5508	0.5459	0.5459	0.5435	0.5412	0.5389	0.5367	0.5435	0.5389	0.5435	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	55.5100	10.0500	45.4600	0.2700	12.2742			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8375			(33)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.7596 (36)
Total fabric heat loss	(33) + (36) =	45.5971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.2993	21.9898	22.0904	21.8917	21.8917	21.7962	21.7032	21.6127	21.5248	21.7962	21.6127	21.7962	(38)
Heat transfer coeff	67.8964	67.5868	67.6875	67.4887	67.4887	67.3932	67.3002	67.2098	67.1219	67.3932	67.2098	67.3932	(39)
Average = Sum(39)m / 12 =												67.4308	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2906	1.2847	1.2866	1.2828	1.2828	1.2810	1.2792	1.2775	1.2758	1.2810	1.2775	1.2810	(40)
HLP (average)												1.2817	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	98.5843	157.8956	250.6619	356.1887	409.1467	453.2756	428.7700	380.8380	303.3225	198.5098	121.0948	80.6585	(83)
Total gains	508.3880	564.4343	641.7645	723.4210	752.1969	774.3838	736.8383	695.3593	631.3799	550.6115	499.9628	479.5316	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.8095	54.0560	53.9756	54.1345	54.1345	54.2113	54.2862	54.3592	54.4304	54.2113	54.3592	54.2113	
alpha	4.5873	4.6037	4.5984	4.6090	4.6090	4.6141	4.6191	4.6239	4.6287	4.6141	4.6239	4.6141	
util living area													
	0.9838	0.9736	0.9394	0.8493	0.6962	0.4860	0.3543	0.3744	0.6311	0.8812	0.9671	0.9867	(86)
MIT	19.9679	20.1087	20.3995	20.7182	20.9129	20.9864	20.9975	20.9969	20.9574	20.7179	20.3075	19.9449	(87)
Th 2	19.8482	19.8529	19.8514	19.8543	19.8543	19.8557	19.8571	19.8585	19.8598	19.8557	19.8585	19.8557	(88)
util rest of house													
	0.9786	0.9654	0.9208	0.8072	0.6233	0.3931	0.2515	0.2662	0.5326	0.8357	0.9548	0.9823	(89)
MIT 2	18.5292	18.7334	19.1398	19.5611	19.7841	19.8491	19.8565	19.8577	19.8341	19.5756	19.0245	18.5019	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2334	19.4065	19.7563	20.1274	20.3366	20.4058	20.4150	20.4153	20.3839	20.1347	19.6525	19.2082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2334	19.4065	19.7563	20.1274	20.3366	20.4058	20.4150	20.4153	20.3839	20.1347	19.6525	19.2082	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9614	0.9190	0.8182	0.6553	0.4384	0.3019	0.3193	0.5796	0.8482	0.9520	0.9790	(94)
Useful gains	495.7015	542.6681	589.7881	591.8785	492.9280	339.5166	222.4738	222.0327	365.9371	467.0212	475.9895	469.4773	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	973.1826	953.4142	863.4442	717.2322	528.8798	344.0942	223.0985	222.8188	381.5159	588.6594	789.8810	957.5351	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	355.2460	276.0214	203.6002	90.2547	26.7481	0.0000	0.0000	0.0000	0.0000	90.4988	226.0019	363.1150	(98)
Space heating												1631.4860	(98)
Space heating per m2											(98) / (4) =	31.0109	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1748.6452	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	355.2460	276.0214	203.6002	90.2547	26.7481	0.0000	0.0000	0.0000	0.0000	90.4988	226.0019	363.1150	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	380.7567	295.8428	218.2210	96.7360	28.6690	0.0000	0.0000	0.0000	0.0000	96.9977	242.2314	389.1908	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2738	89.1827	88.9038	88.2938	87.4049	86.7000	86.7000	86.7000	86.7000	88.2633	89.0033	89.3109	(217)
Fuel for water heating, kWh/month													
	152.3401	133.7359	139.3097	123.5382	120.6789	106.3715	99.9420	112.7293	113.4942	128.2615	137.2468	147.8793	(219)
Water heating fuel used												1515.5273	(219)
Annual totals kWh/year													
Space heating fuel - main system												1748.6452	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 967 * 1.00) =												-286.1698	(233)
Total delivered energy for all uses												3298.5131	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1748.6452	7.3800	129.0500	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1515.5273	7.3800	111.8459	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	245.5103	28.6600	70.3633	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			439.7542	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1748.6452	0.2160	377.7074	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1515.5273	0.2160	327.3539	(264)
Space and water heating			705.0613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	0.5190	-148.5221	(269)
Total kg/year			722.8840	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1748.6452	1.2200	2133.3472	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1515.5273	1.2200	1848.9433	(264)
Space and water heating			3982.2905	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	245.5103	3.0700	753.7168	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	3.0700	-878.5413	(269)
Primary energy kWh/year			4087.7159	(272)
Primary energy kWh/m2/year			77.6985	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£92	£92	£0
Mains gas	£348	£348	£0
Space heating	£258	£258	£0
Water heating	£112	£112	£0
Lighting	£70	£70	£0
Total cost of fuels	£440	£440	£0
Total cost of uses	£440	£440	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	78 kWh/m²	78 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	240.63 (P1)
Transmission heat loss coefficient	45.60 (37)
Summer heat loss coefficient	286.22 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	4.5800	125.2818	0.7400	0.7000	0.8865	237.1398
South	1.0800	118.5567	0.7400	0.7000	0.8865	52.9177
West	3.3100	125.2818	0.7400	0.7000	0.8865	171.3827
total:						500.3486

	Jun	Jul	Aug	
Solar gains	538	500	443	(P3)
Internal gains	318	305	312	
Total summer gains	856	805	755	(P5)
Summer gain/loss ratio	2.99	2.81	2.64	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.64	20.36	20.19	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 675 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 675 - EPC	**Prop Type Ref**	
Property	33 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	17.40	**TER**	21.34
Environmental	89 B	**% DER<TER**	18.47		
CO_2 Emissions (t/year)	0.72	**DFEE**	51.19	**TFEE**	57.43
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.86		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	21.34	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	17.40	$kgCO_2/m^2$	Pass
	-3.94 (-18.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.43	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	51.19	$kWh/m^2/yr$	
	-6.2 (-10.8%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.08 m², No overhang
Windows facing East	4.58 m², No overhang
Windows facing South	1.08 m², No overhang
Windows facing West	3.31 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.21 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.039	W/m²K
Photovoltaic array	0.37	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 676 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 676 - EPC	**Prop Type Ref**	
Property	35 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	13.77	**TER**	20.39
Environmental	91 B	**% DER<TER**	32.45		
CO_2 Emissions (t/year)	0.52	**DFEE**	45.94	**TFEE**	52.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.59		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Ground-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.39 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.85 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing East: 4.58 m², No overhang
Windows facing South: 1.08 m², No overhang
Windows facing West: 3.31 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.039 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2883	0.2883	0.2807	0.3035	0.3263	0.3414	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 4			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	40.1300	10.0500	30.0800	0.2700	8.1216			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.6849			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2578	(36)
Total fabric heat loss (33) + (36) =	40.9427	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	22.9385	22.8242	22.2874	22.1869	21.7194	21.7194	21.6328	21.8995	22.1869	22.3901	22.6026	(38)
Heat transfer coeff	63.9978	63.8812	63.7669	63.2301	63.1296	62.6620	62.6620	62.5755	62.8421	63.1296	63.3328	63.5452	(39)
Average = Sum(39)m / 12 =												63.2296	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2165	1.2142	1.2121	1.2019	1.2000	1.1911	1.1911	1.1894	1.1945	1.2000	1.2038	1.2079	(40)
HLP (average)												1.2019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	279.8918	278.1712	268.1774	252.1890	236.2165	220.6121	210.3395	215.2481	223.3420	239.5043	258.0610	271.7285	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438	(83)
Total gains	357.7669	424.5528	498.5864	577.7945	630.0308	622.3777	593.3381	547.0350	487.3652	410.0226	353.9920	336.5723	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0875	57.1917	57.2942	57.7806	57.8726	58.3044	58.3044	58.3851	58.1373	57.8726	57.6869	57.4940	
alpha	4.8058	4.8128	4.8196	4.8520	4.8582	4.8870	4.8870	4.8923	4.8758	4.8582	4.8458	4.8329	
util living area													
	0.9965	0.9916	0.9759	0.9223	0.7988	0.6154	0.4587	0.5152	0.7780	0.9593	0.9927	0.9974	(86)
MIT	19.7438	19.9281	20.2267	20.5894	20.8517	20.9681	20.9938	20.9893	20.9036	20.5344	20.0650	19.7072	(87)
Th 2	19.9069	19.9086	19.9104	19.9185	19.9200	19.9272	19.9272	19.9285	19.9244	19.9200	19.9169	19.9137	(88)
util rest of house													
	0.9954	0.9889	0.9676	0.8966	0.7403	0.5242	0.3500	0.4008	0.6942	0.9404	0.9898	0.9965	(89)
MIT 2	18.2466	18.5158	18.9468	19.4557	19.7840	19.9075	19.9250	19.9244	19.8525	19.3946	18.7224	18.1980	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	18.9794	19.2070	19.5733	20.0106	20.3066	20.4266	20.4481	20.4456	20.3670	19.9524	19.3795	18.9367	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9794	19.2070	19.5733	20.0106	20.3066	20.4266	20.4481	20.4456	20.3670	19.9524	19.3795	18.9367	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9865	0.9645	0.8991	0.7627	0.5679	0.4034	0.4570	0.7312	0.9411	0.9879	0.9954	(94)
Useful gains	355.6187	418.8100	480.8720	519.4775	480.5257	353.4669	239.3654	249.9867	356.3810	385.8585	349.6942	335.0342	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	939.4475	913.9512	833.6418	702.5237	543.3288	365.1081	241.1310	253.1570	393.8295	590.4164	777.6979	936.4441	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	434.3686	332.7349	262.4608	131.7933	46.7255	0.0000	0.0000	0.0000	0.0000	152.1911	308.1627	447.4490	(98)
Space heating												2115.8859	(98)
Space heating per m2											(98) / (4) =	40.2183	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2267.8305	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	434.3686	332.7349	262.4608	131.7933	46.7255	0.0000	0.0000	0.0000	0.0000	152.1911	308.1627	447.4490	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	465.5612	356.6291	281.3084	141.2575	50.0809	0.0000	0.0000	0.0000	0.0000	163.1201	330.2923	479.5809	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4147	89.3214	89.1137	88.6334	87.7743	86.7000	86.7000	86.7000	86.7000	88.7285	89.2480	89.4535	(217)
Fuel for water heating, kWh/month													
	152.0999	133.5283	138.9815	123.0649	120.1711	106.3715	99.9420	112.7293	113.4942	127.5890	136.8705	147.6435	(219)
Water heating fuel used												1512.4857	(219)
Annual totals kWh/year													
Space heating fuel - main system												2267.8305	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3602.6570	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2267.8305	0.2160	489.8514	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1512.4857	0.2160	326.6969	(264)
Space and water heating			816.5483	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total CO2, kg/year			724.3432	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.7700	ZC1
Total Floor Area	TFA	52.6100	
Assumed number of occupants	N	1.7671	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3468	ZC2
CO2 emissions from cooking, equation (L16)		3.0680	ZC3
Total CO2 emissions		34.1849	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.1849	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			10.0500	1.3258	13.3239			(27)
Ground floor			52.6100	0.1300	6.8393			(28a)
External Wall	40.1300	10.0500	30.0800	0.1800	5.4144			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.9450			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.5584	(36)
Total fabric heat loss (33) + (36) =	38.5034	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	62.6035	62.4463	62.2922	61.5685	61.4332	60.8029	60.8029	60.6862	61.0457	61.4332	61.7071	61.9934	(39)
Average = Sum(39)m / 12 =												61.5679	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1900	1.1870	1.1840	1.1703	1.1677	1.1557	1.1557	1.1535	1.1603	1.1677	1.1729	1.1784	(40)
HLP (average)												1.1703	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671	(42)
Average daily hot water use (litres/day)	76.1678	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	42.6957	37.1615	39.5905	36.8109	36.4854	33.8060	34.9328	36.4854	36.8109	39.5905	39.8159	42.6957	(61)
Total heat required for water heating calculated for each month													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
									Total per year (kWh/year) = Sum(64)m =			1655.2968	(64)
Heat gains from water heating, kWh/month													
	51.9871	45.4231	47.1834	41.7094	40.3122	35.3668	33.6742	37.7415	38.1647	43.6501	46.7974	50.6835	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	69.8751	67.5939	63.4185	57.9297	54.1831	49.1206	45.2611	50.7279	53.0066	58.6694	64.9964	68.1230	(72)
Total internal gains													
	290.2903	288.0529	277.5445	261.0427	244.5543	228.4351	218.1667	223.5898	232.2015	248.8773	267.9461	282.1294	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	3.3100	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	66.2991	124.6222	196.1590	277.2046	335.2743	342.0436	326.0663	282.4673	224.7764	145.1710	81.6710	55.2049	(83)
Total gains	356.5894	412.6751	473.7035	538.2474	579.8286	570.4788	544.2331	506.0571	456.9780	394.0483	349.6171	337.3342	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.3590	58.5059	58.6506	59.3399	59.4707	60.0872	60.0872	60.2027	59.8482	59.4707	59.2067	58.9332	
alpha	4.8906	4.9004	4.9100	4.9560	4.9647	5.0058	5.0058	5.0135	4.9899	4.9647	4.9471	4.9289	
util living area													
	0.9966	0.9925	0.9796	0.9352	0.8261	0.6466	0.4843	0.5387	0.7974	0.9631	0.9930	0.9974	(86)
MIT	19.7770	19.9435	20.2208	20.5703	20.8357	20.9639	20.9930	20.9884	20.8987	20.5385	20.0924	19.7479	(87)
Th 2	19.9280	19.9304	19.9328	19.9438	19.9459	19.9556	19.9556	19.9574	19.9519	19.9459	19.9417	19.9374	(88)
util rest of house													
	0.9954	0.9899	0.9725	0.9129	0.7716	0.5555	0.3732	0.4232	0.7170	0.9459	0.9902	0.9965	(89)
MIT 2	18.3099	18.5538	18.9555	19.4526	19.7917	19.9327	19.9531	19.9528	19.8746	19.4209	18.7798	18.2740	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.0279	19.2340	19.5748	19.9997	20.3027	20.4374	20.4621	20.4597	20.3759	19.9679	19.4222	18.9954	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0279	19.2340	19.5748	19.9997	20.3027	20.4374	20.4621	20.4597	20.3759	19.9679	19.4222	18.9954	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9877	0.9695	0.9143	0.7916	0.5990	0.4278	0.4800	0.7522	0.9463	0.9883	0.9954	(94)
Useful gains	354.4822	407.6184	459.2670	492.1016	458.9668	341.6994	232.8255	242.8962	343.7194	372.8895	345.5327	335.7893	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	922.0191	895.1031	814.4584	683.3898	528.4921	354.9324	234.8252	246.3658	383.1155	575.5006	760.3696	917.2175	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	422.2475	327.5897	264.2624	137.7275	51.7268	0.0000	0.0000	0.0000	0.0000	150.7426	298.6826	432.5826	(98)
Space heating												2085.5618	(98)
Space heating per m2											(98) / (4) =	39.6419	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2232.9355	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	422.2475	327.5897	264.2624	137.7275	51.7268	0.0000	0.0000	0.0000	0.0000	150.7426	298.6826	432.5826	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	452.0851	350.7384	282.9362	147.4598	55.3821	0.0000	0.0000	0.0000	0.0000	161.3947	319.7886	463.1505	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.2891	87.0281	86.4347	85.1095	82.9332	80.3000	80.3000	80.3000	80.3000	85.2178	86.7425	87.3914	(217)
Fuel for water heating, kWh/month													
	191.2561	167.5681	175.5408	158.1201	157.1055	142.9071	136.9159	152.6291	154.3147	165.5777	173.6441	186.5461	(219)
Water heating fuel used												1962.1252	(219)
Annual totals kWh/year													
Space heating fuel - main system												2232.9355	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Total delivered energy for all uses												4515.5711	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2232.9355	0.2160	482.3141	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1962.1252	0.2160	423.8191	(264)
Space and water heating			906.1331	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Total CO2, kg/m2/year			1072.4780	(272)
Emissions per m2 for space and water heating			17.2236	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4220	(272b)
Emissions per m2 for pumps and fans			0.7399	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.2236 * 1.00) + 2.4220 + 0.7399, rounded to 2 d.p.			20.3900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2883	0.2883	0.2807	0.3035	0.3263	0.3414	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 4			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	40.1300	10.0500	30.0800	0.2700	8.1216			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.6849			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2578	(36)
Total fabric heat loss (33) + (36) =	40.9427	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	22.9385	22.8242	22.2874	22.1869	21.7194	21.7194	21.6328	21.8995	22.1869	22.3901	22.6026	(38)
Heat transfer coeff	63.9978	63.8812	63.7669	63.2301	63.1296	62.6620	62.6620	62.5755	62.8421	63.1296	63.3328	63.5452	(39)
Average = Sum(39)m / 12 =												63.2296	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2165	1.2142	1.2121	1.2019	1.2000	1.1911	1.1911	1.1894	1.1945	1.2000	1.2038	1.2079	(40)
HLP (average)												1.2019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825 (71)

Water heating gains (Table 5)

	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683 (72)

Total internal gains

	252.9033	251.8226	243.1545	228.9671	214.1642	200.2055	191.3301	194.4467	201.9027	216.2013	232.6532	245.3747 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.1100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438 (83)
Total gains	330.7784	398.2042	473.5635	554.5725	607.9785	601.9711	574.3286	526.2337	465.9258	386.7196	328.5842	310.2185 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0875	57.1917	57.2942	57.7806	57.8726	58.3044	58.3044	58.3851	58.1373	57.8726	57.6869	57.4940	
alpha	4.8058	4.8128	4.8196	4.8520	4.8582	4.8870	4.8870	4.8923	4.8758	4.8582	4.8458	4.8329	
util living area	0.9975	0.9936	0.9802	0.9319	0.8145	0.6326	0.4731	0.5337	0.7987	0.9671	0.9947	0.9982	(86)
MIT	19.6969	19.8834	20.1873	20.5609	20.8374	20.9641	20.9929	20.9876	20.8911	20.5002	20.0215	19.6611	(87)
Th 2	19.9069	19.9086	19.9104	19.9185	19.9200	19.9272	19.9272	19.9285	19.9244	19.9200	19.9169	19.9137	(88)
util rest of house	0.9967	0.9914	0.9733	0.9085	0.7577	0.5402	0.3614	0.4161	0.7170	0.9512	0.9925	0.9976	(89)
MIT 2	18.7267	18.9135	19.2145	19.5774	19.8170	19.9119	19.9255	19.9252	19.8679	19.5299	19.0585	18.6965	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2016	19.3882	19.6906	20.0588	20.3164	20.4269	20.4479	20.4452	20.3687	20.0048	19.5299	19.1686	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2016	19.3882	19.6906	20.0588	20.3164	20.4269	20.4479	20.4452	20.3687	20.0048	19.5299	19.1686	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9901	0.9716	0.9120	0.7801	0.5847	0.4163	0.4740	0.7536	0.9527	0.9915	0.9970	(94)
Useful gains	329.4434	394.2579	460.1030	505.7501	474.2947	351.9524	239.0936	249.4190	351.1116	368.4379	325.7922	309.2870	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	953.6667	925.5237	841.1238	705.5718	543.9524	365.1267	241.1184	253.1291	393.9386	593.7219	787.2178	951.1852	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	464.4221	357.0106	283.4795	143.8716	51.8253	0.0000	0.0000	0.0000	0.0000	167.6113	332.2265	477.5723	(98)
Space heating												2278.0193	(98)
Space heating per m2											(98) / (4) =	43.3001	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	589.0233	463.6992	475.5735	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9201	0.9587	0.9409	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	541.9722	444.5586	447.4847	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	770.2977	736.7195	681.5228	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	164.3944	217.3677	174.1244	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												555.8865 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	41.0986	54.3419	43.5311	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												138.9716 (107)
Space cooling per m2												2.6415 (108)
Energy for space heating												43.3001 (99)
Energy for space cooling												2.6415 (108)
Total												45.9417 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			10.0500	1.3258	13.3239			(27)
Ground floor			52.6100	0.1300	6.8393			(28a)
External Wall	40.1300	10.0500	30.0800	0.1800	5.4144			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.9450			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5584	(36)
Total fabric heat loss					(33) + (36) =		38.5034	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	62.6035	62.4463	62.2922	61.5685	61.4332	60.8029	60.8029	60.6862	61.0457	61.4332	61.7071	61.9934	(39)
Average = Sum(39)m / 12 =												61.5679	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1900	1.1870	1.1840	1.1703	1.1677	1.1557	1.1557	1.1535	1.1603	1.1677	1.1729	1.1784	(40)
HLP (average)												1.1703	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7671 (42)
Average daily hot water use (litres/day)		76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.9018	12.3475	10.0416	7.6022	5.6827	4.7976	5.1840	6.7383	9.0441	11.4836	13.4031	14.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	252.9033	251.8226	243.1545	228.9671	214.1642	200.2055	191.3301	194.4467	201.9027	216.2013	232.6532	245.3747	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	3.1300	19.6403	0.6300	0.7000	0.7700	19.8677	(80)

Solar gains	66.2991	124.6222	196.1590	277.2046	335.2743	342.0436	326.0663	282.4673	224.7764	145.1710	81.6710	55.2049	(83)
Total gains	319.2024	376.4448	439.3135	506.1717	549.4386	542.2492	517.3964	476.9140	426.6791	361.3722	314.3242	300.5796	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.3590	58.5059	58.6506	59.3399	59.4707	60.0872	60.0872	60.2027	59.8482	59.4707	59.2067	58.9332	
alpha	4.8906	4.9004	4.9100	4.9560	4.9647	5.0058	5.0058	5.0135	4.9899	4.9647	4.9471	4.9289	
util living area													
	0.9979	0.9949	0.9849	0.9475	0.8482	0.6731	0.5077	0.5681	0.8276	0.9735	0.9956	0.9984	(86)
MIT	19.7117	19.8814	20.1651	20.5280	20.8126	20.9569	20.9914	20.9853	20.8787	20.4891	20.0315	19.6833	(87)
Th 2	19.9280	19.9304	19.9328	19.9438	19.9459	19.9556	19.9556	19.9574	19.9519	19.9459	19.9417	19.9374	(88)
util rest of house													
	0.9972	0.9932	0.9795	0.9285	0.7968	0.5809	0.3921	0.4480	0.7515	0.9603	0.9938	0.9979	(89)
MIT 2	18.7582	18.9291	19.2117	19.5704	19.8236	19.9366	19.9535	19.9534	19.8867	19.5418	19.0883	18.7374	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2249	19.3952	19.6783	20.0391	20.3077	20.4360	20.4615	20.4585	20.3722	20.0054	19.5500	19.2004	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2249	19.3952	19.6783	20.0391	20.3077	20.4360	20.4615	20.4585	20.3722	20.0054	19.5500	19.2004	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9920	0.9779	0.9305	0.8160	0.6250	0.4490	0.5072	0.7850	0.9612	0.9929	0.9974	(94)
Useful gains	318.1005	373.4424	429.5897	470.9792	448.3510	338.9171	232.3104	241.8735	334.9229	347.3500	312.0808	299.8009	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	934.3506	905.1695	820.9082	685.8184	528.7954	354.8457	234.7884	246.2926	382.8916	577.8055	768.2503	929.9254	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	458.4900	357.3206	291.1410	154.6843	59.8506	0.0000	0.0000	0.0000	0.0000	171.4589	328.4420	468.8127	(98)
Space heating												2290.2002	(98)
Space heating per m2											(98) / (4) =	43.5317	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	571.5471	449.9413	461.2148	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9057	0.9508	0.9315	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	517.6695	427.7953	429.6361	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	700.4929	670.1753	623.8764	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	131.6329	180.3308	144.5148	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												456.4784	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   32.9082   45.0827   36.1287    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        114.1196 (107)
Space cooling per m2                                                                                                   2.1692 (108)
Energy for space heating                                                                                              43.5317 (99)
Energy for space cooling                                                                                               2.1692 (108)
Total                                                                                                                 45.7008 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   52.6 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3187	0.2959	0.3035	0.2883	0.2883	0.2807	0.2732	0.2656	0.2580	0.2807	0.2656	0.2807	(22b)
Effective ac	0.5508	0.5438	0.5461	0.5416	0.5416	0.5394	0.5373	0.5353	0.5333	0.5394	0.5353	0.5394	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 4			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	40.1300	10.0500	30.0800	0.2700	8.1216			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.6849			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2578	(36)
Total fabric heat loss (33) + (36) =	40.9427	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.0888	21.8083	21.8995	21.7194	21.7194	21.6328	21.5485	21.4665	21.3869	21.6328	21.4665	21.6328	(38)
Heat transfer coeff	63.0315	62.7509	62.8421	62.6620	62.6620	62.5755	62.4912	62.4092	62.3296	62.5755	62.4092	62.5755	(39)
Average = Sum(39)m / 12 =												62.6095	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1981	1.1928	1.1945	1.1911	1.1911	1.1894	1.1878	1.1863	1.1847	1.1894	1.1863	1.1894	(40)
HLP (average)												1.1901	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428 (61)
Total heat required for water heating calculated for each month												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203 (64)
RHI water heating demand												1336 (64)
Heat gains from water heating, kWh/month												
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	98.5843	157.8956	250.6619	356.1887	409.1467	453.2756	428.7700	380.8380	303.3225	198.5098	121.0948	80.6585	(83)
Total gains	508.3880	564.4343	641.7645	723.4210	752.1969	774.3838	736.8383	695.3593	631.3799	550.6115	499.9628	479.5316	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9627	58.2218	58.1373	58.3044	58.3044	58.3851	58.4638	58.5406	58.6154	58.3851	58.5406	58.3851	
alpha	4.8642	4.8815	4.8758	4.8870	4.8870	4.8923	4.8976	4.9027	4.9077	4.8923	4.9027	4.8923	
util living area													
	0.9824	0.9707	0.9311	0.8285	0.6641	0.4549	0.3298	0.3487	0.5976	0.8643	0.9631	0.9856	(86)
MIT	20.0880	20.2254	20.5002	20.7852	20.9413	20.9922	20.9987	20.9984	20.9727	20.7788	20.4041	20.0631	(87)
Th 2	19.9215	19.9258	19.9244	19.9272	19.9272	19.9285	19.9298	19.9310	19.9322	19.9285	19.9310	19.9285	(88)
util rest of house													
	0.9769	0.9619	0.9112	0.7853	0.5947	0.3721	0.2398	0.2539	0.5066	0.8171	0.9500	0.9810	(89)
MIT 2	18.7547	18.9533	19.3346	19.7058	19.8803	19.9246	19.9294	19.9306	19.9159	19.7110	19.2144	18.7246	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.4073	19.5760	19.9051	20.2341	20.3996	20.4472	20.4528	20.4532	20.4332	20.2336	19.7967	19.3798	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4073	19.5760	19.9051	20.2341	20.3996	20.4472	20.4528	20.4532	20.4332	20.2336	19.7967	19.3798	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9736	0.9585	0.9108	0.7986	0.6263	0.4126	0.2839	0.3004	0.5504	0.8319	0.9480	0.9780	(94)
Useful gains	494.9724	540.9840	584.5080	577.6932	471.0659	319.4983	209.2029	208.8652	347.5119	458.0566	473.9456	468.9701	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	914.4157	895.8305	810.9833	672.6201	495.0058	322.0866	209.5202	209.2714	357.3458	552.7660	742.4618	899.8200	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	312.0658	238.4568	168.4976	68.3474	17.8113	0.0000	0.0000	0.0000	0.0000	70.4638	193.3317	320.5523	(98)
Space heating												1389.5267	(98)
RHI space heating demand												1390	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3870	0.3794	0.3718	0.3339	0.3263	0.2883	0.2883	0.2807	0.3035	0.3263	0.3414	0.3566	(22b)
Effective ac	0.5749	0.5720	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5461	0.5532	0.5583	0.5636	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening 4			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	40.1300	10.0500	30.0800	0.2700	8.1216			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.6849			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2578	(36)
Total fabric heat loss (33) + (36) =	40.9427	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.0551	22.9385	22.8242	22.2874	22.1869	21.7194	21.7194	21.6328	21.8995	22.1869	22.3901	22.6026	(38)
Heat transfer coeff	63.9978	63.8812	63.7669	63.2301	63.1296	62.6620	62.6620	62.5755	62.8421	63.1296	63.3328	63.5452	(39)
Average = Sum(39)m / 12 =												63.2296	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2165	1.2142	1.2121	1.2019	1.2000	1.1911	1.1911	1.1894	1.1945	1.2000	1.2038	1.2079	(40)
HLP (average)												1.2019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428 (61)
Total heat required for water heating calculated for each month												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203 (64)
Heat gains from water heating, kWh/month												
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	3.3100	19.6403	0.7400	0.7000	0.7700	23.3366	(80)

Solar gains	77.8751	146.3816	230.4090	325.6054	393.8143	401.7656	382.9985	331.7869	264.0231	170.5183	95.9310	64.8438	(83)
Total gains	487.6788	552.9203	621.5116	692.8378	736.8644	722.8737	691.0668	646.3082	592.0806	522.6200	474.7990	463.7169	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.0875	57.1917	57.2942	57.7806	57.8726	58.3044	58.3044	58.3851	58.1373	57.8726	57.6869	57.4940	
alpha	4.8058	4.8128	4.8196	4.8520	4.8582	4.8870	4.8870	4.8923	4.8758	4.8582	4.8458	4.8329	
util living area													
	0.9873	0.9760	0.9464	0.8675	0.7238	0.5405	0.3963	0.4406	0.6812	0.9087	0.9762	0.9899	(86)
MIT	19.9642	20.1375	20.4061	20.7099	20.9049	20.9817	20.9967	20.9945	20.9464	20.6786	20.2632	19.9250	(87)
Th 2	19.9069	19.9086	19.9104	19.9185	19.9200	19.9272	19.9272	19.9285	19.9244	19.9200	19.9169	19.9137	(88)
util rest of house													
	0.9834	0.9688	0.9305	0.8314	0.6607	0.4560	0.3011	0.3404	0.5941	0.8745	0.9677	0.9867	(89)
MIT 2	18.5656	18.8152	19.1946	19.6060	19.8370	19.9164	19.9261	19.9265	19.8875	19.5797	19.0049	18.5140	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2501	19.4624	19.7876	20.1463	20.3597	20.4378	20.4501	20.4493	20.4058	20.1176	19.6207	19.2046	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2501	19.4624	19.7876	20.1463	20.3597	20.4378	20.4501	20.4493	20.4058	20.1176	19.6207	19.2046	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9804	0.9651	0.9284	0.8397	0.6875	0.4969	0.3478	0.3896	0.6348	0.8816	0.9648	0.9840	(94)
Useful gains	478.1112	533.6443	576.9861	581.7922	506.6275	359.2106	240.3354	251.7995	375.8394	460.7293	458.0982	456.2956	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	956.7753	930.2620	847.3073	711.1026	546.6812	365.8065	241.2543	253.3839	396.2683	600.8399	792.9738	953.4723	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	356.1261	266.5271	201.1190	93.1035	29.8000	0.0000	0.0000	0.0000	0.0000	104.2423	241.1105	369.8994	(98)
Space heating												1661.9278	(98)
Space heating per m2											(98) / (4) =	31.5896	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	1781.2731 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	356.1261	266.5271	201.1190	93.1035	29.8000	0.0000	0.0000	0.0000	0.0000	104.2423	241.1105	369.8994	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	381.7000	285.6667	215.5616	99.7894	31.9400	0.0000	0.0000	0.0000	0.0000	111.7281	258.4249	396.4624	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2756	89.1555	88.8933	88.3215	87.4682	86.7000	86.7000	86.7000	86.7000	88.3893	89.0565	89.3241	(217)
Fuel for water heating, kWh/month	152.3370	133.7767	139.3262	123.4995	120.5916	106.3715	99.9420	112.7293	113.4942	128.0786	137.1648	147.8574	(219)
Water heating fuel used												1515.1687	(219)
Annual totals kWh/year													
Space heating fuel - main system												1781.2731	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3118.7826	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1781.2731	3.4800	61.9883	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1515.1687	3.4800	52.7279	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	245.5103	13.1900	32.3828	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			276.9915	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1918 (257)
SAP value		83.3737
SAP rating (Section 12)		83 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1781.2731	0.2160	384.7550	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1515.1687	0.2160	327.2764	(264)
Space and water heating			712.0314	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total kg/year			619.8263	(272)
CO2 emissions per m2			11.7800	(273)
EI value			91.4910	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8806 = 3.952, stars = 4
Water heating environmental impact	0.216 / 0.8806 = 0.2453, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		3.8500	
Infiltration rate		0.3571	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3035	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3187	0.2959	0.3035	0.2883	0.2883	0.2807	0.2732	0.2656	0.2580	0.2807	0.2656	0.2807	(22b)
Effective ac	0.5508	0.5438	0.5461	0.5416	0.5416	0.5394	0.5373	0.5353	0.5333	0.5394	0.5353	0.5394	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			10.0500	1.2357	12.4192			(27)
Opening Type 4			1.9500	1.5000	2.9250			(26)
Ground floor			52.6100	0.1900	9.9959			(28a)
External Wall	40.1300	10.0500	30.0800	0.2700	8.1216			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.6849			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Ceiling 1			52.6100					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2578	(36)
Total fabric heat loss (33) + (36) =	40.9427	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.0888	21.8083	21.8995	21.7194	21.7194	21.6328	21.5485	21.4665	21.3869	21.6328	21.4665	21.6328	(38)
Heat transfer coeff	63.0315	62.7509	62.8421	62.6620	62.6620	62.5755	62.4912	62.4092	62.3296	62.5755	62.4092	62.5755	(39)
Average = Sum(39)m / 12 =												62.6095	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1981	1.1928	1.1945	1.1911	1.1911	1.1894	1.1878	1.1863	1.1847	1.1894	1.1863	1.1894	(40)
HLP (average)												1.1901	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428 (61)
Total heat required for water heating calculated for each month												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203 (64)
Heat gains from water heating, kWh/month												
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.7545	30.8687	25.1041	19.0054	14.2068	11.9940	12.9599	16.8458	22.6103	28.7090	33.5077	35.7205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	409.8037	406.5387	391.1026	367.2323	343.0501	321.1082	308.0683	314.5212	328.0575	352.1017	378.8681	398.8731	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	3.3100	25.1925	0.7400	0.7000	0.7700	29.9339	(80)

Solar gains	98.5843	157.8956	250.6619	356.1887	409.1467	453.2756	428.7700	380.8380	303.3225	198.5098	121.0948	80.6585	(83)
Total gains	508.3880	564.4343	641.7645	723.4210	752.1969	774.3838	736.8383	695.3593	631.3799	550.6115	499.9628	479.5316	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9627	58.2218	58.1373	58.3044	58.3044	58.3851	58.4638	58.5406	58.6154	58.3851	58.5406	58.3851	
alpha	4.8642	4.8815	4.8758	4.8870	4.8870	4.8923	4.8976	4.9027	4.9077	4.8923	4.9027	4.8923	
util living area													
	0.9824	0.9707	0.9311	0.8285	0.6641	0.4549	0.3298	0.3487	0.5976	0.8643	0.9631	0.9856	(86)
MIT	20.0880	20.2254	20.5002	20.7852	20.9413	20.9922	20.9987	20.9984	20.9727	20.7788	20.4041	20.0631	(87)
Th 2	19.9215	19.9258	19.9244	19.9272	19.9272	19.9285	19.9298	19.9310	19.9322	19.9285	19.9310	19.9285	(88)
util rest of house													
	0.9769	0.9619	0.9112	0.7853	0.5947	0.3721	0.2398	0.2539	0.5066	0.8171	0.9500	0.9810	(89)
MIT 2	18.7547	18.9533	19.3346	19.7058	19.8803	19.9246	19.9294	19.9306	19.9159	19.7110	19.2144	18.7246	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.4073	19.5760	19.9051	20.2341	20.3996	20.4472	20.4528	20.4532	20.4332	20.2336	19.7967	19.3798	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4073	19.5760	19.9051	20.2341	20.3996	20.4472	20.4528	20.4532	20.4332	20.2336	19.7967	19.3798	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9736	0.9585	0.9108	0.7986	0.6263	0.4126	0.2839	0.3004	0.5504	0.8319	0.9480	0.9780	(94)
Useful gains	494.9724	540.9840	584.5080	577.6932	471.0659	319.4983	209.2029	208.8652	347.5119	458.0566	473.9456	468.9701	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	914.4157	895.8305	810.9833	672.6201	495.0058	322.0866	209.5202	209.2714	357.3458	552.7660	742.4618	899.8200	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	312.0658	238.4568	168.4976	68.3474	17.8113	0.0000	0.0000	0.0000	0.0000	70.4638	193.3317	320.5523	(98)
Space heating												1389.5267	(98)
Space heating per m2											(98) / (4) =	26.4118	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1489.3105	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	312.0658	238.4568	168.4976	68.3474	17.8113	0.0000	0.0000	0.0000	0.0000	70.4638	193.3317	320.5523	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	334.4757	255.5807	180.5976	73.2555	19.0904	0.0000	0.0000	0.0000	0.0000	75.5239	207.2151	343.5716	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1761	89.0670	88.7390	88.0523	87.2022	86.7000	86.7000	86.7000	86.7000	88.0466	88.8712	89.2190	(217)
Fuel for water heating, kWh/month													
	152.5069	133.9097	139.5684	123.8771	120.9593	106.3715	99.9420	112.7293	113.4942	128.5770	137.4509	148.0316	(219)
Water heating fuel used												1517.4178	(219)
Annual totals kWh/year													
Space heating fuel - main system												1489.3105	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												245.5103	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 967 * 1.00) =												-564.6053	(233)
Total delivered energy for all uses												2762.6334	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1489.3105	7.3800	109.9111	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1517.4178	7.3800	111.9854	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	245.5103	28.6600	70.3633	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			420.7548	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1489.3105	0.2160	321.6911	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1517.4178	0.2160	327.7623	(264)
Space and water heating			649.4533	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	245.5103	0.5190	127.4199	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	0.5190	-293.0302	(269)
Total kg/year			522.7680	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1489.3105	1.2200	1816.9589	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1517.4178	1.2200	1851.2498	(264)
Space and water heating			3668.2086	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	245.5103	3.0700	753.7168	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	3.0700	-1733.3383	(269)
Primary energy kWh/year			2918.8371	(272)
Primary energy kWh/m2/year			55.4807	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 83
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£92	£92	£0
Mains gas	£329	£329	£0
Space heating	£238	£238	£0
Water heating	£112	£112	£0
Lighting	£70	£70	£0
Total cost of fuels	£421	£421	£0
Total cost of uses	£420	£420	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	55 kWh/m²	55 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	240.63 (P1)
Transmission heat loss coefficient	40.94 (37)
Summer heat loss coefficient	281.57 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	4.5800	125.2818	0.7400	0.7000	0.8865	237.1398
South	1.0800	118.5567	0.7400	0.7000	0.8865	52.9177
West	3.3100	125.2818	0.7400	0.7000	0.8865	171.3827
total:						500.3486

	Jun	Jul	Aug	
Solar gains	538	500	443	(P3)
Internal gains	318	305	312	
Total summer gains	856	805	755	(P5)
Summer gain/loss ratio	3.04	2.86	2.68	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.69	20.41	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 676 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 676 - EPC	**Prop Type Ref**	
Property	35 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	13.77	**TER**	20.39
Environmental	91 B	**% DER<TER**	32.45		
CO_2 Emissions (t/year)	0.52	**DFEE**	45.94	**TFEE**	52.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.59		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.39	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.77	$kgCO_2/m^2$	Pass
	-6.62 (-32.5%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.56	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	45.94	$kWh/m^2/yr$	
	-6.7 (-12.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.85 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.08 m², No overhang
Windows facing East	4.58 m², No overhang
Windows facing South	1.08 m², No overhang
Windows facing West	3.31 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	3.85 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.039	W/m²K
Air permeability	3.9	m³/m²h
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 677 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 677 - EPC	**Prop Type Ref**	
Property	37 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	17.07	**TER**	20.56
Environmental	89 B	**% DER<TER**	16.98		
CO_2 Emissions (t/year)	0.71	**DFEE**	49.12	**TFEE**	52.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.04		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Top-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.
---------------------------------------------------------------------------------------------------
1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.56 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.07 kgCO□/m²OK
---------------------------------------------------------------------------------------------------
1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.1 kWh/m²/yrOK
---------------------------------------------------------------------------------------------------
2 Fabric U-values
Element         Average                 Highest
External wall   0.26 (max. 0.30)        0.27 (max. 0.70)          OK
Floor           (no floor)
Roof            0.16 (max. 0.20)        0.16 (max. 0.35)          OK
Openings        1.34 (max. 2.00)        1.50 (max. 3.30)          OK
---------------------------------------------------------------------------------------------------
2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---------------------------------------------------------------------------------------------------
3 Air permeability
Air permeability at 50 pascals:         4.36 (measured in this dwelling)
Maximum                                 10.0                                    OK
---------------------------------------------------------------------------------------------------
4 Heating efficiency
Main heating system:                    Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0%                                  OK

Secondary heating system:               None
---------------------------------------------------------------------------------------------------
5 Cylinder insulation
Hot water storage                       No cylinder
---------------------------------------------------------------------------------------------------
6 Controls
Space heating controls:                 Time and temperature zone control       OK


Hot water controls:                     No cylinder


Boiler interlock                        Yes                                     OK
---------------------------------------------------------------------------------------------------
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum                                 75%                                     OK
---------------------------------------------------------------------------------------------------
8 Mechanical ventilation
Not applicable
---------------------------------------------------------------------------------------------------
9 Summertime temperature
Overheating risk (Southern England):    Not significant                         OK
Based on:
Overshading:                            Average
Windows facing North:                   1.08 m², No overhang
Windows facing East:                    4.58 m², No overhang
Windows facing South:                   1.08 m², No overhang
Windows facing West:                    2.01 m², No overhang
Air change rate:                        6.00 ach
Blinds/curtains:                        Dark-coloured curtain or roller blind, closed 10% of daylight hours
---------------------------------------------------------------------------------------------------
10 Key features
Thermal bridging y-value                0.036 W/m²K
Photovoltaic array                      0.37 kW



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3826	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3252	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4146	0.4065	0.3984	0.3577	0.3496	0.3089	0.3089	0.3008	0.3252	0.3496	0.3658	0.3821	(22b)
Effective ac	0.5860	0.5826	0.5793	0.5640	0.5611	0.5477	0.5477	0.5452	0.5529	0.5611	0.5669	0.5730	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	55.5100	8.7500	46.7600	0.2700	12.6252			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0037			(33)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4193 (36)
Total fabric heat loss	(33) + (36) =	42.4231 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4993	23.3655	23.2343	22.6180	22.5027	21.9660	21.9660	21.8666	22.1727	22.5027	22.7360	22.9798	(38)
Heat transfer coeff	65.9224	65.7885	65.6573	65.0411	64.9258	64.3891	64.3891	64.2897	64.5958	64.9258	65.1590	65.4029	(39)
Average = Sum(39)m / 12 =												65.0405	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2530	1.2505	1.2480	1.2363	1.2341	1.2239	1.2239	1.2220	1.2278	1.2341	1.2385	1.2432	(40)
HLP (average)												1.2363	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	280.2077	278.4518	268.4056	252.3618	236.3456	220.7211	210.4573	215.4012	223.5476	239.7653	258.3656	272.0532	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	348.9173	406.9038	469.2871	534.9032	577.3834	568.4605	542.0207	503.0061	453.2290	389.0087	342.8684	329.3598	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4208	55.5336	55.6445	56.1718	56.2715	56.7406	56.7406	56.8283	56.5590	56.2715	56.0701	55.8610	
alpha	4.6947	4.7022	4.7096	4.7448	4.7514	4.7827	4.7827	4.7886	4.7706	4.7514	4.7380	4.7241	
util living area													
	0.9969	0.9931	0.9816	0.9425	0.8441	0.6742	0.5112	0.5680	0.8197	0.9678	0.9937	0.9976	(86)
MIT	19.6804	19.8516	20.1382	20.5029	20.7953	20.9492	20.9890	20.9823	20.8694	20.4747	20.0074	19.6481	(87)
Th 2	19.8778	19.8798	19.8818	19.8911	19.8928	19.9009	19.9009	19.9024	19.8978	19.8928	19.8893	19.8856	(88)
util rest of house													
	0.9958	0.9908	0.9750	0.9216	0.7906	0.5784	0.3894	0.4423	0.7398	0.9520	0.9912	0.9968	(89)
MIT 2	18.1340	18.3846	18.8002	19.3199	19.6986	19.8686	19.8971	19.8955	19.7967	19.2928	18.6195	18.0922	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	18.8909	19.1026	19.4551	19.8989	20.2353	20.3975	20.4316	20.4275	20.3217	19.8713	19.2988	18.8537	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8909	19.1026	19.4551	19.8989	20.2353	20.3975	20.4316	20.4275	20.3217	19.8713	19.2988	18.8537	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9945	0.9886	0.9718	0.9218	0.8088	0.6236	0.4494	0.5041	0.7736	0.9516	0.9893	0.9958	(94)
Useful gains	347.0081	402.2550	456.0628	493.0589	466.9602	354.4959	243.5618	253.5841	350.6154	370.1910	339.2098	327.9654	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	961.8675	934.3688	850.5956	715.3791	554.1638	373.2953	246.7109	258.9237	401.8976	601.9466	794.8633	958.3948	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	457.4554	357.5805	293.5324	160.0705	64.8795	0.0000	0.0000	0.0000	0.0000	172.4262	328.0705	469.0395	(98)
Space heating												2303.0545	(98)
Space heating per m2											(98) / (4) =	43.7760	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2468.4399 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	457.4554	357.5805	293.5324	160.0705	64.8795	0.0000	0.0000	0.0000	0.0000	172.4262	328.0705	469.0395	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	490.3059	383.2588	314.6113	171.5654	69.5386	0.0000	0.0000	0.0000	0.0000	184.8083	351.6297	502.7219	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4488	89.3718	89.2009	88.8056	88.0367	86.7000	86.7000	86.7000	86.7000	88.8380	89.2940	89.4836	(217)
Fuel for water heating, kWh/month													
	152.0419	133.4529	138.8456	122.8263	119.8129	106.3715	99.9420	112.7293	113.4942	127.4317	136.8000	147.5938	(219)
Water heating fuel used												1511.3420	(219)
Annual totals kWh/year													
Space heating fuel - main system												2468.4399	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4053.3744	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2468.4399	0.2160	533.1830	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1511.3420	0.2160	326.4499	(264)
Space and water heating			859.6329	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total CO2, kg/year			897.8274	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.0700	ZC1
Total Floor Area	TFA	52.6100	
Assumed number of occupants	N	1.7671	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3468	ZC2
CO2 emissions from cooking, equation (L16)		3.0680	ZC3
Total CO2 emissions		37.4849	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.4849	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			8.7500	1.3258	11.6004			(27)
External Wall	55.5100	8.7500	46.7600	0.1800	8.4168			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Roof 1	52.6100		52.6100	0.1300	6.8393			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.2239			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5247	(36)
Total fabric heat loss					(33) + (36) =		37.7486	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	61.8486	61.6915	61.5374	60.8137	60.6784	60.0481	60.0481	59.9314	60.2908	60.6784	60.9522	61.2386	(39)
Average = Sum(39)m / 12 =												60.8131	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1756	1.1726	1.1697	1.1559	1.1534	1.1414	1.1414	1.1392	1.1460	1.1534	1.1586	1.1640	(40)
HLP (average)												1.1559	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671	(42)
Average daily hot water use (litres/day)	76.1678	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	42.6957	37.1615	39.5905	36.8109	36.4854	33.8060	34.9328	36.4854	36.8109	39.5905	39.8159	42.6957	(61)
Total heat required for water heating calculated for each month													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
Total per year (kWh/year) = Sum(64)m =												1655.2968	(64)
Heat gains from water heating, kWh/month													
	51.9871	45.4231	47.1834	41.7094	40.3122	35.3668	33.6742	37.7415	38.1647	43.6501	46.7974	50.6835	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	69.8751	67.5939	63.4185	57.9297	54.1831	49.1206	45.2611	50.7279	53.0066	58.6694	64.9964	68.1230	(72)
Total internal gains													
	290.6062	288.3335	277.7727	261.2155	244.6834	228.5442	218.2845	223.7429	232.4070	249.1382	268.2507	282.4540	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	58.4960	109.3578	171.0208	240.5420	290.3430	296.0484	282.2769	244.8528	195.5396	127.0585	71.9415	48.7881	(83)
Total gains	349.1023	397.6913	448.7935	501.7575	535.0264	524.5925	500.5615	468.5958	427.9467	376.1968	340.1922	331.2421	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0712	59.2217	59.3700	60.0764	60.2105	60.8425	60.8425	60.9609	60.5975	60.2105	59.9399	59.6596	
alpha	4.9381	4.9481	4.9580	5.0051	5.0140	5.0562	5.0562	5.0641	5.0398	5.0140	4.9960	4.9773	
util living area													
	0.9969	0.9935	0.9833	0.9480	0.8551	0.6847	0.5178	0.5711	0.8224	0.9684	0.9937	0.9976	(86)
MIT	19.7831	19.9366	20.1978	20.5360	20.8095	20.9551	20.9910	20.9856	20.8856	20.5241	20.0925	19.7565	(87)
Th 2	19.9396	19.9420	19.9443	19.9554	19.9575	19.9672	19.9672	19.9690	19.9634	19.9575	19.9533	19.9489	(88)
util rest of house													
	0.9958	0.9913	0.9774	0.9291	0.8052	0.5931	0.4015	0.4517	0.7460	0.9532	0.9912	0.9968	(89)
MIT 2	18.3270	18.5522	18.9317	19.4171	19.7740	19.9379	19.9639	19.9632	19.8737	19.4109	18.7884	18.2948	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.0397	19.2298	19.5514	19.9647	20.2808	20.4358	20.4666	20.4636	20.3690	19.9557	19.4266	19.0102	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0397	19.2298	19.5514	19.9647	20.2808	20.4358	20.4666	20.4636	20.3690	19.9557	19.4266	19.0102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9893	0.9746	0.9293	0.8222	0.6364	0.4587	0.5105	0.7787	0.9532	0.9895	0.9958	(94)
Useful gains	347.2133	393.4531	437.3823	466.2947	439.8879	333.8604	229.5992	239.2025	333.2279	358.5906	336.6073	329.8408	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	911.6291	884.0280	803.1465	672.8882	520.6685	350.4271	232.1839	243.5374	377.9620	567.6914	751.3367	906.9569	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	419.9253	329.6663	272.1285	148.7473	60.1008	0.0000	0.0000	0.0000	0.0000	155.5710	298.6052	429.3744	(98)
Space heating												2114.1189	(98)
Space heating per m2											(98) / (4) =	40.1847	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2263.5106	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	419.9253	329.6663	272.1285	148.7473	60.1008	0.0000	0.0000	0.0000	0.0000	155.5710	298.6052	429.3744	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	449.5988	352.9618	291.3582	159.2583	64.3478	0.0000	0.0000	0.0000	0.0000	166.5642	319.7058	459.7156	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.2772	87.0423	86.5051	85.3037	83.2356	80.3000	80.3000	80.3000	80.3000	85.2973	86.7419	87.3756	(217)
Fuel for water heating, kWh/month													
	191.2821	167.5408	175.3979	157.7602	156.5347	142.9071	136.9159	152.6291	154.3147	165.4232	173.6453	186.5798	(219)
Water heating fuel used												1960.9308	(219)
Annual totals kWh/year													
Space heating fuel - main system												2263.5106	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Total delivered energy for all uses												4550.5307	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2263.5106	0.2160	488.9183	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1960.9308	0.2160	423.5611	(264)
Space and water heating			912.4793	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Total CO2, kg/m2/year			1081.7197	(272)
Emissions per m2 for space and water heating			17.3442	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4770	(272b)
Emissions per m2 for pumps and fans			0.7399	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.3442 * 1.00) + 2.4770 + 0.7399, rounded to 2 d.p.			20.5600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3826	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3252	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4146	0.4065	0.3984	0.3577	0.3496	0.3089	0.3089	0.3008	0.3252	0.3496	0.3658	0.3821	(22b)
Effective ac	0.5860	0.5826	0.5793	0.5640	0.5611	0.5477	0.5477	0.5452	0.5529	0.5611	0.5669	0.5730	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	55.5100	8.7500	46.7600	0.2700	12.6252			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0037			(33)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4193	(36)
Total fabric heat loss (33) + (36) =	42.4231	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4993	23.3655	23.2343	22.6180	22.5027	21.9660	21.9660	21.8666	22.1727	22.5027	22.7360	22.9798	(38)
Heat transfer coeff	65.9224	65.7885	65.6573	65.0411	64.9258	64.3891	64.3891	64.2897	64.5958	64.9258	65.1590	65.4029	(39)
Average = Sum(39)m / 12 =												65.0405	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2530	1.2505	1.2480	1.2363	1.2341	1.2239	1.2239	1.2220	1.2278	1.2341	1.2385	1.2432	(40)
HLP (average)												1.2363	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	253.2192	252.1032	243.3827	229.1398	214.2934	200.3146	191.4479	194.5998	202.1082	216.4622	232.9578	245.6994	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	321.9289	380.5553	444.2642	511.6813	555.3311	548.0539	523.0113	482.2048	431.7897	365.7056	317.4606	303.0060	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4208	55.5336	55.6445	56.1718	56.2715	56.7406	56.7406	56.8283	56.5590	56.2715	56.0701	55.8610	
alpha	4.6947	4.7022	4.7096	4.7448	4.7514	4.7827	4.7827	4.7886	4.7706	4.7514	4.7380	4.7241	
util living area													
	0.9978	0.9948	0.9851	0.9505	0.8588	0.6929	0.5281	0.5890	0.8396	0.9744	0.9955	0.9984	(86)
MIT	19.6338	19.8068	20.0978	20.4716	20.7769	20.9430	20.9875	20.9794	20.8536	20.4393	19.9640	19.6023	(87)
Th 2	19.8778	19.8798	19.8818	19.8911	19.8928	19.9009	19.9009	19.9024	19.8978	19.8928	19.8893	19.8856	(88)
util rest of house													
	0.9970	0.9930	0.9797	0.9319	0.8079	0.5967	0.4031	0.4604	0.7632	0.9613	0.9936	0.9978	(89)
MIT 2	18.6408	18.8146	19.1042	19.4727	19.7464	19.8758	19.8979	19.8969	19.8186	19.4501	18.9794	18.6155	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.1268	19.3003	19.5905	19.9616	20.2508	20.3981	20.4312	20.4267	20.3252	19.9343	19.4613	19.0985	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1268	19.3003	19.5905	19.9616	20.2508	20.3981	20.4312	20.4267	20.3252	19.9343	19.4613	19.0985	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9917	0.9779	0.9333	0.8260	0.6424	0.4647	0.5239	0.7960	0.9619	0.9926	0.9972	(94)
Useful gains	320.7522	377.4135	434.4455	477.5285	458.7076	352.0461	243.0576	252.6058	343.7174	351.7873	315.1146	302.1670	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	977.4195	947.3722	859.4889	719.4584	555.1658	373.3350	246.6868	258.8755	402.1200	606.0363	805.4528	974.4048	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	488.5605	383.0122	316.2324	174.1895	71.7649	0.0000	0.0000	0.0000	0.0000	189.1612	353.0436	500.1450	(98)
Space heating												2476.1093	(98)
Space heating per m2											(98) / (4) =	47.0654	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	605.2571	476.4790	488.6014	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8847	0.9364	0.9138	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	535.4920	446.1868	446.5081	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	707.4228	676.8950	630.2643	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	123.7901	171.6469	136.7146	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												432.1516 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	30.9475	42.9117	34.1787	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												108.0379 (107)
Space cooling per m2												2.0536 (108)
Energy for space heating												47.0654 (99)
Energy for space cooling												2.0536 (108)
Total												49.1189 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.1 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			8.7500	1.3258	11.6004			(27)
External Wall	55.5100	8.7500	46.7600	0.1800	8.4168			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Roof 1	52.6100		52.6100	0.1300	6.8393			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.2239			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5247	(36)
Total fabric heat loss					(33) + (36) =		37.7486	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	61.8486	61.6915	61.5374	60.8137	60.6784	60.0481	60.0481	59.9314	60.2908	60.6784	60.9522	61.2386	(39)
Average = Sum(39)m / 12 =												60.8131	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1756	1.1726	1.1697	1.1559	1.1534	1.1414	1.1414	1.1392	1.1460	1.1534	1.1586	1.1640	(40)
HLP (average)												1.1559	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7671 (42)
Average daily hot water use (litres/day)		76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	253.2192	252.1032	243.3827	229.1398	214.2934	200.3146	191.4479	194.5998	202.1082	216.4622	232.9578	245.6994	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	58.4960	109.3578	171.0208	240.5420	290.3430	296.0484	282.2769	244.8528	195.5396	127.0585	71.9415	48.7881	(83)
Total gains	311.7153	361.4610	414.4035	469.6819	504.6363	496.3629	473.7248	439.4527	397.6478	343.5207	304.8993	294.4874	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0712	59.2217	59.3700	60.0764	60.2105	60.8425	60.8425	60.9609	60.5975	60.2105	59.9399	59.6596	
alpha	4.9381	4.9481	4.9580	5.0051	5.0140	5.0562	5.0562	5.0641	5.0398	5.0140	4.9960	4.9773	
util living area													
	0.9981	0.9957	0.9879	0.9590	0.8766	0.7134	0.5445	0.6039	0.8527	0.9778	0.9961	0.9986	(86)
MIT	19.7176	19.8741	20.1411	20.4910	20.7825	20.9460	20.9888	20.9816	20.8625	20.4734	20.0313	19.6917	(87)
Th 2	19.9396	19.9420	19.9443	19.9554	19.9575	19.9672	19.9672	19.9690	19.9634	19.9575	19.9533	19.9489	(88)
util rest of house													
	0.9975	0.9942	0.9835	0.9434	0.8307	0.6216	0.4235	0.4801	0.7818	0.9666	0.9945	0.9981	(89)
MIT 2	18.7733	18.9311	19.1977	19.5466	19.8115	19.9426	19.9644	19.9638	19.8873	19.5369	19.0974	18.7550	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2355	19.3927	19.6594	20.0089	20.2867	20.4337	20.4658	20.4619	20.3646	19.9953	19.5545	19.2135	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2355	19.3927	19.6594	20.0089	20.2867	20.4337	20.4658	20.4619	20.3646	19.9953	19.5545	19.2135	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9932	0.9820	0.9443	0.8468	0.6652	0.4831	0.5412	0.8122	0.9671	0.9937	0.9976	(94)
Useful gains	310.7472	359.0123	406.9625	443.5265	427.3049	330.1668	228.8748	237.8280	322.9857	332.2145	302.9774	293.7942	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	923.7392	894.0730	809.7964	675.5721	521.0293	350.3037	232.1313	243.4381	377.6996	570.0905	759.1276	919.4045	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	456.0661	359.5608	299.7085	167.0728	69.7310	0.0000	0.0000	0.0000	0.0000	176.9797	328.4281	465.4541	(98)
Space heating												2323.0011	(98)
Space heating per m2											(98) / (4) =	44.1551	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	564.4519	444.3557	455.4783	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8862	0.9391	0.9180	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	500.2417	417.3000	418.1454	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	647.0048	619.2874	580.2943	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	105.6694	150.2786	120.6388	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												376.5869	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                    fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   26.4174   37.5697   30.1597    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          94.1467 (107)
Space cooling per m2                                                                                                    1.7895 (108)
Energy for space heating                                                                                               44.1551 (99)
Energy for space cooling                                                                                                1.7895 (108)
Total                                                                                                                  45.9446 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                    52.8 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3826	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3252	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3414	0.3171	0.3252	0.3089	0.3089	0.3008	0.2927	0.2845	0.2764	0.3008	0.2845	0.3008	(22b)
Effective ac	0.5583	0.5503	0.5529	0.5477	0.5477	0.5452	0.5428	0.5405	0.5382	0.5452	0.5405	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	55.5100	8.7500	46.7600	0.2700	12.6252			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0037			(33)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4193 (36)
Total fabric heat loss	(33) + (36) =	42.4231 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.3901	22.0680	22.1727	21.9660	21.9660	21.8666	21.7698	21.6758	21.5843	21.8666	21.6758	21.8666	(38)
Heat transfer coeff	64.8131	64.4911	64.5958	64.3891	64.3891	64.2897	64.1929	64.0988	64.0074	64.2897	64.0988	64.2897	(39)
Average = Sum(39)m / 12 =												64.3288	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2320	1.2258	1.2278	1.2239	1.2239	1.2220	1.2202	1.2184	1.2166	1.2220	1.2184	1.2220	(40)
HLP (average)												1.2227	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
RHI water heating demand												1336	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	86.8278	138.3328	218.2727	308.8635	354.1958	392.2436	371.0921	329.9484	263.6022	173.4847	106.4839	71.1553	(83)
Total gains	497.4213	545.5729	609.9458	676.5277	697.5688	713.6243	679.4549	644.8524	592.1734	526.2388	486.1134	470.8401	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3693	56.6508	56.5590	56.7406	56.7406	56.8283	56.9139	56.9975	57.0789	56.8283	56.9975	56.8283	
alpha	4.7580	4.7767	4.7706	4.7827	4.7827	4.7886	4.7943	4.7998	4.8053	4.7886	4.7998	4.7886	
util living area													
	0.9844	0.9753	0.9446	0.8622	0.7144	0.5030	0.3665	0.3851	0.6426	0.8860	0.9681	0.9870	(86)
MIT	20.0259	20.1540	20.4223	20.7231	20.9137	20.9868	20.9977	20.9971	20.9599	20.7341	20.3492	20.0064	(87)
Th 2	19.8945	19.8994	19.8978	19.9009	19.9009	19.9024	19.9039	19.9053	19.9067	19.9024	19.9053	19.9024	(88)
util rest of house													
	0.9794	0.9676	0.9275	0.8229	0.6438	0.4110	0.2646	0.2784	0.5467	0.8426	0.9563	0.9828	(89)
MIT 2	18.6459	18.8326	19.2084	19.6093	19.8302	19.8958	19.9033	19.9046	19.8821	19.6360	19.1186	18.6241	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.3213	19.4794	19.8025	20.1545	20.3605	20.4298	20.4389	20.4393	20.4096	20.1735	19.7210	19.3006	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3213	19.4794	19.8025	20.1545	20.3605	20.4298	20.4389	20.4393	20.4096	20.1735	19.7210	19.3006	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9761	0.9640	0.9258	0.8328	0.6747	0.4559	0.3146	0.3308	0.5924	0.8546	0.9539	0.9798	(94)
Useful gains	485.5352	525.9082	564.6648	563.4048	470.6293	325.3396	213.7549	213.3279	350.8075	449.7415	463.7085	461.3201	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	934.6925	914.4441	826.9889	686.0327	506.1298	329.7927	214.3368	214.0477	365.4569	564.0436	757.7091	919.3836	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	334.1731	261.0961	195.1692	88.2921	26.4123	0.0000	0.0000	0.0000	0.0000	85.0408	211.6804	340.7992	(98)
Space heating												1542.6632	(98)
RHI space heating demand												1543	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3826	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3252	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4146	0.4065	0.3984	0.3577	0.3496	0.3089	0.3089	0.3008	0.3252	0.3496	0.3658	0.3821	(22b)
Effective ac	0.5860	0.5826	0.5793	0.5640	0.5611	0.5477	0.5477	0.5452	0.5529	0.5611	0.5669	0.5730	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	55.5100	8.7500	46.7600	0.2700	12.6252			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0037			(33)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.4193	(36)
Total fabric heat loss (33) + (36) =	42.4231	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4993	23.3655	23.2343	22.6180	22.5027	21.9660	21.9660	21.8666	22.1727	22.5027	22.7360	22.9798	(38)
Heat transfer coeff	65.9224	65.7885	65.6573	65.0411	64.9258	64.3891	64.3891	64.2897	64.5958	64.9258	65.1590	65.4029	(39)
Average = Sum(39)m / 12 =												65.0405	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2530	1.2505	1.2480	1.2363	1.2341	1.2239	1.2239	1.2220	1.2278	1.2341	1.2385	1.2432	(40)
HLP (average)												1.2363	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	479.3031	535.6922	592.5546	650.2057	684.4107	669.1201	639.9262	602.5090	558.2528	501.9975	464.1322	456.9914	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4208	55.5336	55.6445	56.1718	56.2715	56.7406	56.7406	56.8283	56.5590	56.2715	56.0701	55.8610	
alpha	4.6947	4.7022	4.7096	4.7448	4.7514	4.7827	4.7827	4.7886	4.7706	4.7514	4.7380	4.7241	
util living area													
	0.9885	0.9795	0.9566	0.8945	0.7707	0.5911	0.4377	0.4824	0.7228	0.9233	0.9790	0.9907	(86)
MIT	19.9012	20.0631	20.3245	20.6391	20.8658	20.9708	20.9943	20.9911	20.9257	20.6278	20.2071	19.8660	(87)
Th 2	19.8778	19.8798	19.8818	19.8911	19.8928	19.9009	19.9009	19.9024	19.8978	19.8928	19.8893	19.8856	(88)
util rest of house													
	0.9849	0.9732	0.9431	0.8626	0.7089	0.4999	0.3310	0.3716	0.6343	0.8926	0.9713	0.9877	(89)
MIT 2	18.4538	18.6880	19.0603	19.4947	19.7724	19.8833	19.8990	19.8992	19.8452	19.4930	18.9050	18.4086	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.1622	19.3610	19.6791	20.0548	20.3076	20.4156	20.4351	20.4336	20.3741	20.0484	19.5423	19.1219	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1622	19.3610	19.6791	20.0548	20.3076	20.4156	20.4351	20.4336	20.3741	20.0484	19.5423	19.1219	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9819	0.9695	0.9401	0.8679	0.7335	0.5437	0.3834	0.4260	0.6747	0.8976	0.9683	0.9850	(94)
Useful gains	470.6218	519.3555	557.0747	564.3204	501.9886	363.8205	245.3374	256.6913	376.6684	450.5946	449.4110	450.1579	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	979.7520	951.3707	865.3016	725.5220	558.8532	374.4598	246.9398	259.3184	405.2785	613.4451	810.7315	975.9360	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	378.7928	290.3142	229.3209	116.0651	42.3072	0.0000	0.0000	0.0000	0.0000	121.1608	260.1508	391.1789	(98)
Space heating												1829.2907	(98)
Space heating per m2											(98) / (4) =	34.7708	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1960.6546	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	378.7928	290.3142	229.3209	116.0651	42.3072	0.0000	0.0000	0.0000	0.0000	121.1608	260.1508	391.1789	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	405.9945	311.1621	245.7887	124.3999	45.3453	0.0000	0.0000	0.0000	0.0000	129.8616	278.8326	419.2700	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3202	89.2212	89.0040	88.5193	87.7009	86.7000	86.7000	86.7000	86.7000	88.5245	89.1177	89.3634	(217)
Fuel for water heating, kWh/month													
	152.2609	133.6782	139.1529	123.2236	120.2716	106.3715	99.9420	112.7293	113.4942	127.8830	137.0708	147.7924	(219)
Water heating fuel used												1513.8701	(219)
Annual totals kWh/year													
Space heating fuel - main system												1960.6546	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												3548.1172	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1960.6546	3.4800	68.2308	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1513.8701	3.4800	52.6827	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	251.0893	13.1900	33.1187	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			283.9246	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2217	(257)
SAP value		82.9575	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1960.6546	0.2160	423.5014	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1513.8701	0.2160	326.9959	(264)
Space and water heating			750.4973	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total kg/year			788.6918	(272)
CO2 emissions per m2			14.9900	(273)
EI value			89.1728	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8813 = 3.949, stars = 4
Water heating environmental impact	0.216 / 0.8813 = 0.2451, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.3600	
Infiltration rate		0.3826	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3252	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3414	0.3171	0.3252	0.3089	0.3089	0.3008	0.2927	0.2845	0.2764	0.3008	0.2845	0.3008	(22b)
Effective ac	0.5583	0.5503	0.5529	0.5477	0.5477	0.5452	0.5428	0.5405	0.5382	0.5452	0.5405	0.5452	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	55.5100	8.7500	46.7600	0.2700	12.6252			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			123.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.0037			(33)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4193 (36)
Total fabric heat loss	(33) + (36) =	42.4231 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.3901	22.0680	22.1727	21.9660	21.9660	21.8666	21.7698	21.6758	21.5843	21.8666	21.6758	21.8666	(38)
Heat transfer coeff	64.8131	64.4911	64.5958	64.3891	64.3891	64.2897	64.1929	64.0988	64.0074	64.2897	64.0988	64.2897	(39)
Average = Sum(39)m / 12 =												64.3288	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2320	1.2258	1.2278	1.2239	1.2239	1.2220	1.2202	1.2184	1.2166	1.2220	1.2184	1.2220	(40)
HLP (average)												1.2227	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	86.8278	138.3328	218.2727	308.8635	354.1958	392.2436	371.0921	329.9484	263.6022	173.4847	106.4839	71.1553	(83)
Total gains	497.4213	545.5729	609.9458	676.5277	697.5688	713.6243	679.4549	644.8524	592.1734	526.2388	486.1134	470.8401	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3693	56.6508	56.5590	56.7406	56.7406	56.8283	56.9139	56.9975	57.0789	56.8283	56.9975	56.8283	
alpha	4.7580	4.7767	4.7706	4.7827	4.7827	4.7886	4.7943	4.7998	4.8053	4.7886	4.7998	4.7886	
util living area													
	0.9844	0.9753	0.9446	0.8622	0.7144	0.5030	0.3665	0.3851	0.6426	0.8860	0.9681	0.9870	(86)
MIT	20.0259	20.1540	20.4223	20.7231	20.9137	20.9868	20.9977	20.9971	20.9599	20.7341	20.3492	20.0064	(87)
Th 2	19.8945	19.8994	19.8978	19.9009	19.9009	19.9024	19.9039	19.9053	19.9067	19.9024	19.9053	19.9024	(88)
util rest of house													
	0.9794	0.9676	0.9275	0.8229	0.6438	0.4110	0.2646	0.2784	0.5467	0.8426	0.9563	0.9828	(89)
MIT 2	18.6459	18.8326	19.2084	19.6093	19.8302	19.8958	19.9033	19.9046	19.8821	19.6360	19.1186	18.6241	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.3213	19.4794	19.8025	20.1545	20.3605	20.4298	20.4389	20.4393	20.4096	20.1735	19.7210	19.3006	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3213	19.4794	19.8025	20.1545	20.3605	20.4298	20.4389	20.4393	20.4096	20.1735	19.7210	19.3006	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9761	0.9640	0.9258	0.8328	0.6747	0.4559	0.3146	0.3308	0.5924	0.8546	0.9539	0.9798	(94)
Useful gains	485.5352	525.9082	564.6648	563.4048	470.6293	325.3396	213.7549	213.3279	350.8075	449.7415	463.7085	461.3201	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	934.6925	914.4441	826.9889	686.0327	506.1298	329.7927	214.3368	214.0477	365.4569	564.0436	757.7091	919.3836	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	334.1731	261.0961	195.1692	88.2921	26.4123	0.0000	0.0000	0.0000	0.0000	85.0408	211.6804	340.7992	(98)
Space heating												1542.6632	(98)
Space heating per m2											(98) / (4) =	29.3226	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1653.4440	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	334.1731	261.0961	195.1692	88.2921	26.4123	0.0000	0.0000	0.0000	0.0000	85.0408	211.6804	340.7992	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	358.1705	279.8458	209.1845	94.6324	28.3090	0.0000	0.0000	0.0000	0.0000	91.1477	226.8815	365.2725	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2283	89.1394	88.8675	88.2743	87.3978	86.7000	86.7000	86.7000	86.7000	88.2085	88.9486	89.2648	(217)
Fuel for water heating, kWh/month													
	152.4177	133.8009	139.3667	123.5655	120.6887	106.3715	99.9420	112.7293	113.4942	128.3411	137.3314	147.9557	(219)
Water heating fuel used												1516.0045	(219)
Annual totals kWh/year													
Space heating fuel - main system												1653.4440	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 967 * 1.00) =												-286.1698	(233)
Total delivered energy for all uses												3209.3680	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1653.4440	7.3800	122.0242	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1516.0045	7.3800	111.8811	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	251.0893	28.6600	71.9622	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			434.3625	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1653.4440	0.2160	357.1439	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1516.0045	0.2160	327.4570	(264)
Space and water heating			684.6009	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	0.5190	-148.5221	(269)
Total kg/year			705.3191	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1653.4440	1.2200	2017.2017	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1516.0045	1.2200	1849.5255	(264)
Space and water heating			3866.7272	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	251.0893	3.0700	770.8443	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	3.0700	-878.5413	(269)
Primary energy kWh/year			3989.2801	(272)
Primary energy kWh/m2/year			75.8274	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£93	£93	£0
Mains gas	£341	£341	£0
Space heating	£251	£251	£0
Water heating	£112	£112	£0
Lighting	£72	£72	£0
Total cost of fuels	£434	£434	£0
Total cost of uses	£435	£435	£0
Delivered energy	61 kWh/m²	61 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	76 kWh/m²	76 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	240.63 (P1)
Transmission heat loss coefficient	42.42 (37)
Summer heat loss coefficient	283.05 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	4.5800	125.2818	0.7400	0.7000	0.8865	237.1398
South	1.0800	118.5567	0.7400	0.7000	0.8865	52.9177
West	2.0100	125.2818	0.7400	0.7000	0.8865	104.0723
total:						433.0382

	Jun	Jul	Aug	
Solar gains	465	433	384	(P3)
Internal gains	318	305	312	
Total summer gains	784	738	696	(P5)
Summer gain/loss ratio	2.77	2.61	2.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.42	20.16	20.01	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 677 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 677 - EPC	**Prop Type Ref**	
Property	37 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	17.07	**TER**	20.56
Environmental	89 B	**% DER<TER**	16.98		
CO_2 Emissions (t/year)	0.71	**DFEE**	49.12	**TFEE**	52.84
General Requirements Compliance	Pass	**% DFEE<TFEE**	7.04		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.56	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	17.07	$kgCO_2/m^2$	Pass
	-3.49 (-17.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.84	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.12	$kWh/m^2/yr$	
	-3.7 (-7.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

5 Cylinder insulation

Hot water storage	No cylinder	

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	No cylinder	
Boiler interlock	Yes	Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.08 m², No overhang
Windows facing East	4.58 m², No overhang
Windows facing South	1.08 m², No overhang
Windows facing West	2.01 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.36 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Thermal bridging y-value	0.036	W/m²K
Photovoltaic array	0.37	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 678 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 678 - EPC	**Prop Type Ref**	
Property	39 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	13.49	**TER**	19.82
Environmental	92 A	**% DER<TER**	31.94		
CO_2 Emissions (t/year)	0.51	**DFEE**	44.09	**TFEE**	49.06
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Top-floor flat, total floor area 53 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.82 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.49 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)49.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: No cylinder

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum: 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing East: 4.58 m², No overhang
Windows facing South: 1.08 m², No overhang
Windows facing West: 2.01 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.036 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3876	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4200	0.4118	0.4036	0.3624	0.3541	0.3130	0.3130	0.3047	0.3294	0.3541	0.3706	0.3871	(22b)
Effective ac	0.5882	0.5848	0.5814	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5749	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	40.1300	8.7500	31.3800	0.2700	8.4726			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8511			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8577	(36)
Total fabric heat loss (33) + (36) =	37.7088	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5900	23.4526	23.3180	22.6855	22.5672	22.0163	22.0163	21.9143	22.2285	22.5672	22.8066	23.0568	(38)
Heat transfer coeff	61.2988	61.1615	61.0268	60.3944	60.2760	59.7252	59.7252	59.6232	59.9374	60.2760	60.5154	60.7657	(39)
Average = Sum(39)m / 12 =												60.3938	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1652	1.1625	1.1600	1.1480	1.1457	1.1352	1.1352	1.1333	1.1393	1.1457	1.1503	1.1550	(40)
HLP (average)												1.1480	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	280.2077	278.4518	268.4056	252.3618	236.3456	220.7211	210.4573	215.4012	223.5476	239.7653	258.3656	272.0532	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	348.9173	406.9038	469.2871	534.9032	577.3834	568.4605	542.0207	503.0061	453.2290	389.0087	342.8684	329.3598	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6010	59.7349	59.8667	60.4936	60.6124	61.1714	61.1714	61.2761	60.9548	60.6124	60.3726	60.1239	
alpha	4.9734	4.9823	4.9911	5.0329	5.0408	5.0781	5.0781	5.0851	5.0637	5.0408	5.0248	5.0083	
util living area													
	0.9969	0.9928	0.9797	0.9342	0.8219	0.6402	0.4784	0.5336	0.7946	0.9637	0.9935	0.9977	(86)
MIT	19.7968	19.9657	20.2425	20.5874	20.8463	20.9672	20.9938	20.9895	20.9045	20.5498	20.1065	19.7653	(87)
Th 2	19.9480	19.9501	19.9521	19.9619	19.9637	19.9722	19.9722	19.9737	19.9689	19.9637	19.9600	19.9562	(88)
util rest of house													
	0.9958	0.9904	0.9728	0.9118	0.7674	0.5505	0.3700	0.4205	0.7148	0.9468	0.9908	0.9969	(89)
MIT 2	18.3529	18.6001	19.0010	19.4902	19.8197	19.9514	19.9700	19.9696	19.8960	19.4505	18.8135	18.3128	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.0596	19.2685	19.6087	20.0272	20.3222	20.4486	20.4711	20.4688	20.3896	19.9886	19.4464	19.0237	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0596	19.2685	19.6087	20.0272	20.3222	20.4486	20.4711	20.4688	20.3896	19.9886	19.4464	19.0237	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9883	0.9699	0.9135	0.7877	0.5934	0.4233	0.4761	0.7499	0.9473	0.9891	0.9959	(94)
Useful gains	347.0355	402.1425	455.1683	488.6100	454.7887	337.3304	229.4393	239.4783	339.8874	368.4966	339.1307	328.0024	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	904.7487	878.7980	799.9800	672.0213	519.7097	349.3087	231.2010	242.5953	376.9827	565.9073	747.1467	900.7742	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	414.9386	320.3125	256.5399	132.0562	48.3012	0.0000	0.0000	0.0000	0.0000	146.8735	293.7715	426.1422	(98)
Space heating												2038.9357	(98)
Space heating per m2											(98) / (4) =	38.7557	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2185.3544	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	414.9386	320.3125	256.5399	132.0562	48.3012	0.0000	0.0000	0.0000	0.0000	146.8735	293.7715	426.1422	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	444.7359	343.3146	274.9624	141.5393	51.7698	0.0000	0.0000	0.0000	0.0000	157.4207	314.8677	456.7441	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3838	89.2940	89.0955	88.6352	87.7994	86.7000	86.7000	86.7000	86.7000	88.6969	89.2121	89.4215	(217)
Fuel for water heating, kWh/month	152.1525	133.5692	139.0100	123.0624	120.1366	106.3715	99.9420	112.7293	113.4942	127.6344	136.9257	147.6964	(219)
Water heating fuel used												1512.7240	(219)
Annual totals kWh/year													
Space heating fuel - main system												2185.3544	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3525.9983	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2185.3544	0.2160	472.0366	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1512.7240	0.2160	326.7484	(264)
Space and water heating			798.7849	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total CO2, kg/year			709.4754	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.4900	ZC1
Total Floor Area	TFA	52.6100	
Assumed number of occupants	N	1.7671	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.3468	ZC2
CO2 emissions from cooking, equation (L16)		3.0680	ZC3
Total CO2 emissions		33.9049	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.9049	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			8.7500	1.3258	11.6004			(27)
External Wall	40.1300	8.7500	31.3800	0.1800	5.6484			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Roof 1	52.6100		52.6100	0.1300	6.8393			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4555			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3194	(36)
Total fabric heat loss					(33) + (36) =		34.7749	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	58.8750	58.7178	58.5637	57.8401	57.7047	57.0744	57.0744	56.9577	57.3172	57.7047	57.9786	58.2649	(39)
Average = Sum(39)m / 12 =												57.8394	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1191	1.1161	1.1132	1.0994	1.0968	1.0849	1.0849	1.0826	1.0895	1.0968	1.1020	1.1075	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7671 (42)
Average daily hot water use (litres/day)		76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	42.6957	37.1615	39.5905	36.8109	36.4854	33.8060	34.9328	36.4854	36.8109	39.5905	39.8159	42.6957	(61)
Total heat required for water heating calculated for each month													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
									Total per year (kWh/year) = Sum(64)m =			1655.2968	(64)
Heat gains from water heating, kWh/month													
	51.9871	45.4231	47.1834	41.7094	40.3122	35.3668	33.6742	37.7415	38.1647	43.6501	46.7974	50.6835	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	69.8751	67.5939	63.4185	57.9297	54.1831	49.1206	45.2611	50.7279	53.0066	58.6694	64.9964	68.1230	(72)
Total internal gains													
	290.6062	288.3335	277.7727	261.2155	244.6834	228.5442	218.2845	223.7429	232.4070	249.1382	268.2507	282.4540	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	58.4960	109.3578	171.0208	240.5420	290.3430	296.0484	282.2769	244.8528	195.5396	127.0585	71.9415	48.7881	(83)
Total gains	349.1023	397.6913	448.7935	501.7575	535.0264	524.5925	500.5615	468.5958	427.9467	376.1968	340.1922	331.2421	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.0548	62.2209	62.3846	63.1651	63.3133	64.0125	64.0125	64.1436	63.7413	63.3133	63.0142	62.7045	
alpha	5.1370	5.1481	5.1590	5.2110	5.2209	5.2675	5.2675	5.2762	5.2494	5.2209	5.2009	5.1803	
util living area													
	0.9968	0.9933	0.9821	0.9428	0.8405	0.6613	0.4950	0.5474	0.8051	0.9655	0.9935	0.9976	(86)
MIT	19.8596	20.0114	20.2660	20.5913	20.8433	20.9668	20.9939	20.9900	20.9080	20.5730	20.1573	19.8335	(87)
Th 2	19.9853	19.9877	19.9901	20.0013	20.0034	20.0132	20.0132	20.0150	20.0094	20.0034	19.9992	19.9947	(88)
util rest of house													
	0.9958	0.9910	0.9759	0.9229	0.7897	0.5735	0.3875	0.4362	0.7285	0.9495	0.9909	0.9968	(89)
MIT 2	18.4712	18.6939	19.0634	19.5288	19.8538	19.9918	20.0110	20.0110	19.9382	19.5139	18.9157	18.4398	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.1508	19.3388	19.6520	20.0489	20.3381	20.4690	20.4921	20.4902	20.4129	20.0323	19.5234	19.1219	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1508	19.3388	19.6520	20.0489	20.3381	20.4690	20.4921	20.4902	20.4129	20.0323	19.5234	19.1219	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9946	0.9891	0.9733	0.9240	0.8081	0.6154	0.4403	0.4908	0.7622	0.9501	0.9892	0.9958	(94)
Useful gains	347.2189	393.3633	436.8193	463.6096	432.3738	322.8411	220.4183	229.9977	326.1772	357.4197	336.5287	329.8555	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	874.3376	847.8118	770.2306	644.8517	498.4589	334.9694	222.1403	232.9681	361.8373	544.2855	720.2900	869.4252	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	392.1763	305.3894	248.0580	130.4943	49.1673	0.0000	0.0000	0.0000	0.0000	139.0281	276.3081	401.4399	(98)
Space heating												1942.0615	(98)
Space heating per m2											(98) / (4) =	36.9143	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2079.2950	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	392.1763	305.3894	248.0580	130.4943	49.1673	0.0000	0.0000	0.0000	0.0000	139.0281	276.3081	401.4399	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	419.8890	326.9693	265.5867	139.7155	52.6417	0.0000	0.0000	0.0000	0.0000	148.8524	295.8331	429.8072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	166.9457	145.8314	151.7281	134.5752	130.2925	114.7544	109.9435	122.5612	123.9147	141.1016	150.6232	163.0252	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.1279	86.8687	86.2813	84.9738	82.8356	80.3000	80.3000	80.3000	80.3000	85.0140	86.5589	87.2312	(217)
Fuel for water heating, kWh/month													
	191.6100	167.8756	175.8529	158.3726	157.2905	142.9071	136.9159	152.6291	154.3147	165.9746	174.0123	186.8887	(219)
Water heating fuel used												1964.6441	(219)
Annual totals kWh/year													
Space heating fuel - main system												2079.2950	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Total delivered energy for all uses												4370.0284	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2079.2950	0.2160	449.1277	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1964.6441	0.2160	424.3631	(264)
Space and water heating			873.4908	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Total CO2, kg/m2/year			1042.7312	(272)
Emissions per m2 for space and water heating			16.6031	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4770	(272b)
Emissions per m2 for pumps and fans			0.7399	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6031 * 1.00) + 2.4770 + 0.7399, rounded to 2 d.p.			19.8200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3876	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4200	0.4118	0.4036	0.3624	0.3541	0.3130	0.3130	0.3047	0.3294	0.3541	0.3706	0.3871	(22b)
Effective ac	0.5882	0.5848	0.5814	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5749	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	40.1300	8.7500	31.3800	0.2700	8.4726			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8511			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8577	(36)
Total fabric heat loss (33) + (36) =	37.7088	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5900	23.4526	23.3180	22.6855	22.5672	22.0163	22.0163	21.9143	22.2285	22.5672	22.8066	23.0568	(38)
Heat transfer coeff	61.2988	61.1615	61.0268	60.3944	60.2760	59.7252	59.7252	59.6232	59.9374	60.2760	60.5154	60.7657	(39)
Average = Sum(39)m / 12 =												60.3938	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1652	1.1625	1.1600	1.1480	1.1457	1.1352	1.1352	1.1333	1.1393	1.1457	1.1503	1.1550	(40)
HLP (average)												1.1480	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671	(42)
Average daily hot water use (litres/day)	76.1678	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

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If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)

Water heating gains (Table 5)

	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)

Total internal gains

	253.2192	252.1032	243.3827	229.1398	214.2934	200.3146	191.4479	194.5998	202.1082	216.4622	232.9578	245.6994	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	321.9289	380.5553	444.2642	511.6813	555.3311	548.0539	523.0113	482.2048	431.7897	365.7056	317.4606	303.0060	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6010	59.7349	59.8667	60.4936	60.6124	61.1714	61.1714	61.2761	60.9548	60.6124	60.3726	60.1239	
alpha	4.9734	4.9823	4.9911	5.0329	5.0408	5.0781	5.0781	5.0851	5.0637	5.0408	5.0248	5.0083	
util living area	0.9978	0.9946	0.9838	0.9436	0.8384	0.6593	0.4948	0.5544	0.8166	0.9714	0.9953	0.9984	(86)
MIT	19.7495	19.9203	20.2020	20.5572	20.8303	20.9626	20.9928	20.9876	20.8909	20.5147	20.0625	19.7188	(87)
Th 2	19.9480	19.9501	19.9521	19.9619	19.9637	19.9722	19.9722	19.9737	19.9689	19.9637	19.9600	19.9562	(88)
util rest of house	0.9971	0.9928	0.9780	0.9235	0.7860	0.5688	0.3832	0.4380	0.7395	0.9574	0.9934	0.9978	(89)
MIT 2	18.8118	18.9835	19.2636	19.6127	19.8536	19.9558	19.9704	19.9704	19.9108	19.5809	19.1338	18.7878	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.2707	19.4420	19.7229	20.0750	20.3316	20.4486	20.4708	20.4682	20.3905	20.0379	19.5884	19.2435	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2707	19.4420	19.7229	20.0750	20.3316	20.4486	20.4708	20.4682	20.3905	20.0379	19.5884	19.2435	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9916	0.9765	0.9261	0.8061	0.6123	0.4381	0.4953	0.7738	0.9586	0.9925	0.9973	(94)
Useful gains	320.7850	377.3658	433.8186	473.8449	447.6616	335.5552	229.1282	238.8425	334.1116	350.5736	315.0911	302.2017	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	917.6895	889.4127	806.9500	674.9055	520.2810	349.3080	231.1849	242.5613	377.0384	568.8810	755.7377	914.1285	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	444.0970	344.0955	277.6097	144.7636	54.0288	0.0000	0.0000	0.0000	0.0000	162.4207	317.2655	455.2735	(98)
Space heating												2199.5543	(98)
Space heating per m2											(98) / (4) =	41.8087	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	561.4166	441.9663	453.1360	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9154	0.9569	0.9394	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	513.9458	422.9328	425.6595	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	707.4228	676.8950	630.2643	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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                0.0000     0.0000     0.0000     0.0000     0.0000   139.3034   188.9479   152.2259     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                          480.4772 (104)
Cooled fraction                                                                                          fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    34.8259    47.2370    38.0565     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          120.1193 (107)
Space cooling per m2                                                                                                                     2.2832 (108)
Energy for space heating                                                                                                                41.8087 (99)
Energy for space cooling                                                                                                                 2.2832 (108)
Total                                                                                                                                   44.0919 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                                   44.1 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4146	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3524	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4493	0.4405	0.4317	0.3876	0.3788	0.3348	0.3348	0.3260	0.3524	0.3788	0.3964	0.4141	(22b)
Effective ac	0.6009	0.5970	0.5932	0.5751	0.5717	0.5560	0.5560	0.5531	0.5621	0.5717	0.5786	0.5857	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.40)			8.7500	1.3258	11.6004			(27)
External Wall	40.1300	8.7500	31.3800	0.1800	5.6484			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.1800	2.4174			(29a)
Roof 1	52.6100		52.6100	0.1300	6.8393			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4555			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3194	(36)
Total fabric heat loss					(33) + (36) =		34.7749	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1001	23.9429	23.7888	23.0652	22.9298	22.2995	22.2995	22.1828	22.5423	22.9298	23.2037	23.4900	(38)
Heat transfer coeff	58.8750	58.7178	58.5637	57.8401	57.7047	57.0744	57.0744	56.9577	57.3172	57.7047	57.9786	58.2649	(39)
Average = Sum(39)m / 12 =												57.8394	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1191	1.1161	1.1132	1.0994	1.0968	1.0849	1.0849	1.0826	1.0895	1.0968	1.1020	1.1075	(40)
HLP (average)												1.0994	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.7671 (42)
Average daily hot water use (litres/day)		76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.4031	23.0924	23.8292	20.7749	19.9340	17.2015	15.9398	18.2911	18.5096	21.5711	23.5465	25.5700	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	88.3532	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.2177	12.6281	10.2698	7.7749	5.8118	4.9066	5.3018	6.8914	9.2497	11.7446	13.7076	14.6129	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	154.0075	155.6056	151.5784	143.0049	132.1825	122.0110	115.2158	113.6176	117.6448	126.2183	137.0407	147.2122	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	31.8353	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	35.4881	34.3636	32.0285	28.8540	26.7930	23.8910	21.4244	24.5848	25.7077	28.9934	32.7035	34.3683	(72)
Total internal gains													
	253.2192	252.1032	243.3827	229.1398	214.2934	200.3146	191.4479	194.5998	202.1082	216.4622	232.9578	245.6994	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.5800	19.6403	0.6300	0.7000	0.7700	27.4906	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)
West	2.0100	19.6403	0.6300	0.7000	0.7700	12.0647	(80)

Solar gains	58.4960	109.3578	171.0208	240.5420	290.3430	296.0484	282.2769	244.8528	195.5396	127.0585	71.9415	48.7881	(83)
Total gains	311.7153	361.4610	414.4035	469.6819	504.6363	496.3629	473.7248	439.4527	397.6478	343.5207	304.8993	294.4874	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.0548	62.2209	62.3846	63.1651	63.3133	64.0125	64.0125	64.1436	63.7413	63.3133	63.0142	62.7045	
alpha	5.1370	5.1481	5.1590	5.2110	5.2209	5.2675	5.2675	5.2762	5.2494	5.2209	5.2009	5.1803	
util living area													
	0.9981	0.9956	0.9872	0.9551	0.8639	0.6906	0.5211	0.5798	0.8377	0.9760	0.9960	0.9986	(86)
MIT	19.7935	19.9483	20.2091	20.5472	20.8185	20.9594	20.9923	20.9870	20.8874	20.5226	20.0956	19.7680	(87)
Th 2	19.9853	19.9877	19.9901	20.0013	20.0034	20.0132	20.0132	20.0150	20.0094	20.0034	19.9992	19.9947	(88)
util rest of house													
	0.9975	0.9941	0.9826	0.9385	0.8167	0.6021	0.4090	0.4639	0.7659	0.9642	0.9944	0.9981	(89)
MIT 2	18.8856	19.0418	19.3021	19.6387	19.8827	19.9949	20.0113	20.0114	19.9478	19.6223	19.1984	18.8679	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.3300	19.4855	19.7460	20.0834	20.3407	20.4670	20.4915	20.4889	20.4077	20.0630	19.6375	19.3085	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3300	19.4855	19.7460	20.0834	20.3407	20.4670	20.4915	20.4889	20.4077	20.0630	19.6375	19.3085	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9932	0.9813	0.9401	0.8342	0.6445	0.4642	0.5211	0.7975	0.9651	0.9936	0.9977	(94)
Useful gains	310.7643	358.9865	406.6390	441.5599	420.9508	319.8821	219.9012	228.9815	317.1184	331.5165	302.9604	293.8127	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	884.8885	856.4300	775.7365	646.8466	498.6088	334.8554	222.1026	232.8944	361.5379	546.0577	726.9064	880.2942	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	427.1484	334.2821	274.6085	147.8065	57.7776	0.0000	0.0000	0.0000	0.0000	159.6187	305.2411	436.3423	(98)
Space heating												2142.8251	(98)
Space heating per m2											(98) / (4) =	40.7304	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	536.4993	422.3505	432.8783	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9078	0.9534	0.9357	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	487.0419	402.6761	405.0270	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	647.0048	619.2874	580.2943	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	115.1733	161.1589	130.3988	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												406.7310	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   28.7933   40.2897   32.5997    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        101.6827 (107)
Space cooling per m2                                                                                                   1.9328 (108)
Energy for space heating                                                                                              40.7304 (99)
Energy for space cooling                                                                                               1.9328 (108)
Total                                                                                                                 42.6631 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                   49.1 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3876	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3459	0.3212	0.3294	0.3130	0.3130	0.3047	0.2965	0.2883	0.2800	0.3047	0.2883	0.3047	(22b)
Effective ac	0.5598	0.5516	0.5543	0.5490	0.5490	0.5464	0.5440	0.5415	0.5392	0.5464	0.5415	0.5464	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	40.1300	8.7500	31.3800	0.2700	8.4726			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.8511			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8577	(36)
Total fabric heat loss (33) + (36) =	37.7088	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.4516	22.1211	22.2285	22.0163	22.0163	21.9143	21.8150	21.7185	21.6246	21.9143	21.7185	21.9143	(38)
Heat transfer coeff	60.1604	59.8299	59.9374	59.7252	59.7252	59.6232	59.5239	59.4273	59.3335	59.6232	59.4273	59.6232	(39)
Average = Sum(39)m / 12 =												59.6633	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1435	1.1372	1.1393	1.1352	1.1352	1.1333	1.1314	1.1296	1.1278	1.1333	1.1296	1.1333	(40)
HLP (average)												1.1341	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428 (61)
Total heat required for water heating calculated for each month												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203 (64)
RHI water heating demand												1336 (64)
Heat gains from water heating, kWh/month												
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	86.8278	138.3328	218.2727	308.8635	354.1958	392.2436	371.0921	329.9484	263.6022	173.4847	106.4839	71.1553	(83)
Total gains	497.4213	545.5729	609.9458	676.5277	697.5688	713.6243	679.4549	644.8524	592.1734	526.2388	486.1134	470.8401	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7288	61.0643	60.9548	61.1714	61.1714	61.2761	61.3783	61.4780	61.5753	61.2761	61.4780	61.2761	
alpha	5.0486	5.0710	5.0637	5.0781	5.0781	5.0851	5.0919	5.0985	5.1050	5.0851	5.0985	5.0851	
util living area													
	0.9829	0.9723	0.9365	0.8417	0.6816	0.4704	0.3407	0.3582	0.6076	0.8687	0.9639	0.9858	(86)
MIT	20.1427	20.2684	20.5208	20.7899	20.9424	20.9926	20.9988	20.9986	20.9749	20.7936	20.4447	20.1230	(87)
Th 2	19.9655	19.9705	19.9689	19.9722	19.9722	19.9737	19.9753	19.9767	19.9782	19.9737	19.9767	19.9737	(88)
util rest of house													
	0.9776	0.9641	0.9181	0.8010	0.6142	0.3885	0.2517	0.2649	0.5190	0.8233	0.9512	0.9814	(89)
MIT 2	18.8658	19.0486	19.3996	19.7532	19.9254	19.9700	19.9750	19.9764	19.9629	19.7693	19.3068	18.8441	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.4908	19.6457	19.9484	20.2606	20.4232	20.4705	20.4761	20.4767	20.4582	20.2707	19.8637	19.4701	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4908	19.6457	19.9484	20.2606	20.4232	20.4705	20.4761	20.4767	20.4582	20.2707	19.8637	19.4701	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9609	0.9177	0.8133	0.6448	0.4285	0.2953	0.3106	0.5617	0.8378	0.9495	0.9786	(94)
Useful gains	484.7610	524.2351	559.7374	550.2266	449.7858	305.8136	200.6720	200.3071	332.6190	440.8630	461.5695	460.7527	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	877.7882	858.2999	776.0905	642.6777	473.2135	308.2814	200.9585	200.6669	341.6550	528.8980	710.9712	862.7512	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	292.4123	224.4916	160.9667	66.5648	17.4303	0.0000	0.0000	0.0000	0.0000	65.4981	179.5692	299.0869	(98)
Space heating												1306.0197	(98)
RHI space heating demand												1306	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3876	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4200	0.4118	0.4036	0.3624	0.3541	0.3130	0.3130	0.3047	0.3294	0.3541	0.3706	0.3871	(22b)
Effective ac	0.5882	0.5848	0.5814	0.5657	0.5627	0.5490	0.5490	0.5464	0.5543	0.5627	0.5687	0.5749	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	40.1300	8.7500	31.3800	0.2700	8.4726			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8511			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8577	(36)
Total fabric heat loss (33) + (36) =	37.7088	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.5900	23.4526	23.3180	22.6855	22.5672	22.0163	22.0163	21.9143	22.2285	22.5672	22.8066	23.0568	(38)
Heat transfer coeff	61.2988	61.1615	61.0268	60.3944	60.2760	59.7252	59.7252	59.6232	59.9374	60.2760	60.5154	60.7657	(39)
Average = Sum(39)m / 12 =												60.3938	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1652	1.1625	1.1600	1.1480	1.1457	1.1352	1.1352	1.1333	1.1393	1.1457	1.1503	1.1550	(40)
HLP (average)												1.1480	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428 (61)
Total heat required for water heating calculated for each month												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723 (64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203 (64)
Heat gains from water heating, kWh/month												
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.5800	19.6403	0.7400	0.7000	0.7700	32.2906	(76)
South	1.0800	46.7521	0.7400	0.7000	0.7700	18.1254	(78)
West	2.0100	19.6403	0.7400	0.7000	0.7700	14.1712	(80)

Solar gains	68.7096	128.4521	200.8815	282.5415	341.0378	347.7394	331.5634	287.6049	229.6815	149.2434	84.5027	57.3066	(83)
Total gains	479.3031	535.6922	592.5546	650.2057	684.4107	669.1201	639.9262	602.5090	558.2528	501.9975	464.1322	456.9914	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6010	59.7349	59.8667	60.4936	60.6124	61.1714	61.1714	61.2761	60.9548	60.6124	60.3726	60.1239	
alpha	4.9734	4.9823	4.9911	5.0329	5.0408	5.0781	5.0781	5.0851	5.0637	5.0408	5.0248	5.0083	
util living area													
	0.9877	0.9774	0.9509	0.8789	0.7417	0.5565	0.4080	0.4506	0.6907	0.9120	0.9768	0.9901	(86)
MIT	20.0203	20.1788	20.4273	20.7155	20.9054	20.9823	20.9970	20.9951	20.9499	20.6980	20.3077	19.9862	(87)
Th 2	19.9480	19.9501	19.9521	19.9619	19.9637	19.9722	19.9722	19.9737	19.9689	19.9637	19.9600	19.9562	(88)
util rest of house													
	0.9839	0.9707	0.9363	0.8453	0.6810	0.4735	0.3141	0.3525	0.6062	0.8793	0.9685	0.9870	(89)
MIT 2	18.6765	18.9053	19.2576	19.6521	19.8799	19.9616	19.9711	19.9719	19.9339	19.6418	19.1006	18.6333	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	19.3343	19.5286	19.8301	20.1726	20.3818	20.4612	20.4732	20.4727	20.4312	20.1587	19.6914	19.2955	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3343	19.5286	19.8301	20.1726	20.3818	20.4612	20.4732	20.4727	20.4312	20.1587	19.6914	19.2955	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9810	0.9673	0.9343	0.8528	0.7066	0.5137	0.3602	0.4006	0.6456	0.8863	0.9659	0.9845	(94)
Useful gains	470.2136	518.1885	553.6309	554.5042	483.6223	343.7168	230.4853	241.3941	360.4321	444.8954	448.3079	449.8858	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	921.5825	894.7073	813.4927	680.8010	523.3063	350.0595	231.3292	242.8265	379.4738	576.1626	761.9763	917.2892	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	335.8185	253.0206	193.3372	90.9337	29.5249	0.0000	0.0000	0.0000	0.0000	97.6628	225.8412	347.7481	(98)
Space heating												1573.8870	(98)
Space heating per m2											(98) / (4) =	29.9161	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1686.9100	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	335.8185	253.0206	193.3372	90.9337	29.5249	0.0000	0.0000	0.0000	0.0000	97.6628	225.8412	347.7481	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	359.9341	271.1904	207.2210	97.4638	31.6451	0.0000	0.0000	0.0000	0.0000	104.6761	242.0592	372.7204	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2320	89.1146	88.8593	88.3005	87.4626	86.7000	86.7000	86.7000	86.7000	88.3310	89.0028	89.2796	(217)
Fuel for water heating, kWh/month	152.4114	133.8382	139.3794	123.5289	120.5993	106.3715	99.9420	112.7293	113.4942	128.1632	137.2477	147.9311	(219)
Water heating fuel used												1515.6361	(219)
Annual totals kWh/year													
Space heating fuel - main system												1686.9100	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3030.4659	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1686.9100	3.4800	58.7045	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1515.6361	3.4800	52.7441	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	251.0893	13.1900	33.1187	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			274.4598	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1810	(257)
SAP value		83.5257	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1686.9100	0.2160	364.3726	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1515.6361	0.2160	327.3774	(264)
Space and water heating			691.7499	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total kg/year			602.4404	(272)
CO2 emissions per m2			11.4500	(273)
EI value			91.7296	
EI rating			92	(274)
EI band			A	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8803 = 3.953, stars = 4
Water heating environmental impact	0.216 / 0.8803 = 0.2454, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	52.6100 (1b)	x	2.3100 (2b)	=	121.5291	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	52.6100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5291	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1646	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3876	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3294	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3459	0.3212	0.3294	0.3130	0.3130	0.3047	0.2965	0.2883	0.2800	0.3047	0.2883	0.3047	(22b)
Effective ac	0.5598	0.5516	0.5543	0.5490	0.5490	0.5464	0.5440	0.5415	0.5392	0.5464	0.5415	0.5464	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			8.7500	1.2357	10.8127			(27)
Opening Type 7			1.9500	1.5000	2.9250			(26)
External Wall	40.1300	8.7500	31.3800	0.2700	8.4726			(29a)
Communal Wall	15.3800	1.9500	13.4300	0.2400	3.2232			(29a)
Roof 1	52.6100		52.6100	0.1600	8.4176			(30)
Total net area of external elements Aum(A, m2)			108.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.8511			(33)
Party Wall			15.3800	0.0000	0.0000			(32)
Party Floor 1			52.6100					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.8577	(36)
Total fabric heat loss (33) + (36) =	37.7088	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	22.4516	22.1211	22.2285	22.0163	22.0163	21.9143	21.8150	21.7185	21.6246	21.9143	21.7185	21.9143	(38)
Heat transfer coeff	60.1604	59.8299	59.9374	59.7252	59.7252	59.6232	59.5239	59.4273	59.3335	59.6232	59.4273	59.6232	(39)
Average = Sum(39)m / 12 =												59.6633	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1435	1.1372	1.1393	1.1352	1.1352	1.1333	1.1314	1.1296	1.1278	1.1333	1.1296	1.1333	(40)
HLP (average)												1.1341	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7671 (42)
Average daily hot water use (litres/day)	76.1678 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	83.7845	80.7378	77.6911	74.6444	71.5977	68.5510	68.5510	71.5977	74.6444	77.6911	80.7378	83.7845	(44)
Energy conte	124.2500	108.6699	112.1376	97.7643	93.8071	80.9484	75.0106	86.0758	87.1038	101.5111	110.8073	120.3295	(45)
Energy content (annual)										Total = Sum(45)m =		1198.4155	(45)
Distribution loss (46)m = 0.15 x (45)m	18.6375	16.3005	16.8206	14.6646	14.0711	12.1423	11.2516	12.9114	13.0656	15.2267	16.6211	18.0494	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7497	10.5994	11.7140	11.3123	11.6721	11.2756	11.6391	11.6605	11.2956	11.6967	11.3470	11.7428	(61)
Total heat required for water heating calculated for each month													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
								Total per year (kWh/year) = Sum(64)m =				1336.1203	(64)
Heat gains from water heating, kWh/month													
	44.2506	38.7826	40.2143	35.3347	34.1089	29.7343	27.8508	31.5353	31.7859	36.6766	39.6802	42.9453	(65)

---

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	106.0238	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.5443	31.5701	25.6746	19.4373	14.5296	12.2665	13.2544	17.2286	23.1241	29.3614	34.2691	36.5322	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	229.8619	232.2471	226.2364	213.4402	197.2874	182.1059	171.9638	169.5786	175.5893	188.3855	204.5383	219.7198	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	47.3694	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	-70.6825	(71)
Water heating gains (Table 5)													
	59.4766	57.7122	54.0514	49.0760	45.8453	41.2976	37.4339	42.3862	44.1471	49.2965	55.1113	57.7221	(72)
Total internal gains													
	410.5934	407.2402	391.6731	367.6642	343.3730	321.3807	308.3628	314.9040	328.5713	352.7541	379.6295	399.6848	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.5800	25.1925	0.7400	0.7000	0.7700	41.4191	(76)
South	1.0800	56.7559	0.7400	0.7000	0.7700	22.0038	(78)
West	2.0100	25.1925	0.7400	0.7000	0.7700	18.1774	(80)

Solar gains	86.8278	138.3328	218.2727	308.8635	354.1958	392.2436	371.0921	329.9484	263.6022	173.4847	106.4839	71.1553	(83)
Total gains	497.4213	545.5729	609.9458	676.5277	697.5688	713.6243	679.4549	644.8524	592.1734	526.2388	486.1134	470.8401	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.7288	61.0643	60.9548	61.1714	61.1714	61.2761	61.3783	61.4780	61.5753	61.2761	61.4780	61.2761	
alpha	5.0486	5.0710	5.0637	5.0781	5.0781	5.0851	5.0919	5.0985	5.1050	5.0851	5.0985	5.0851	
util living area													
	0.9829	0.9723	0.9365	0.8417	0.6816	0.4704	0.3407	0.3582	0.6076	0.8687	0.9639	0.9858	(86)
MIT	20.1427	20.2684	20.5208	20.7899	20.9424	20.9926	20.9988	20.9986	20.9749	20.7936	20.4447	20.1230	(87)
Th 2	19.9655	19.9705	19.9689	19.9722	19.9722	19.9737	19.9753	19.9767	19.9782	19.9737	19.9767	19.9737	(88)
util rest of house													
	0.9776	0.9641	0.9181	0.8010	0.6142	0.3885	0.2517	0.2649	0.5190	0.8233	0.9512	0.9814	(89)
MIT 2	18.8658	19.0486	19.3996	19.7532	19.9254	19.9700	19.9750	19.9764	19.9629	19.7693	19.3068	18.8441	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	19.4908	19.6457	19.9484	20.2606	20.4232	20.4705	20.4761	20.4767	20.4582	20.2707	19.8637	19.4701	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4908	19.6457	19.9484	20.2606	20.4232	20.4705	20.4761	20.4767	20.4582	20.2707	19.8637	19.4701	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9609	0.9177	0.8133	0.6448	0.4285	0.2953	0.3106	0.5617	0.8378	0.9495	0.9786	(94)
Useful gains	484.7610	524.2351	559.7374	550.2266	449.7858	305.8136	200.6720	200.3071	332.6190	440.8630	461.5695	460.7527	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	877.7882	858.2999	776.0905	642.6777	473.2135	308.2814	200.9585	200.6669	341.6550	528.8980	710.9712	862.7512	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	292.4123	224.4916	160.9667	66.5648	17.4303	0.0000	0.0000	0.0000	0.0000	65.4981	179.5692	299.0869	(98)
Space heating												1306.0197	(98)
Space heating per m2											(98) / (4) =	24.8246	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1399.8068	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	292.4123	224.4916	160.9667	66.5648	17.4303	0.0000	0.0000	0.0000	0.0000	65.4981	179.5692	299.0869	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	313.4108	240.6126	172.5260	71.3449	18.6820	0.0000	0.0000	0.0000	0.0000	70.2016	192.4643	320.5647	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	135.9997	119.2693	123.8516	109.0766	105.4793	92.2241	86.6497	97.7363	98.3994	113.2078	122.1543	132.0723	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.1252	89.0176	88.6985	88.0300	87.1930	86.7000	86.7000	86.7000	86.7000	87.9856	88.8071	89.1659	(217)
Fuel for water heating, kWh/month													
	152.5940	133.9840	139.6322	123.9084	120.9722	106.3715	99.9420	112.7293	113.4942	128.6662	137.5501	148.1198	(219)
Water heating fuel used												1517.9637	(219)
Annual totals kWh/year													
Space heating fuel - main system												1399.8068	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												251.0893	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 967 * 1.00) =												-564.6053	(233)
Total delivered energy for all uses												2679.2546	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1399.8068	7.3800	103.3057	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1517.9637	7.3800	112.0257	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	251.0893	28.6600	71.9622	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			415.7887	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1399.8068	0.2160	302.3583	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1517.9637	0.2160	327.8802	(264)
Space and water heating			630.2384	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	251.0893	0.5190	130.3154	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	0.5190	-293.0302	(269)
Total kg/year			506.4486	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1399.8068	1.2200	1707.7643	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1517.9637	1.2200	1851.9157	(264)
Space and water heating			3559.6800	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	251.0893	3.0700	770.8443	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	3.0700	-1733.3383	(269)
Primary energy kWh/year			2827.4360	(272)
Primary energy kWh/m2/year			53.7433	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 84
Current environmental impact rating: A 92

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 84
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£93	£93	£0
Mains gas	£322	£322	£0
Space heating	£232	£232	£0
Water heating	£112	£112	£0
Lighting	£72	£72	£0
Total cost of fuels	£415	£415	£0
Total cost of uses	£416	£416	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	54 kWh/m²	54 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	240.63 (P1)
Transmission heat loss coefficient	37.71 (37)
Summer heat loss coefficient	278.34 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	4.5800	125.2818	0.7400	0.7000	0.8865	237.1398
South	1.0800	118.5567	0.7400	0.7000	0.8865	52.9177
West	2.0100	125.2818	0.7400	0.7000	0.8865	104.0723
total:						433.0382

	Jun	Jul	Aug	
Solar gains	465	433	384	(P3)
Internal gains	318	305	312	
Total summer gains	784	738	696	(P5)
Summer gain/loss ratio	2.82	2.65	2.50	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.47	20.20	20.05	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 678 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 678 - EPC	**Prop Type Ref**	
Property	39 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	84 B	**DER**	13.49	**TER**	19.82
Environmental	92 A	**% DER<TER**	31.94		
CO_2 Emissions (t/year)	0.51	**DFEE**	44.09	**TFEE**	49.06
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.13		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.82	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.49	$kgCO_2/m^2$	Pass
	-6.33 (-31.9%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.06	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	44.09	$kWh/m^2/yr$	
	-5.0 (-10.2%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%	Pass

Secondary heating system	None		
5 Cylinder insulation			
Hot water storage	No cylinder		
6 Controls			
Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass
7 Low energy lights			
Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass
8 Mechanical ventilation			
Not applicable			

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	1.08 m², No overhang
Windows facing East	4.58 m², No overhang
Windows facing South	1.08 m², No overhang
Windows facing West	2.01 m², No overhang
Air change rate	6.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.036	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 679 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 679 - EPC	**Prop Type Ref**	
Property	41 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	16.56	**TER**	20.26
Environmental	89 B	**% DER<TER**	18.25		
CO_2 Emissions (t/year)	0.81	**DFEE**	48.23	**TFEE**	55.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS BUILT

Ground-floor flat, total floor area 63 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.56 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 4.46 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing East: 2.72 m², No overhang
Windows facing South: 3.65 m², No overhang
Windows facing West: 4.14 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.038 W/m²K
Photovoltaic array 0.37 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3615	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3073	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3918	0.3841	0.3764	0.3380	0.3303	0.2919	0.2919	0.2842	0.3073	0.3303	0.3457	0.3611	(22b)
Effective ac	0.5767	0.5738	0.5708	0.5571	0.5546	0.5426	0.5426	0.5404	0.5472	0.5546	0.5598	0.5652	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 9			4.2400	1.5000	6.3600			(26a)
Ground floor			62.5100	0.1800	11.2518			(28a)
External Wall	60.3800	15.8300	44.5500	0.2700	12.0285			(29a)
Roof 1	11.2500		11.2500	0.1600	1.8000			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7625			(33)
Party Wall			19.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0981	(36)
Total fabric heat loss (33) + (36) =	50.8606	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.4828	27.3408	27.2016	26.5478	26.4254	25.8560	25.8560	25.7505	26.0753	26.4254	26.6729	26.9316	(38)
Heat transfer coeff	78.3434	78.2014	78.0622	77.4084	77.2860	76.7166	76.7166	76.6111	76.9359	77.2860	77.5335	77.7922	(39)
Average = Sum(39)m / 12 =												77.4078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2533	1.2510	1.2488	1.2383	1.2364	1.2273	1.2273	1.2256	1.2308	1.2364	1.2403	1.2445	(40)
HLP (average)												1.2383	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0516 (42)
Average daily hot water use (litres/day)	82.9264 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2913	17.7469	18.3132	15.9659	15.3197	13.2197	12.2500	14.0570	14.2249	16.5778	18.0960	19.6510	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7902	10.6336	11.7479	11.3408	11.6983	11.2972	11.6591	11.6845	11.3209	11.7274	11.3818	11.7820	(61)
Total heat required for water heating calculated for each month													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.8195	(64)
Heat gains from water heating, kWh/month													
	47.9266	41.9973	43.5313	38.2263	36.8831	32.1280	30.0689	34.0809	34.3622	39.6793	42.9581	46.5053	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2459	14.4294	11.7348	8.8840	6.6409	5.6065	6.0580	7.8745	10.5691	13.4199	15.6630	16.6974	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.2299	181.0898	176.4030	166.4255	153.8306	141.9932	134.0851	132.2253	136.9121	146.8896	159.4844	171.3218	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	64.4174	62.4960	58.5097	53.0920	49.5741	44.6222	40.4152	45.8077	47.7252	53.3324	59.6641	62.5071	(72)
Total internal gains													
	316.6678	314.7898	303.4222	285.1761	266.8202	248.9965	237.3330	242.6820	251.9810	270.4164	291.5861	307.3009	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	2.7200	19.6403	0.7400	0.7000	0.7700	19.1769	(76)
South	3.6500	46.7521	0.7400	0.7000	0.7700	61.2571	(78)
West	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(80)

Solar gains	113.7450	202.8146	296.9953	393.1837	457.9749	460.9475	441.8939	393.5530	330.8099	229.8524	138.0021	96.1418	(83)
Total gains	430.4128	517.6044	600.4174	678.3598	724.7951	709.9440	679.2269	636.2351	582.7909	500.2689	429.5882	403.4427	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4096	55.5102	55.6092	56.0789	56.1676	56.5845	56.5845	56.6624	56.4232	56.1676	55.9883	55.8022	
alpha	4.6940	4.7007	4.7073	4.7386	4.7445	4.7723	4.7723	4.7775	4.7615	4.7445	4.7326	4.7201	
util living area													
	0.9964	0.9909	0.9756	0.9291	0.8224	0.6499	0.4879	0.5387	0.7858	0.9574	0.9922	0.9973	(86)
MIT	19.7030	19.8992	20.1940	20.5470	20.8186	20.9562	20.9909	20.9857	20.8920	20.5195	20.0371	19.6640	(87)
Th 2	19.8776	19.8794	19.8812	19.8895	19.8910	19.8982	19.8982	19.8996	19.8955	19.8910	19.8879	19.8846	(88)
util rest of house													
	0.9951	0.9879	0.9672	0.9047	0.7658	0.5547	0.3704	0.4174	0.7012	0.9376	0.9891	0.9964	(89)
MIT 2	18.1668	18.4531	18.8786	19.3763	19.7220	19.8708	19.8951	19.8941	19.8147	19.3515	18.6613	18.1147	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.1484	19.3771	19.7190	20.1243	20.4226	20.5643	20.5953	20.5916	20.5031	20.0978	19.5403	19.1046	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1484	19.3771	19.7190	20.1243	20.4226	20.5643	20.5953	20.5916	20.5031	20.0978	19.5403	19.1046	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9941	0.9861	0.9658	0.9105	0.7947	0.6139	0.4456	0.4950	0.7506	0.9419	0.9878	0.9955	(94)
Useful gains	427.8548	510.4276	579.8632	617.6597	576.0053	435.8492	302.6921	314.9359	437.4348	471.2229	424.3537	401.6354	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1163.2707	1132.1296	1031.9068	868.8523	674.1383	457.5606	306.5028	321.1200	492.6249	734.0481	964.5412	1159.4605	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	547.1495	417.7837	336.3204	180.8587	73.0109	0.0000	0.0000	0.0000	0.0000	195.5419	388.9350	563.8219	(98)
Space heating												2703.4221	(98)
Space heating per m2											(98) / (4) =	43.2478	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2897.5585	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	547.1495	417.7837	336.3204	180.8587	73.0109	0.0000	0.0000	0.0000	0.0000	195.5419	388.9350	563.8219	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	586.4410	447.7854	360.4721	193.8464	78.2540	0.0000	0.0000	0.0000	0.0000	209.5841	416.8650	604.3107	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.5126	89.4243	89.2451	88.8451	88.0721	86.7000	86.7000	86.7000	86.7000	88.8803	89.3597	89.5486	(217)
Fuel for water heating, kWh/month													
	164.2958	144.1960	149.9644	132.5679	129.2456	114.6811	107.6421	121.5665	122.4381	137.5399	147.7416	159.4540	(219)
Water heating fuel used												1631.3331	(219)
Annual totals kWh/year													
Space heating fuel - main system												2897.5585	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.9068	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4638.3016	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2897.5585	0.2160	625.8726	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1631.3331	0.2160	352.3680	(264)
Space and water heating			978.2406	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.9068	0.5190	148.9046	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total CO2, kg/year			1035.0244	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.5600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.5600	ZC1
Total Floor Area	TFA	62.5100	
Assumed number of occupants	N	2.0516	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.9905	ZC2
CO2 emissions from cooking, equation (L16)		2.6914	ZC3
Total CO2 emissions		36.2419	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.2419	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3885	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3302	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4210	0.4128	0.4045	0.3633	0.3550	0.3137	0.3137	0.3055	0.3302	0.3550	0.3715	0.3880	(22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			11.3900	1.3258	15.1004			(27)
Ground floor			62.5100	0.1300	8.1263			(28a)
External Wall	60.3800	15.6300	44.7500	0.1800	8.0550			(29a)
Roof 1	11.2500		11.2500	0.1300	1.4625			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8322			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3322	(36)
Total fabric heat loss						(33) + (36) =	48.1644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0494	27.8854	27.7247	26.9696	26.8283	26.1706	26.1706	26.0488	26.4239	26.8283	27.1141	27.4129	(38)
Heat transfer coeff	76.2138	76.0498	75.8890	75.1339	74.9926	74.3350	74.3350	74.2132	74.5883	74.9926	75.2784	75.5772	(39)
Average = Sum(39)m / 12 =												75.1332	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2192	1.2166	1.2140	1.2020	1.1997	1.1892	1.1892	1.1872	1.1932	1.1997	1.2043	1.2090	(40)
HLP (average)												1.2019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0516	(42)
Average daily hot water use (litres/day)	82.9264	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2913	17.7469	18.3132	15.9659	15.3197	13.2197	12.2500	14.0570	14.2249	16.5778	18.0960	19.6510	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	46.4842	40.4590	43.1036	40.0773	39.7229	36.8057	38.0326	39.7229	40.0773	43.1036	43.3489	46.4842	(61)
Total heat required for water heating calculated for each month													
	181.7595	158.7716	165.1916	146.5166	141.8539	124.9370	119.6992	133.4365	134.9102	153.6222	163.9886	177.4911	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	181.7595	158.7716	165.1916	146.5166	141.8539	124.9370	119.6992	133.4365	134.9102	153.6222	163.9886	177.4911	(64)
									Total per year (kWh/year) = Sum(64)m =			1802.1782	(64)
Heat gains from water heating, kWh/month													
	56.6001	49.4537	51.3702	45.4104	43.8893	38.5051	36.6623	41.0905	41.5513	47.5233	50.9499	55.1808	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2885	14.4673	11.7656	8.9073	6.6583	5.6212	6.0739	7.8951	10.5968	13.4551	15.7041	16.7412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.2299	181.0898	176.4030	166.4255	153.8306	141.9932	134.0851	132.2253	136.9121	146.8896	159.4844	171.3218	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	76.0754	73.5918	69.0459	63.0700	58.9910	53.4793	49.2773	55.2292	57.7101	63.8754	70.7638	74.1678	(72)
Total internal gains													
	328.3684	325.9234	313.9891	295.1774	276.2545	257.8684	246.2109	252.1242	261.9936	280.9947	302.7269	319.0054	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0600	10.6334	0.6300	0.7000	0.7700	3.4447	(74)
East	2.6700	19.6403	0.6300	0.7000	0.7700	16.0262	(76)
South	3.5900	46.7521	0.6300	0.7000	0.7700	51.2941	(78)
West	4.0700	19.6403	0.6300	0.7000	0.7700	24.4294	(80)

Solar gains	95.1944	169.7292	248.5274	328.9929	383.1870	385.6666	369.7278	329.2942	276.8146	192.3511	115.4938	80.4632	(83)
Total gains	423.5627	495.6527	562.5165	624.1703	659.4415	643.5349	615.9388	581.4184	538.8082	473.3458	418.2207	399.4686	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9578	57.0807	57.2016	57.7765	57.8853	58.3974	58.3974	58.4933	58.1991	57.8853	57.6655	57.4376	
alpha	4.7972	4.8054	4.8134	4.8518	4.8590	4.8932	4.8932	4.8996	4.8799	4.8590	4.8444	4.8292	
util living area													
	0.9966	0.9922	0.9803	0.9431	0.8517	0.6864	0.5195	0.5685	0.8104	0.9633	0.9929	0.9974	(86)
MIT	19.7379	19.9125	20.1847	20.5231	20.7978	20.9492	20.9894	20.9838	20.8837	20.5177	20.0611	19.7049	(87)
Th 2	19.9047	19.9067	19.9088	19.9184	19.9202	19.9287	19.9287	19.9302	19.9254	19.9202	19.9166	19.9128	(88)
util rest of house													
	0.9954	0.9896	0.9734	0.9227	0.8002	0.5922	0.3989	0.4456	0.7303	0.9459	0.9900	0.9966	(89)
MIT 2	18.2364	18.4919	18.8864	19.3692	19.7267	19.8958	19.9249	19.9238	19.8359	19.3724	18.7165	18.1941	(90)
Living area fraction										fLA = Living area / (4) =		0.6389	(91)
MIT	19.1958	19.3996	19.7159	20.1065	20.4111	20.5689	20.6051	20.6011	20.5054	20.1042	19.5756	19.1594	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1958	19.3996	19.7159	20.1065	20.4111	20.5689	20.6051	20.6011	20.5054	20.1042	19.5756	19.1594	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9944	0.9881	0.9719	0.9268	0.8254	0.6504	0.4761	0.5242	0.7765	0.9494	0.9889	0.9957	(94)
Useful gains	421.2104	489.7459	546.6966	578.4511	544.3016	418.5502	293.2692	304.7748	418.3794	449.4104	413.5719	397.7655	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1135.2634	1102.6924	1002.9445	841.9861	653.2657	443.6977	297.7163	311.7771	477.7648	712.7420	939.1444	1130.5922	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	531.2554	411.9000	339.4485	189.7452	81.0693	0.0000	0.0000	0.0000	0.0000	195.9187	378.4122	545.2231	(98)
Space heating												2672.9724	(98)
Space heating per m2											(98) / (4) =	42.7607	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2861.8548	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	531.2554	411.9000	339.4485	189.7452	81.0693	0.0000	0.0000	0.0000	0.0000	195.9187	378.4122	545.2231	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	568.7959	441.0065	363.4352	203.1533	86.7980	0.0000	0.0000	0.0000	0.0000	209.7630	405.1523	583.7507	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	181.7595	158.7716	165.1916	146.5166	141.8539	124.9370	119.6992	133.4365	134.9102	153.6222	163.9886	177.4911	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.5916	87.3435	86.8252	85.7031	83.7008	80.3000	80.3000	80.3000	80.3000	85.6645	87.0882	87.6912	(217)
Fuel for water heating, kWh/month													
	207.5080	181.7784	190.2578	170.9584	169.4774	155.5878	149.0650	166.1725	168.0077	179.3299	188.3017	202.4046	(219)
Water heating fuel used												2128.8493	(219)
Annual totals kWh/year													
Space heating fuel - main system												2861.8548	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												287.6592	(232)
Total delivered energy for all uses												5353.3633	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2861.8548	0.2160	618.1606	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2128.8493	0.2160	459.8314	(264)
Space and water heating			1077.9921	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	287.6592	0.5190	149.2951	(268)
Total CO2, kg/m2/year			1266.2122	(272)
Emissions per m2 for space and water heating			17.2451	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3883	(272b)
Emissions per m2 for pumps and fans			0.6227	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.2451 * 1.00) + 2.3883 + 0.6227, rounded to 2 d.p.			20.2600	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3615	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3073	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3918	0.3841	0.3764	0.3380	0.3303	0.2919	0.2919	0.2842	0.3073	0.3303	0.3457	0.3611	(22b)
Effective ac	0.5767	0.5738	0.5708	0.5571	0.5546	0.5426	0.5426	0.5404	0.5472	0.5546	0.5598	0.5652	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 9			4.2400	1.5000	6.3600			(26a)
Ground floor			62.5100	0.1800	11.2518			(28a)
External Wall	60.3800	15.8300	44.5500	0.2700	12.0285			(29a)
Roof 1	11.2500		11.2500	0.1600	1.8000			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7625			(33)
Party Wall			19.9500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0981	(36)
Total fabric heat loss					(33) + (36) =		50.8606	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.4828	27.3408	27.2016	26.5478	26.4254	25.8560	25.8560	25.7505	26.0753	26.4254	26.6729	26.9316	(38)
Heat transfer coeff	78.3434	78.2014	78.0622	77.4084	77.2860	76.7166	76.7166	76.6111	76.9359	77.2860	77.5335	77.7922	(39)
Average = Sum(39)m / 12 =												77.4078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2533	1.2510	1.2488	1.2383	1.2364	1.2273	1.2273	1.2256	1.2308	1.2364	1.2403	1.2445	(40)
HLP (average)												1.2383	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0516	(42)
Average daily hot water use (litres/day)												82.9264	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.7460	25.1414	25.9437	22.6184	21.7028	18.7279	17.3542	19.9141	20.1520	23.4852	25.6359	27.8390	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2459	14.4294	11.7348	8.8840	6.6409	5.6065	6.0580	7.8745	10.5691	13.4199	15.6630	16.6974	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.2299	181.0898	176.4030	166.4255	153.8306	141.9932	134.0851	132.2253	136.9121	146.8896	159.4844	171.3218	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	38.6371	37.4128	34.8706	31.4144	29.1705	26.0110	23.3255	26.7663	27.9889	31.5661	35.6055	37.4180	(72)
Total internal gains													
	287.8875	286.7066	276.7830	260.4984	243.4166	227.3853	217.2433	220.6407	229.2446	245.6502	264.5275	279.2118	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	2.7200	19.6403	0.7400	0.7000	0.7700	19.1769	(76)
South	3.6500	46.7521	0.7400	0.7000	0.7700	61.2571	(78)
West	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(80)

Solar gains	113.7450	202.8146	296.9953	393.1837	457.9749	460.9475	441.8939	393.5530	330.8099	229.8524	138.0021	96.1418	(83)
Total gains	401.6324	489.5212	573.7783	653.6822	701.3915	688.3328	659.1372	614.1937	560.0545	475.5026	402.5296	375.3536	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4096	55.5102	55.6092	56.0789	56.1676	56.5845	56.5845	56.6624	56.4232	56.1676	55.9883	55.8022	
alpha	4.6940	4.7007	4.7073	4.7386	4.7445	4.7723	4.7723	4.7775	4.7615	4.7445	4.7326	4.7201	
util living area													
	0.9973	0.9928	0.9794	0.9371	0.8359	0.6658	0.5016	0.5558	0.8036	0.9644	0.9941	0.9980	(86)
MIT	19.6613	19.8595	20.1589	20.5208	20.8040	20.9515	20.9898	20.9837	20.8804	20.4894	19.9985	19.6230	(87)
Th 2	19.8776	19.8794	19.8812	19.8895	19.8910	19.8982	19.8982	19.8996	19.8955	19.8910	19.8879	19.8846	(88)
util rest of house													
	0.9964	0.9903	0.9722	0.9147	0.7811	0.5699	0.3814	0.4318	0.7212	0.9473	0.9916	0.9973	(89)
MIT 2	18.6680	18.8664	19.1628	19.5158	19.7650	19.8773	19.8958	19.8953	19.8333	19.4951	19.0123	18.6354	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.3027	19.5010	19.7992	20.1579	20.4289	20.5636	20.5948	20.5907	20.5023	20.1304	19.6424	19.2664	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3027	19.5010	19.7992	20.1579	20.4289	20.5636	20.5948	20.5907	20.5023	20.1304	19.6424	19.2664	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9893	0.9716	0.9208	0.8095	0.6296	0.4584	0.5112	0.7695	0.9516	0.9909	0.9968	(94)
Useful gains	399.9176	484.2600	557.4814	601.9235	567.7545	433.3863	302.1739	313.9787	430.9642	452.5090	398.8770	374.1697	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1175.3596	1141.8142	1038.1678	871.4556	674.6190	457.5108	306.4673	321.0542	492.5674	736.5679	972.4574	1172.0484	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	576.9288	441.8764	357.6306	194.0631	79.5072	0.0000	0.0000	0.0000	0.0000	211.3399	412.9779	593.6218	(98)
Space heating												2867.9458	(98)
Space heating per m2											(98) / (4) =	45.8798	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	721.1359	567.7028	582.2446	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8982	0.9454	0.9274	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	647.7162	536.7218	539.9458	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	881.1216	845.4913	794.1950	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	168.0518	229.7245	189.1614	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												586.9377 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	42.0130	57.4311	47.2903	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												146.7344 (107)
Space cooling per m2												2.3474 (108)
Energy for space heating												45.8798 (99)
Energy for space cooling												2.3474 (108)
Total												48.2272 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.2 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1385	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3885	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3302	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4210	0.4128	0.4045	0.3633	0.3550	0.3137	0.3137	0.3055	0.3302	0.3550	0.3715	0.3880	(22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5467	0.5545	0.5630	0.5690	0.5753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.2400	1.2000	5.0880			(26a)
TER Opening Type (Uw = 1.40)			11.3900	1.3258	15.1004			(27)
Ground floor			62.5100	0.1300	8.1263			(28a)
External Wall	60.3800	15.6300	44.7500	0.1800	8.0550			(29a)
Roof 1	11.2500		11.2500	0.1300	1.4625			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8322			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3322	(36)
Total fabric heat loss						(33) + (36) =	48.1644	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.0494	27.8854	27.7247	26.9696	26.8283	26.1706	26.1706	26.0488	26.4239	26.8283	27.1141	27.4129	(38)
Heat transfer coeff	76.2138	76.0498	75.8890	75.1339	74.9926	74.3350	74.3350	74.2132	74.5883	74.9926	75.2784	75.5772	(39)
Average = Sum(39)m / 12 =												75.1332	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2192	1.2166	1.2140	1.2020	1.1997	1.1892	1.1892	1.1872	1.1932	1.1997	1.2043	1.2090	(40)
HLP (average)												1.2019	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.0516 (42)
Average daily hot water use (litres/day)		82.9264 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	28.7460	25.1414	25.9437	22.6184	21.7028	18.7279	17.3542	19.9141	20.1520	23.4852	25.6359	27.8390	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	102.5820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	16.2885	14.4673	11.7656	8.9073	6.6583	5.6212	6.0739	7.8951	10.5968	13.4551	15.7041	16.7412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	179.2299	181.0898	176.4030	166.4255	153.8306	141.9932	134.0851	132.2253	136.9121	146.8896	159.4844	171.3218	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	33.2582	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	38.6371	37.4128	34.8706	31.4144	29.1705	26.0110	23.3255	26.7663	27.9889	31.5661	35.6055	37.4180	(72)
Total internal gains													
	287.9301	286.7445	276.8138	260.5217	243.4340	227.4000	217.2591	220.6613	229.2723	245.6854	264.5686	279.2555	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0600	10.6334	0.6300	0.7000	0.7700	3.4447	(74)
East	2.6700	19.6403	0.6300	0.7000	0.7700	16.0262	(76)
South	3.5900	46.7521	0.6300	0.7000	0.7700	51.2941	(78)
West	4.0700	19.6403	0.6300	0.7000	0.7700	24.4294	(80)

Solar gains	95.1944	169.7292	248.5274	328.9929	383.1870	385.6666	369.7278	329.2942	276.8146	192.3511	115.4938	80.4632	(83)
Total gains	383.1244	456.4737	525.3411	589.5146	626.6210	613.0666	586.9870	549.9556	506.0870	438.0365	380.0624	359.7187	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.9578	57.0807	57.2016	57.7765	57.8853	58.3974	58.3974	58.4933	58.1991	57.8853	57.6655	57.4376	
alpha	4.7972	4.8054	4.8134	4.8518	4.8590	4.8932	4.8932	4.8996	4.8799	4.8590	4.8444	4.8292	
util living area													
	0.9978	0.9945	0.9849	0.9533	0.8705	0.7112	0.5426	0.5965	0.8368	0.9725	0.9953	0.9984	(86)
MIT	19.6788	19.8564	20.1342	20.4834	20.7737	20.9407	20.9872	20.9801	20.8641	20.4730	20.0061	19.6465	(87)
Th 2	19.9047	19.9067	19.9088	19.9184	19.9202	19.9287	19.9287	19.9302	19.9254	19.9202	19.9166	19.9128	(88)
util rest of house													
	0.9970	0.9926	0.9795	0.9358	0.8225	0.6169	0.4180	0.4697	0.7611	0.9588	0.9933	0.9978	(89)
MIT 2	18.7069	18.8852	19.1618	19.5073	19.7697	19.9020	19.9255	19.9248	19.8519	19.5049	19.0429	18.6811	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.3278	19.5057	19.7831	20.1310	20.4112	20.5657	20.6039	20.5991	20.4986	20.1235	19.6583	19.2979	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3278	19.5057	19.7831	20.1310	20.4112	20.5657	20.6039	20.5991	20.4986	20.1235	19.6583	19.2979	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9917	0.9787	0.9397	0.8461	0.6752	0.4979	0.5509	0.8047	0.9619	0.9927	0.9974	(94)
Useful gains	381.7886	452.7050	514.1674	553.9749	530.1990	413.9294	292.2441	302.9710	407.2539	421.3346	377.2986	358.7835	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1145.3296	1110.7625	1008.0424	843.8259	653.2781	443.4586	297.6298	311.6265	477.2643	714.1891	945.3683	1141.0612	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	568.0745	442.2147	367.4430	208.6927	91.5709	0.0000	0.0000	0.0000	0.0000	217.8837	409.0102	582.0146	(98)
Space heating												2886.9042	(98)
Space heating per m2											(98) / (4) =	46.1831	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	698.7487	550.0787	564.0201	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8783	0.9336	0.9139	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.7240	513.5636	515.4371	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	793.1676	761.1811	719.1390	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	129.1994	184.2274	151.5542	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												464.9810	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   32.2998   46.0569   37.8886    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                        116.2453 (107)
Space cooling per m2                                                                                                   1.8596 (108)
Energy for space heating                                                                                              46.1831 (99)
Energy for space cooling                                                                                               1.8596 (108)
Total                                                                                                                 48.0427 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                55.2 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3615	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3073	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3226	0.2996	0.3073	0.2919	0.2919	0.2842	0.2766	0.2689	0.2612	0.2842	0.2689	0.2842	(22b)
Effective ac	0.5520	0.5449	0.5472	0.5426	0.5426	0.5404	0.5382	0.5361	0.5341	0.5404	0.5361	0.5404	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 9			4.2400	1.5000	6.3600			(26a)
Ground floor			62.5100	0.1800	11.2518			(28a)
External Wall	60.3800	15.8300	44.5500	0.2700	12.0285			(29a)
Roof 1	11.2500		11.2500	0.1600	1.8000			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7625			(33)
Party Wall			19.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0981	(36)
Total fabric heat loss (33) + (36) =	50.8606	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.3059	25.9643	26.0753	25.8560	25.8560	25.7505	25.6479	25.5481	25.4511	25.7505	25.5481	25.7505	(38)
Heat transfer coeff	77.1665	76.8249	76.9359	76.7166	76.7166	76.6111	76.5085	76.4087	76.3117	76.6111	76.4087	76.6111	(39)
Average = Sum(39)m / 12 =												76.6526	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2290	1.2308	1.2273	1.2273	1.2256	1.2239	1.2223	1.2208	1.2256	1.2223	1.2256	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0516 (42)
Average daily hot water use (litres/day)	82.9264 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2913	17.7469	18.3132	15.9659	15.3197	13.2197	12.2500	14.0570	14.2249	16.5778	18.0960	19.6510	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7902	10.6336	11.7479	11.3408	11.6983	11.2972	11.6591	11.6845	11.3209	11.7274	11.3818	11.7820	(61)
Total heat required for water heating calculated for each month													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.8195	(64)
RHI water heating demand												1443	(64)
Heat gains from water heating, kWh/month													
	47.9266	41.9973	43.5313	38.2263	36.8831	32.1280	30.0689	34.0809	34.3622	39.6793	42.9581	46.5053	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.6146	36.0736	29.3370	22.2100	16.6022	14.0163	15.1451	19.6862	26.4227	33.5497	39.1575	41.7434	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.5073	270.2832	263.2881	248.3962	229.5980	211.9302	200.1271	197.3512	204.3463	219.2382	238.0365	255.7042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	64.4174	62.4960	58.5097	53.0920	49.5741	44.6222	40.4152	45.8077	47.7252	53.3324	59.6641	62.5071	(72)
Total internal gains													
	465.9337	462.2471	444.5291	417.0925	389.1686	363.9630	349.0817	356.2393	371.8886	399.5146	430.2523	453.3490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	2.7200	25.1925	0.7400	0.7000	0.7700	24.5982	(76)
South	3.6500	56.7559	0.7400	0.7000	0.7700	74.3647	(78)
West	4.1400	25.1925	0.7400	0.7000	0.7700	37.4400	(80)

Solar gains	141.6304	215.1239	318.1777	425.1024	471.9169	516.6332	491.1124	447.1453	374.7306	263.2009	171.3142	117.6556	(83)
Total gains	607.5641	677.3710	762.7068	842.1949	861.0854	880.5962	840.1940	803.3846	746.6192	662.7155	601.5665	571.0046	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2546	56.5048	56.4232	56.5845	56.5845	56.6624	56.7384	56.8126	56.8848	56.6624	56.8126	56.6624	
alpha	4.7503	4.7670	4.7615	4.7723	4.7723	4.7775	4.7826	4.7875	4.7923	4.7775	4.7875	4.7775	
util living area													
	0.9826	0.9709	0.9346	0.8454	0.6963	0.4870	0.3535	0.3689	0.6138	0.8670	0.9632	0.9859	(86)
MIT	20.0451	20.1877	20.4607	20.7477	20.9221	20.9884	20.9980	20.9976	20.9666	20.7616	20.3749	20.0177	(87)
Th 2	19.8925	19.8969	19.8955	19.8982	19.8982	19.8996	19.9009	19.9022	19.9034	19.8996	19.9022	19.8996	(88)
util rest of house													
	0.9772	0.9621	0.9153	0.8036	0.6253	0.3971	0.2548	0.2662	0.5194	0.8196	0.9499	0.9814	(89)
MIT 2	18.6719	18.8780	19.2578	19.6358	19.8351	19.8938	19.9004	19.9016	19.8833	19.6651	19.1515	18.6383	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.5493	19.7148	20.0264	20.3463	20.5297	20.5932	20.6017	20.6018	20.5755	20.3657	19.9332	19.5196	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5493	19.7148	20.0264	20.3463	20.5297	20.5932	20.6017	20.6018	20.5755	20.3657	19.9332	19.5196	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9604	0.9179	0.8217	0.6672	0.4543	0.3179	0.3319	0.5786	0.8414	0.9504	0.9794	(94)
Useful gains	592.4214	650.5397	700.0575	692.0576	574.5576	400.0691	267.1360	266.6463	431.9582	557.5924	571.7166	559.2667	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1130.4337	1107.4141	1002.1951	832.0890	616.0079	405.5144	267.9083	267.5717	448.3654	686.8699	919.4415	1112.3667	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	400.2811	307.0196	224.7903	100.8226	30.8391	0.0000	0.0000	0.0000	0.0000	96.1825	250.3619	411.5064	(98)
Space heating												1821.8035	(98)
RHI space heating demand												1822	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3615	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3073	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3918	0.3841	0.3764	0.3380	0.3303	0.2919	0.2919	0.2842	0.3073	0.3303	0.3457	0.3611	(22b)
Effective ac	0.5767	0.5738	0.5708	0.5571	0.5546	0.5426	0.5426	0.5404	0.5472	0.5546	0.5598	0.5652	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 9			4.2400	1.5000	6.3600			(26a)
Ground floor			62.5100	0.1800	11.2518			(28a)
External Wall	60.3800	15.8300	44.5500	0.2700	12.0285			(29a)
Roof 1	11.2500		11.2500	0.1600	1.8000			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7625			(33)
Party Wall			19.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0981	(36)
Total fabric heat loss (33) + (36) =	50.8606	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	27.4828	27.3408	27.2016	26.5478	26.4254	25.8560	25.8560	25.7505	26.0753	26.4254	26.6729	26.9316	(38)
Heat transfer coeff	78.3434	78.2014	78.0622	77.4084	77.2860	76.7166	76.7166	76.6111	76.9359	77.2860	77.5335	77.7922	(39)
Average = Sum(39)m / 12 =												77.4078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2533	1.2510	1.2488	1.2383	1.2364	1.2273	1.2273	1.2256	1.2308	1.2364	1.2403	1.2445	(40)
HLP (average)												1.2383	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0516 (42)
Average daily hot water use (litres/day)	82.9264 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2913	17.7469	18.3132	15.9659	15.3197	13.2197	12.2500	14.0570	14.2249	16.5778	18.0960	19.6510	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7902	10.6336	11.7479	11.3408	11.6983	11.2972	11.6591	11.6845	11.3209	11.7274	11.3818	11.7820	(61)
Total heat required for water heating calculated for each month													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.8195	(64)
Heat gains from water heating, kWh/month													
	47.9266	41.9973	43.5313	38.2263	36.8831	32.1280	30.0689	34.0809	34.3622	39.6793	42.9581	46.5053	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.6146	36.0736	29.3370	22.2100	16.6022	14.0163	15.1451	19.6862	26.4227	33.5497	39.1575	41.7434	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.5073	270.2832	263.2881	248.3962	229.5980	211.9302	200.1271	197.3512	204.3463	219.2382	238.0365	255.7042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	64.4174	62.4960	58.5097	53.0920	49.5741	44.6222	40.4152	45.8077	47.7252	53.3324	59.6641	62.5071	(72)
Total internal gains													
	465.9337	462.2471	444.5291	417.0925	389.1686	363.9630	349.0817	356.2393	371.8886	399.5146	430.2523	453.3490	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	2.7200	19.6403	0.7400	0.7000	0.7700	19.1769	(76)
South	3.6500	46.7521	0.7400	0.7000	0.7700	61.2571	(78)
West	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(80)

Solar gains	113.7450	202.8146	296.9953	393.1837	457.9749	460.9475	441.8939	393.5530	330.8099	229.8524	138.0021	96.1418	(83)
Total gains	579.6787	665.0617	741.5244	810.2762	847.1434	824.9105	790.9756	749.7923	702.6985	629.3670	568.2545	549.4909	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4096	55.5102	55.6092	56.0789	56.1676	56.5845	56.5845	56.6624	56.4232	56.1676	55.9883	55.8022	
alpha	4.6940	4.7007	4.7073	4.7386	4.7445	4.7723	4.7723	4.7775	4.7615	4.7445	4.7326	4.7201	
util living area													
	0.9877	0.9759	0.9483	0.8798	0.7519	0.5739	0.4225	0.4632	0.6948	0.9099	0.9765	0.9902	(86)
MIT	19.9149	20.1001	20.3672	20.6691	20.8791	20.9739	20.9950	20.9924	20.9369	20.6582	20.2273	19.8734	(87)
Th 2	19.8776	19.8794	19.8812	19.8895	19.8910	19.8982	19.8982	19.8996	19.8955	19.8910	19.8879	19.8846	(88)
util rest of house													
	0.9838	0.9685	0.9327	0.8452	0.6889	0.4841	0.3190	0.3559	0.6059	0.8756	0.9681	0.9871	(89)
MIT 2	18.4735	18.7401	19.1182	19.5303	19.7839	19.8827	19.8966	19.8968	19.8518	19.5292	18.9323	18.4185	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.3945	19.6090	19.9162	20.2579	20.4837	20.5799	20.5984	20.5968	20.5451	20.2505	19.7597	19.3481	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3945	19.6090	19.9162	20.2579	20.4837	20.5799	20.5984	20.5968	20.5451	20.2505	19.7597	19.3481	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9664	0.9332	0.8577	0.7240	0.5406	0.3852	0.4245	0.6600	0.8880	0.9669	0.9852	(94)
Useful gains	569.0924	642.7221	692.0009	694.9355	613.3384	445.9464	304.6944	318.2845	463.8084	558.8753	549.4234	541.3835	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1182.5524	1150.2660	1047.3014	879.1993	678.8537	458.7608	306.7468	321.5237	495.8592	745.8517	981.5510	1178.4012	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	456.4143	341.0695	264.3435	132.6699	48.7434	0.0000	0.0000	0.0000	0.0000	139.1104	311.1319	473.9412	(98)
Space heating												2167.4241	(98)
Space heating per m2											(98) / (4) =	34.6732	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2323.0698	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	456.4143	341.0695	264.3435	132.6699	48.7434	0.0000	0.0000	0.0000	0.0000	139.1104	311.1319	473.9412	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	489.1900	365.5621	283.3264	142.1971	52.2437	0.0000	0.0000	0.0000	0.0000	149.1001	333.4747	507.9756	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3954	89.2829	89.0571	88.5705	87.7489	86.7000	86.7000	86.7000	86.7000	88.5796	89.1966	89.4402	(217)
Fuel for water heating, kWh/month													
	164.5112	144.4242	150.2811	132.9789	129.7217	114.6811	107.6421	121.5665	122.4381	138.0068	148.0117	159.6474	(219)
Water heating fuel used												1633.9108	(219)
Annual totals kWh/year													
Space heating fuel - main system												2323.0698	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.9068	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 853 * 1.00) =												-252.4969	(233)
Total delivered energy for all uses												4066.3905	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2323.0698	3.4800	80.8428	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1633.9108	3.4800	56.8601	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	286.9068	13.1900	37.8430	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			305.4384	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1932	(257)
SAP value		83.3544	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2323.0698	0.2160	501.7831	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1633.9108	0.2160	352.9247	(264)
Space and water heating			854.7078	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.9068	0.5190	148.9046	(268)
Energy saving/generation technologies				
PV Unit	-252.4969	0.5190	-131.0459	(269)
Total kg/year			911.4916	(272)
CO2 emissions per m2			14.5800	(273)
EI value			88.6392	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8817 = 3.947, stars = 4
Water heating environmental impact	0.216 / 0.8817 = 0.2450, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	62.5100 (1b)	x	2.3100 (2b)	=	144.3981	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.5100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	144.3981	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1385	(8)
Pressure test		Yes	
Measured/design AP50		4.4600	
Infiltration rate		0.3615	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3073	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3226	0.2996	0.3073	0.2919	0.2919	0.2842	0.2766	0.2689	0.2612	0.2842	0.2689	0.2842	(22b)
Effective ac	0.5520	0.5449	0.5472	0.5426	0.5426	0.5404	0.5382	0.5361	0.5341	0.5404	0.5361	0.5404	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.5900	1.2357	14.3222			(27)
Opening Type 9			4.2400	1.5000	6.3600			(26a)
Ground floor			62.5100	0.1800	11.2518			(28a)
External Wall	60.3800	15.8300	44.5500	0.2700	12.0285			(29a)
Roof 1	11.2500		11.2500	0.1600	1.8000			(30)
Total net area of external elements Aum(A, m2)			134.1400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.7625			(33)
Party Wall			19.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0981	(36)
Total fabric heat loss (33) + (36) =	50.8606	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.3059	25.9643	26.0753	25.8560	25.8560	25.7505	25.6479	25.5481	25.4511	25.7505	25.5481	25.7505	(38)
Heat transfer coeff	77.1665	76.8249	76.9359	76.7166	76.7166	76.6111	76.5085	76.4087	76.3117	76.6111	76.4087	76.6111	(39)
Average = Sum(39)m / 12 =												76.6526	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2290	1.2308	1.2273	1.2273	1.2256	1.2239	1.2223	1.2208	1.2256	1.2223	1.2256	(40)
HLP (average)												1.2262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0516 (42)
Average daily hot water use (litres/day)	82.9264 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	91.2191	87.9020	84.5850	81.2679	77.9509	74.6338	74.6338	77.9509	81.2679	84.5850	87.9020	91.2191	(44)
Energy conte	135.2753	118.3126	122.0880	106.4393	102.1310	88.1313	81.6666	93.7136	94.8329	110.5186	120.6397	131.0069	(45)
Energy content (annual)										Total = Sum(45)m =		1304.7558	(45)
Distribution loss (46)m = 0.15 x (45)m	20.2913	17.7469	18.3132	15.9659	15.3197	13.2197	12.2500	14.0570	14.2249	16.5778	18.0960	19.6510	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7902	10.6336	11.7479	11.3408	11.6983	11.2972	11.6591	11.6845	11.3209	11.7274	11.3818	11.7820	(61)
Total heat required for water heating calculated for each month													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
								Total per year (kWh/year) = Sum(64)m =				1442.8195	(64)
Heat gains from water heating, kWh/month													
	47.9266	41.9973	43.5313	38.2263	36.8831	32.1280	30.0689	34.0809	34.3622	39.6793	42.9581	46.5053	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	123.0984	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	40.6146	36.0736	29.3370	22.2100	16.6022	14.0163	15.1451	19.6862	26.4227	33.5497	39.1575	41.7434	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	267.5073	270.2832	263.2881	248.3962	229.5980	211.9302	200.1271	197.3512	204.3463	219.2382	238.0365	255.7042	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	49.3615	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	-82.0656	(71)
Water heating gains (Table 5)													
	64.4174	62.4960	58.5097	53.0920	49.5741	44.6222	40.4152	45.8077	47.7252	53.3324	59.6641	62.5071	(72)
Total internal gains													
	465.9337	462.2471	444.5291	417.0925	389.1686	363.9630	349.0817	356.2393	371.8886	399.5146	430.2523	453.3490	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	2.7200	25.1925	0.7400	0.7000	0.7700	24.5982	(76)
South	3.6500	56.7559	0.7400	0.7000	0.7700	74.3647	(78)
West	4.1400	25.1925	0.7400	0.7000	0.7700	37.4400	(80)

Solar gains	141.6304	215.1239	318.1777	425.1024	471.9169	516.6332	491.1124	447.1453	374.7306	263.2009	171.3142	117.6556	(83)
Total gains	607.5641	677.3710	762.7068	842.1949	861.0854	880.5962	840.1940	803.3846	746.6192	662.7155	601.5665	571.0046	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2546	56.5048	56.4232	56.5845	56.5845	56.6624	56.7384	56.8126	56.8848	56.6624	56.8126	56.6624	
alpha	4.7503	4.7670	4.7615	4.7723	4.7723	4.7775	4.7826	4.7875	4.7923	4.7775	4.7875	4.7775	
util living area													
	0.9826	0.9709	0.9346	0.8454	0.6963	0.4870	0.3535	0.3689	0.6138	0.8670	0.9632	0.9859	(86)
MIT	20.0451	20.1877	20.4607	20.7477	20.9221	20.9884	20.9980	20.9976	20.9666	20.7616	20.3749	20.0177	(87)
Th 2	19.8925	19.8969	19.8955	19.8982	19.8982	19.8996	19.9009	19.9022	19.9034	19.8996	19.9022	19.8996	(88)
util rest of house													
	0.9772	0.9621	0.9153	0.8036	0.6253	0.3971	0.2548	0.2662	0.5194	0.8196	0.9499	0.9814	(89)
MIT 2	18.6719	18.8780	19.2578	19.6358	19.8351	19.8938	19.9004	19.9016	19.8833	19.6651	19.1515	18.6383	(90)
Living area fraction									fLA = Living area / (4) =			0.6389	(91)
MIT	19.5493	19.7148	20.0264	20.3463	20.5297	20.5932	20.6017	20.6018	20.5755	20.3657	19.9332	19.5196	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5493	19.7148	20.0264	20.3463	20.5297	20.5932	20.6017	20.6018	20.5755	20.3657	19.9332	19.5196	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9604	0.9179	0.8217	0.6672	0.4543	0.3179	0.3319	0.5786	0.8414	0.9504	0.9794	(94)
Useful gains	592.4214	650.5397	700.0575	692.0576	574.5576	400.0691	267.1360	266.6463	431.9582	557.5924	571.7166	559.2667	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1130.4337	1107.4141	1002.1951	832.0890	616.0079	405.5144	267.9083	267.5717	448.3654	686.8699	919.4415	1112.3667	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	400.2811	307.0196	224.7903	100.8226	30.8391	0.0000	0.0000	0.0000	0.0000	96.1825	250.3619	411.5064	(98)
Space heating												1821.8035	(98)
Space heating per m2											(98) / (4) =	29.1442	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.3000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	1952.6297 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	400.2811	307.0196	224.7903	100.8226	30.8391	0.0000	0.0000	0.0000	0.0000	96.1825	250.3619	411.5064	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	429.0259	329.0671	240.9328	108.0628	33.0537	0.0000	0.0000	0.0000	0.0000	103.0895	268.3408	441.0573	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	147.0655	128.9462	133.8360	117.7800	113.8293	99.4285	93.3257	105.3981	106.1538	122.2460	132.0215	142.7889	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3037	89.2045	88.9221	88.3240	87.4431	86.7000	86.7000	86.7000	86.7000	88.2492	89.0238	89.3443	(217)
Fuel for water heating, kWh/month													
	164.6802	144.5513	150.5092	133.3499	130.1752	114.6811	107.6421	121.5665	122.4381	138.5236	148.2991	159.8186	(219)
Water heating fuel used												1636.2350	(219)
Annual totals kWh/year													
Space heating fuel - main system												1952.6297	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												286.9068	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.37 * 967 * 1.00) =												-286.1698	(233)
Total delivered energy for all uses												3664.6016	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1952.6297	7.3800	144.1041	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1636.2350	7.3800	120.7541	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	286.9068	28.6600	82.2275	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			475.5807	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1952.6297	0.2160	421.7680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.2350	0.2160	353.4268	(264)
Space and water heating			775.1948	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	286.9068	0.5190	148.9046	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	0.5190	-148.5221	(269)
Total kg/year			814.5023	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1952.6297	1.2200	2382.2082	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1636.2350	1.2200	1996.2067	(264)
Space and water heating			4378.4149	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	286.9068	3.0700	880.8038	(268)
Energy saving/generation technologies				
PV Unit	-286.1698	3.0700	-878.5413	(269)
Primary energy kWh/year			4610.9274	(272)
Primary energy kWh/m2/year			73.7630	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£104	£104	£0
Mains gas	£372	£372	£0
Space heating	£273	£273	£0
Water heating	£121	£121	£0
Lighting	£82	£82	£0
Total cost of fuels	£476	£476	£0
Total cost of uses	£476	£476	£0
Delivered energy	59 kWh/m²	59 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	74 kWh/m²	74 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	285.91 (P1)
Transmission heat loss coefficient	50.86 (37)
Summer heat loss coefficient	336.77 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	2.7200	125.2818	0.7400	0.7000	0.8865	140.8341
South	3.6500	118.5567	0.7400	0.7000	0.8865	178.8421
West	4.1400	125.2818	0.7400	0.7000	0.8865	214.3578
total:						572.9425

	Jun	Jul	Aug	
Solar gains	613	573	520	(P3)
Internal gains	361	346	353	
Total summer gains	974	919	873	(P5)
Summer gain/loss ratio	2.89	2.73	2.59	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.54	20.28	20.14	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 679 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 679 - EPC	**Prop Type Ref**	
Property	41 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	16.56	**TER**	20.26
Environmental	89 B	**% DER<TER**	18.25		
CO_2 Emissions (t/year)	0.81	**DFEE**	48.23	**TFEE**	55.25
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.71		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.26	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	16.56	$kgCO_2/m^2$	Pass
	-3.70 (-18.3%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.25	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	48.23	$kWh/m^2/yr$	
	-7.0 (-12.7%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North	1.08 m², No overhang		
Windows facing East	2.72 m², No overhang		
Windows facing South	3.65 m², No overhang		
Windows facing West	4.14 m², No overhang		
Air change rate	6.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.46 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K	
Thermal bridging y-value	0.038	W/m²K	
Photovoltaic array	0.37	kW	

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 680 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 680 - EPC	**Prop Type Ref**	
Property	43 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	13.87	**TER**	20.23
Environmental	91 B	**% DER<TER**	31.44		
CO_2 Emissions (t/year)	0.57	**DFEE**	46.49	**TFEE**	53.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Semi-Detached Maisonette, total floor area 56 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.23 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.87 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 4.38 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Baxi ASSURE 530 COMBI 2
Combi boiler
Efficiency: 89.4% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: No cylinder

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum: 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing East: 4.14 m², No overhang
Windows facing South: 2.94 m², No overhang
Windows facing West: 3.59 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 10% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Thermal bridging y-value 0.039 W/m²K
Photovoltaic array 0.73 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2916	0.3152	0.3388	0.3546	0.3704	(22b)
Effective ac	0.5808	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7500	1.2357	14.5200			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Floor 1			4.0700	0.1800	0.7326			(28b)
External Wall	63.0300	13.8700	49.1600	0.2700	13.2732			(29a)
Roof 1	57.2700		57.2700	0.1600	9.1632			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8690			(33)
Party Wall			38.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8406	(36)
Total fabric heat loss (33) + (36) =	45.7096	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2464	25.1101	24.9765	24.3489	24.2314	23.6848	23.6848	23.5836	23.8954	24.2314	24.4690	24.7173	(38)
Heat transfer coeff	70.9560	70.8197	70.6860	70.0584	69.9410	69.3944	69.3944	69.2932	69.6050	69.9410	70.1786	70.4269	(39)
Average = Sum(39)m / 12 =												70.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2570	1.2546	1.2435	1.2414	1.2317	1.2317	1.2299	1.2354	1.2414	1.2456	1.2500	(40)
HLP (average)												1.2435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	19.2735	16.8567	17.3946	15.1650	14.5512	12.5566	11.6355	13.3519	13.5114	15.7462	17.1883	18.6653	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7649	10.6122	11.7267	11.3230	11.6819	11.2837	11.6465	11.6695	11.3051	11.7082	11.3600	11.7575	(61)
Total heat required for water heating calculated for each month													
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(64)
								Total per year (kWh/year) = Sum(64)m =				1377.1487	(64)
Heat gains from water heating, kWh/month													
	45.6641	40.0188	41.4897	36.4466	35.1757	30.6547	28.7037	32.5142	32.7766	37.8312	40.9406	44.3142	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6352	12.9989	10.5714	8.0032	5.9825	5.0507	5.4574	7.0938	9.5213	12.0894	14.1102	15.0420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	163.6315	165.3295	161.0507	151.9415	140.4427	129.6356	122.4157	120.7177	124.9966	134.1058	145.6045	156.4117	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	61.3765	59.5517	55.7658	50.6203	47.2792	42.5760	38.5803	43.7019	45.5230	50.8484	56.8620	59.5621	(72)
Total internal gains													
	293.7907	292.0276	281.5353	264.7125	247.8519	231.4098	220.6009	225.6609	234.1884	251.1912	270.7242	285.1633	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(76)
South	2.9400	46.7521	0.7400	0.7000	0.7700	49.3414	(78)
West	3.5900	19.6403	0.7400	0.7000	0.7700	25.3107	(80)

Solar gains	107.9630	195.2986	291.8974	393.9079	464.0172	468.9280	448.7867	396.3864	327.8246	223.0416	131.5260	90.8896	(83)
Total gains	401.7537	487.3262	573.4327	658.6203	711.8691	700.3378	669.3876	622.0472	562.0130	474.2327	402.2502	376.0529	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1398	55.2460	55.3504	55.8462	55.9400	56.3806	56.3806	56.4630	56.2101	55.9400	55.7506	55.5541	
alpha	4.6760	4.6831	4.6900	4.7231	4.7293	4.7587	4.7587	4.7642	4.7473	4.7293	4.7167	4.7036	
util living area													
	0.9958	0.9892	0.9700	0.9114	0.7863	0.6055	0.4502	0.5019	0.7555	0.9496	0.9909	0.9969	(86)
MIT	19.7172	19.9239	20.2333	20.5944	20.8512	20.9671	20.9934	20.9892	20.9086	20.5457	20.0548	19.6767	(87)
Th 2	19.8728	19.8747	19.8765	19.8854	19.8870	19.8947	19.8947	19.8961	19.8917	19.8870	19.8837	19.8802	(88)
util rest of house													
	0.9944	0.9857	0.9600	0.8828	0.7255	0.5128	0.3402	0.3868	0.6681	0.9270	0.9873	0.9958	(89)
MIT 2	18.1840	18.4853	18.9301	19.4337	19.7522	19.8747	19.8925	19.8921	19.8253	19.3829	18.6839	18.1302	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	18.9443	19.1987	19.5763	20.0093	20.2972	20.4164	20.4385	20.4362	20.3625	19.9596	19.3637	18.8972	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9443	19.1987	19.5763	20.0093	20.2972	20.4164	20.4385	20.4362	20.3625	19.9596	19.3637	18.8972	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9828	0.9567	0.8864	0.7494	0.5578	0.3949	0.4441	0.7078	0.9288	0.9851	0.9945	(94)
Useful gains	398.8438	478.9674	548.5952	583.8256	533.4795	390.6650	264.3606	276.2317	397.7783	440.4522	396.2455	374.0006	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1039.1014	1012.6308	924.3150	778.2998	601.2988	403.6276	266.3691	279.6810	435.9034	654.6169	860.6522	1035.0755	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	476.3516	358.6218	279.5356	140.0214	50.4576	0.0000	0.0000	0.0000	0.0000	159.3385	334.3728	491.8397	(98)
Space heating												2290.5391	(98)
Space heating per m2											(98) / (4) =	40.6556	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2455.0258	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	476.3516	358.6218	279.5356	140.0214	50.4576	0.0000	0.0000	0.0000	0.0000	159.3385	334.3728	491.8397	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	510.5591	384.3749	299.6094	150.0766	54.0810	0.0000	0.0000	0.0000	0.0000	170.7808	358.3846	527.1594	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.4551	89.3525	89.1394	88.6605	87.8099	86.7000	86.7000	86.7000	86.7000	88.7423	89.2856	89.4942	(217)
Fuel for water heating, kWh/month	156.7878	137.6461	143.2485	126.8020	123.7788	109.5668	102.9029	116.1274	116.9333	131.4854	141.0624	152.1810	(219)
Water heating fuel used												1558.5223	(219)
Annual totals kWh/year													
Space heating fuel - main system												2455.0258	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												258.4628	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =												-498.1695	(233)
Total delivered energy for all uses												3848.8414	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2455.0258	0.2160	530.2856	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1558.5223	0.2160	336.6408	(264)
Space and water heating			866.9264	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.4628	0.5190	134.1422	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total CO2, kg/year			781.4436	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.8700	ZC1
Total Floor Area	TFA	56.3400	
Assumed number of occupants	N	1.8765	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2106	ZC2
CO2 emissions from cooking, equation (L16)		2.9115	ZC3
Total CO2 emissions		33.9922	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.9922	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4018	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4355	0.4269	0.4184	0.3757	0.3672	0.3245	0.3245	0.3159	0.3415	0.3672	0.3842	0.4013	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7500	1.3258	15.5777			(27)
Floor 1			4.0700	0.1300	0.5291			(28b)
External Wall	63.0300	13.8700	49.1600	0.1800	8.8488			(29a)
Roof 1	57.2700		57.2700	0.1300	7.4451			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.9447			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7508	(36)
Total fabric heat loss						(33) + (36) =	43.6954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8579	25.6978	25.5409	24.8040	24.6661	24.0243	24.0243	23.9054	24.2715	24.6661	24.9450	25.2366	(38)
Heat transfer coeff	69.5533	69.3932	69.2363	68.4994	68.3615	67.7197	67.7197	67.6009	67.9669	68.3615	68.6405	68.9321	(39)
Average = Sum(39)m / 12 =												68.4988	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2317	1.2289	1.2158	1.2134	1.2020	1.2020	1.1999	1.2064	1.2134	1.2183	1.2235	(40)
HLP (average)												1.2158	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.8765	(42)
Average daily hot water use (litres/day)												78.7669	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	19.2735	16.8567	17.3946	15.1650	14.5512	12.5566	11.6355	13.3519	13.5114	15.7462	17.1883	18.6653	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	44.1526	38.4296	40.9415	38.0671	37.7304	34.9595	36.1249	37.7304	38.0671	40.9415	41.1746	44.1526	(61)
Total heat required for water heating calculated for each month													
	172.6425	150.8077	156.9056	139.1674	134.7386	118.6702	113.6951	126.7434	128.1431	145.9165	155.7630	168.5882	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	172.6425	150.8077	156.9056	139.1674	134.7386	118.6702	113.6951	126.7434	128.1431	145.9165	155.7630	168.5882	(64)
								Total per year (kWh/year) = Sum(64)m =				1711.7812	(64)
Heat gains from water heating, kWh/month													
	53.7610	46.9731	48.7934	43.1326	41.6878	36.5737	34.8233	39.0294	39.4671	45.1396	48.3943	52.4130	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6352	12.9989	10.5714	8.0032	5.9825	5.0507	5.4574	7.0938	9.5213	12.0894	14.1102	15.0420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	163.6315	165.3295	161.0507	151.9415	140.4427	129.6356	122.4157	120.7177	124.9966	134.1058	145.6045	156.4117	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	72.2595	69.9005	65.5826	59.9064	56.0320	50.7968	46.8055	52.4589	54.8154	60.6715	67.2143	70.4476	(72)
Total internal gains													
	304.6737	302.3764	291.3521	273.9986	256.6048	239.6305	228.8262	234.4179	243.4807	261.0142	281.0765	296.0487	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.1400	19.6403	0.6300	0.7000	0.7700	24.8496	(76)
South	2.9400	46.7521	0.6300	0.7000	0.7700	42.0068	(78)
West	3.5900	19.6403	0.6300	0.7000	0.7700	21.5483	(80)

Solar gains	91.9144	166.2677	248.5072	335.3540	395.0417	399.2225	382.0752	337.4641	279.0939	189.8867	111.9748	77.3790	(83)
Total gains	396.5882	468.6441	539.8594	609.3526	651.6464	638.8530	610.9014	571.8820	522.5747	450.9009	393.0513	373.4277	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2518	56.3816	56.5093	57.1173	57.2325	57.7749	57.7749	57.8765	57.5648	57.2325	56.9999	56.7588	
alpha	4.7501	4.7588	4.7673	4.8078	4.8155	4.8517	4.8517	4.8584	4.8377	4.8155	4.8000	4.7839	
util living area													
	0.9960	0.9906	0.9753	0.9275	0.8177	0.6414	0.4800	0.5305	0.7810	0.9561	0.9916	0.9970	(86)
MIT	19.7416	19.9275	20.2155	20.5657	20.8304	20.9609	20.9921	20.9875	20.8996	20.5388	20.0708	19.7075	(87)
Th 2	19.8925	19.8947	19.8969	19.9074	19.9093	19.9184	19.9184	19.9201	19.9149	19.9093	19.9054	19.9012	(88)
util rest of house													
	0.9947	0.9875	0.9669	0.9029	0.7610	0.5480	0.3660	0.4127	0.6970	0.9359	0.9883	0.9960	(89)
MIT 2	18.2333	18.5049	18.9208	19.4157	19.7516	19.8940	19.9157	19.9153	19.8400	19.3918	18.7225	18.1897	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	18.9813	19.2104	19.5628	19.9860	20.2866	20.4231	20.4495	20.4470	20.3655	19.9606	19.3912	18.9424	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9813	19.2104	19.5628	19.9860	20.2866	20.4231	20.4495	20.4470	20.3655	19.9606	19.3912	18.9424	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9850	0.9637	0.9050	0.7821	0.5931	0.4228	0.4714	0.7345	0.9371	0.9862	0.9947	(94)
Useful gains	393.8615	461.6074	520.2658	551.4424	509.6680	378.8939	258.2736	269.5607	383.8483	422.5167	387.6185	371.4569	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1021.1314	993.0429	904.4222	759.3846	586.9934	394.3394	260.6896	273.5832	425.8440	639.9072	843.6702	1016.2244	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	466.6888	357.1247	285.8124	149.7184	57.5300	0.0000	0.0000	0.0000	0.0000	161.7385	328.3572	479.7070	(98)
Space heating												2286.6770	(98)
Space heating per m2											(98) / (4) =	40.5871	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2448.2624	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	466.6888	357.1247	285.8124	149.7184	57.5300	0.0000	0.0000	0.0000	0.0000	161.7385	328.3572	479.7070	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000		(210)
Space heating fuel (main heating system)													
	499.6668	382.3605	306.0090	160.2981	61.5953	0.0000	0.0000	0.0000	0.0000	173.1675	351.5602	513.6049	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	172.6425	150.8077	156.9056	139.1674	134.7386	118.6702	113.6951	126.7434	128.1431	145.9165	155.7630	168.5882	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.4305	87.1456	86.5422	85.2354	83.0773	80.3000	80.3000	80.3000	80.3000	85.3108	86.8839	87.5368	(217)
Fuel for water heating, kWh/month													
	197.4627	173.0525	181.3054	163.2742	162.1846	147.7836	141.5879	157.8374	159.5805	171.0411	179.2771	192.5912	(219)
Water heating fuel used												2026.9780	(219)
Annual totals kWh/year													
Space heating fuel - main system												2448.2624	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												258.4628	(232)
Total delivered energy for all uses												4808.7032	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2448.2624	0.2160	528.8247	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2026.9780	0.2160	437.8273	(264)
Space and water heating			966.6519	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.4628	0.5190	134.1422	(268)
Total CO2, kg/m2/year			1139.7191	(272)
Emissions per m2 for space and water heating			17.1575	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3809	(272b)
Emissions per m2 for pumps and fans			0.6909	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1575 * 1.00) + 2.3809 + 0.6909, rounded to 2 d.p.			20.2300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2916	0.3152	0.3388	0.3546	0.3704	(22b)
Effective ac	0.5808	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7500	1.2357	14.5200			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Floor 1			4.0700	0.1800	0.7326			(28b)
External Wall	63.0300	13.8700	49.1600	0.2700	13.2732			(29a)
Roof 1	57.2700		57.2700	0.1600	9.1632			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8690			(33)
Party Wall			38.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8406	(36)
Total fabric heat loss (33) + (36) =	45.7096	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2464	25.1101	24.9765	24.3489	24.2314	23.6848	23.6848	23.5836	23.8954	24.2314	24.4690	24.7173	(38)
Heat transfer coeff	70.9560	70.8197	70.6860	70.0584	69.9410	69.3944	69.3944	69.2932	69.6050	69.9410	70.1786	70.4269	(39)
Average = Sum(39)m / 12 =												70.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2570	1.2546	1.2435	1.2414	1.2317	1.2317	1.2299	1.2354	1.2414	1.2456	1.2500	(40)
HLP (average)												1.2435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

	27.3041	23.8803	24.6424	21.4838	20.6142	17.7885	16.4837	18.9153	19.1412	22.3072	24.3500	26.4426 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	14.6352	12.9989	10.5714	8.0032	5.9825	5.0507	5.4574	7.0938	9.5213	12.0894	14.1102	15.0420 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	163.6315	165.3295	161.0507	151.9415	140.4427	129.6356	122.4157	120.7177	124.9966	134.1058	145.6045	156.4117 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600 (71)

Water heating gains (Table 5)

	36.6991	35.5362	33.1215	29.8386	27.7073	24.7063	22.1555	25.4237	26.5850	29.9828	33.8195	35.5411 (72)

Total internal gains

	266.1133	265.0121	255.8910	240.9308	225.2801	210.5400	201.1761	204.3828	212.2503	227.3255	244.6817	258.1422 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(76)
South	2.9400	46.7521	0.7400	0.7000	0.7700	49.3414	(78)
West	3.5900	19.6403	0.7400	0.7000	0.7700	25.3107	(80)

Solar gains	107.9630	195.2986	291.8974	393.9079	464.0172	468.9280	448.7867	396.3864	327.8246	223.0416	131.5260	90.8896 (83)
Total gains	374.0763	460.3107	547.7884	634.8387	689.2972	679.4680	649.9628	600.7691	540.0749	450.3671	376.2077	349.0319 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1398	55.2460	55.3504	55.8462	55.9400	56.3806	56.3806	56.4630	56.2101	55.9400	55.7506	55.5541	
alpha	4.6760	4.6831	4.6900	4.7231	4.7293	4.7587	4.7587	4.7642	4.7473	4.7293	4.7167	4.7036	
util living area	0.9969	0.9914	0.9746	0.9208	0.8007	0.6209	0.4628	0.5181	0.7743	0.9578	0.9931	0.9977	(86)
MIT	19.6728	19.8819	20.1967	20.5687	20.8384	20.9634	20.9926	20.9877	20.8981	20.5147	20.0139	19.6331	(87)
Th 2	19.8728	19.8747	19.8765	19.8854	19.8870	19.8947	19.8947	19.8961	19.8917	19.8870	19.8837	19.8802	(88)
util rest of house	0.9958	0.9885	0.9660	0.8944	0.7413	0.5270	0.3502	0.4001	0.6884	0.9382	0.9903	0.9970	(89)
MIT 2	18.6756	18.8847	19.1954	19.5545	19.7860	19.8794	19.8930	19.8930	19.8403	19.5148	19.0242	18.6420	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.1701	19.3792	19.6920	20.0575	20.3079	20.4170	20.4383	20.4359	20.3649	20.0106	19.5150	19.1335	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1701	19.3792	19.6920	20.0575	20.3079	20.4170	20.4383	20.4359	20.3649	20.0106	19.5150	19.1335	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9869	0.9642	0.8990	0.7654	0.5728	0.4063	0.4589	0.7278	0.9408	0.9891	0.9963	(94)
Useful gains	372.1786	454.2866	528.1943	570.7090	527.5656	389.1962	264.0917	275.6970	393.0747	423.6969	372.1035	347.7277	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1055.1251	1025.4126	932.4896	781.6743	602.0465	403.6672	266.3584	279.6580	436.0659	658.1889	871.2669	1051.7199	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	508.1122	383.7966	300.7957	151.8950	55.4138	0.0000	0.0000	0.0000	0.0000	174.4620	359.3977	523.7702	(98)
Space heating												2457.6433	(98)
Space heating per m2											(98) / (4) =	43.6216	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	652.3074	513.5186	526.6282	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9200	0.9584	0.9423	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	600.0905	492.1330	496.2555	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	864.5821	828.7305	772.3082	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

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	0.0000	0.0000	0.0000	0.0000	0.0000	190.4339	250.4286	205.3832	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												646.2457 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	47.6085	62.6071	51.3458	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												161.5614 (107)
Space cooling per m2												2.8676 (108)
Energy for space heating												43.6216 (99)
Energy for space cooling												2.8676 (108)
Total												46.4893 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4018	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4355	0.4269	0.4184	0.3757	0.3672	0.3245	0.3245	0.3159	0.3415	0.3672	0.3842	0.4013	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)
TER Opening Type (Uw = 1.40)			11.7500	1.3258	15.5777			(27)
Floor 1			4.0700	0.1300	0.5291			(28b)
External Wall	63.0300	13.8700	49.1600	0.1800	8.8488			(29a)
Roof 1	57.2700		57.2700	0.1300	7.4451			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.9447			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.7508	(36)
Total fabric heat loss	(33) + (36) = 43.6954	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8579	25.6978	25.5409	24.8040	24.6661	24.0243	24.0243	23.9054	24.2715	24.6661	24.9450	25.2366	(38)
Heat transfer coeff	69.5533	69.3932	69.2363	68.4994	68.3615	67.7197	67.7197	67.6009	67.9669	68.3615	68.6405	68.9321	(39)
Average = Sum(39)m / 12 =												68.4988	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2345	1.2317	1.2289	1.2158	1.2134	1.2020	1.2020	1.1999	1.2064	1.2134	1.2183	1.2235	(40)
HLP (average)												1.2158	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	27.3041	23.8803	24.6424	21.4838	20.6142	17.7885	16.4837	18.9153	19.1412	22.3072	24.3500	26.4426	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	93.8250	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.6352	12.9989	10.5714	8.0032	5.9825	5.0507	5.4574	7.0938	9.5213	12.0894	14.1102	15.0420	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	163.6315	165.3295	161.0507	151.9415	140.4427	129.6356	122.4157	120.7177	124.9966	134.1058	145.6045	156.4117	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	32.3825	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	36.6991	35.5362	33.1215	29.8386	27.7073	24.7063	22.1555	25.4237	26.5850	29.9828	33.8195	35.5411	(72)
Total internal gains													
	266.1133	265.0121	255.8910	240.9308	225.2801	210.5400	201.1761	204.3828	212.2503	227.3255	244.6817	258.1422	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097	(74)
East	4.1400	19.6403	0.6300	0.7000	0.7700	24.8496	(76)
South	2.9400	46.7521	0.6300	0.7000	0.7700	42.0068	(78)
West	3.5900	19.6403	0.6300	0.7000	0.7700	21.5483	(80)

Solar gains	91.9144	166.2677	248.5072	335.3540	395.0417	399.2225	382.0752	337.4641	279.0939	189.8867	111.9748	77.3790	(83)
Total gains	358.0278	431.2799	504.3982	576.2848	620.3217	609.7625	583.2513	541.8468	491.3442	417.2122	356.6565	335.5213	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.2518	56.3816	56.5093	57.1173	57.2325	57.7749	57.7749	57.8765	57.5648	57.2325	56.9999	56.7588	
alpha	4.7501	4.7588	4.7673	4.8078	4.8155	4.8517	4.8517	4.8584	4.8377	4.8155	4.8000	4.7839	
util living area													
	0.9974	0.9934	0.9809	0.9396	0.8381	0.6654	0.5011	0.5568	0.8088	0.9668	0.9944	0.9981	(86)
MIT	19.6794	19.8686	20.1633	20.5266	20.8090	20.9543	20.9906	20.9847	20.8819	20.4931	20.0130	19.6459	(87)
Th 2	19.8925	19.8947	19.8969	19.9074	19.9093	19.9184	19.9184	19.9201	19.9149	19.9093	19.9054	19.9012	(88)
util rest of house													
	0.9965	0.9911	0.9742	0.9181	0.7841	0.5710	0.3830	0.4346	0.7281	0.9507	0.9921	0.9975	(89)
MIT 2	18.6978	18.8877	19.1802	19.5369	19.7861	19.8986	19.9162	19.9160	19.8530	19.5142	19.0408	18.6714	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.1846	19.3742	19.6677	20.0277	20.2934	20.4221	20.4490	20.4460	20.3633	19.9996	19.5229	19.1547	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1846	19.3742	19.6677	20.0277	20.2934	20.4221	20.4490	20.4460	20.3633	19.9996	19.5229	19.1547	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9897	0.9725	0.9208	0.8048	0.6167	0.4419	0.4956	0.7644	0.9523	0.9911	0.9969	(94)
Useful gains	356.5138	426.8411	490.5361	530.6454	499.2074	376.0513	257.7298	268.5311	375.5818	397.3129	353.4745	334.4661	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1035.2711	1004.4083	911.6862	762.2416	587.4556	394.2729	260.6520	273.5118	425.6965	642.5743	852.7168	1030.8579	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	504.9955	388.1252	313.3357	166.7492	65.6566	0.0000	0.0000	0.0000	0.0000	182.4745	359.4545	518.1155	(98)
Space heating												2498.9066	(98)
Space heating per m2											(98) / (4) =	44.3540	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	636.5653	501.1259	513.7665	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9025	0.9484	0.9304	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	574.5087	475.2523	477.9893	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	783.1081	750.7560	703.4379	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	150.1916	204.9747	167.7337	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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Space cooling                                                                                                  522.9000 (104)
Cooled fraction                                                                  fC = cooled area / (4) =        1.0000 (105)
Intermittency factor (Table 10b)
          0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
          0.0000    0.0000    0.0000    0.0000    0.0000   37.5479   51.2437   41.9334    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                  130.7250 (107)
Space cooling per m2                                                                                             2.3203 (108)
Energy for space heating                                                                                        44.3540 (99)
Energy for space cooling                                                                                         2.3203 (108)
Total                                                                                                           46.6743 (109)
Target Fabric Energy Efficiency (TFEE)                                                                           53.7 (109)


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CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3310	0.3073	0.3152	0.2994	0.2994	0.2916	0.2837	0.2758	0.2679	0.2916	0.2758	0.2916	(22b)
Effective ac	0.5548	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7500	1.2357	14.5200			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Floor 1			4.0700	0.1800	0.7326			(28b)
External Wall	63.0300	13.8700	49.1600	0.2700	13.2732			(29a)
Roof 1	57.2700		57.2700	0.1600	9.1632			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8690			(33)
Party Wall			38.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8406	(36)
Total fabric heat loss (33) + (36) =	45.7096	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1167	23.7887	23.8954	23.6848	23.6848	23.5836	23.4851	23.3892	23.2961	23.5836	23.3892	23.5836	(38)
Heat transfer coeff	69.8263	69.4983	69.6050	69.3944	69.3944	69.2932	69.1947	69.0988	69.0057	69.2932	69.0988	69.2932	(39)
Average = Sum(39)m / 12 =												69.3330	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2394	1.2336	1.2354	1.2317	1.2317	1.2299	1.2282	1.2265	1.2248	1.2299	1.2265	1.2299	(40)
HLP (average)												1.2306	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	19.2735	16.8567	17.3946	15.1650	14.5512	12.5566	11.6355	13.3519	13.5114	15.7462	17.1883	18.6653	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7649	10.6122	11.7267	11.3230	11.6819	11.2837	11.6465	11.6695	11.3051	11.7082	11.3600	11.7575 (61)
Total heat required for water heating calculated for each month												
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931 (64)
								Total per year (kWh/year) = Sum(64)m =				1377.1487 (64)
RHI water heating demand												1377 (64)
Heat gains from water heating, kWh/month												
	45.6641	40.0188	41.4897	36.4466	35.1757	30.6547	28.7037	32.5142	32.7766	37.8312	40.9406	44.3142 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.5881	32.4972	26.4285	20.0081	14.9563	12.6267	13.6436	17.7345	23.8032	30.2236	35.2754	37.6050	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.2262	246.7605	240.3741	226.7783	209.6160	193.4859	182.7100	180.1757	186.5621	200.1579	217.3202	233.4503	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	61.3765	59.5517	55.7658	50.6203	47.2792	42.5760	38.5803	43.7019	45.5230	50.8484	56.8620	59.5621	(72)
Total internal gains													
	430.8562	427.4749	411.2339	386.0722	360.5170	337.3541	323.5994	330.2775	344.5538	369.8954	398.1231	419.2828	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.1400	25.1925	0.7400	0.7000	0.7700	37.4400	(76)
South	2.9400	56.7559	0.7400	0.7000	0.7700	59.8992	(78)
West	3.5900	25.1925	0.7400	0.7000	0.7700	32.4660	(80)

Solar gains	135.0328	208.1237	314.1118	427.3766	479.3225	526.6152	499.8643	451.7448	372.8909	256.5990	164.0202	111.7143	(83)
Total gains	565.8890	635.5986	725.3457	813.4487	839.8395	863.9693	823.4637	782.0224	717.4447	626.4944	562.1433	530.9972	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0319	56.2963	56.2101	56.3806	56.3806	56.4630	56.5434	56.6218	56.6982	56.4630	56.6218	56.4630	
alpha	4.7355	4.7531	4.7473	4.7587	4.7587	4.7642	4.7696	4.7748	4.7799	4.7642	4.7748	4.7642	
util living area	0.9804	0.9665	0.9229	0.8184	0.6576	0.4511	0.3266	0.3432	0.5829	0.8503	0.9584	0.9842	(86)
MIT	20.0660	20.2171	20.4993	20.7826	20.9383	20.9914	20.9985	20.9982	20.9728	20.7823	20.3975	20.0370	(87)
Th 2	19.8886	19.8933	19.8917	19.8947	19.8947	19.8961	19.8975	19.8989	19.9002	19.8961	19.8989	19.8961	(88)
util rest of house	0.9743	0.9565	0.9011	0.7733	0.5868	0.3666	0.2349	0.2471	0.4909	0.7999	0.9437	0.9791	(89)
MIT 2	18.6988	18.9163	19.3058	19.6726	19.8458	19.8920	19.8972	19.8984	19.8842	19.6853	19.1798	18.6633	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.3768	19.5614	19.8977	20.2231	20.3876	20.4372	20.4434	20.4438	20.4240	20.2293	19.7837	19.3445	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3768	19.5614	19.8977	20.2231	20.3876	20.4372	20.4434	20.4438	20.4240	20.2293	19.7837	19.3445	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9707	0.9529	0.9012	0.7876	0.6194	0.4085	0.2805	0.2948	0.5358	0.8166	0.9418	0.9759	(94)
Useful gains	549.3278	605.6827	653.6925	640.6885	520.1909	352.8923	230.9526	230.5723	384.4148	511.5776	529.4423	518.1761	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1010.8627	991.1430	897.7433	744.1232	547.3530	355.9741	231.3429	231.0550	394.9911	611.8124	821.1495	993.9786	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	343.3820	259.0293	181.5738	74.4729	20.2086	0.0000	0.0000	0.0000	0.0000	74.5747	210.0291	353.9970	(98)
Space heating												1517.2675	(98)
RHI space heating demand												1517	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700 (1b)	x	2.7000 (2b)	=	10.9890	(1b) - (3b)
First floor	52.2700 (1c)	x	2.3100 (2c)	=	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2916	0.3152	0.3388	0.3546	0.3704	(22b)
Effective ac	0.5808	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7500	1.2357	14.5200			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Floor 1			4.0700	0.1800	0.7326			(28b)
External Wall	63.0300	13.8700	49.1600	0.2700	13.2732			(29a)
Roof 1	57.2700		57.2700	0.1600	9.1632			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8690			(33)
Party Wall			38.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8406	(36)
Total fabric heat loss (33) + (36) =	45.7096	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2464	25.1101	24.9765	24.3489	24.2314	23.6848	23.6848	23.5836	23.8954	24.2314	24.4690	24.7173	(38)
Heat transfer coeff	70.9560	70.8197	70.6860	70.0584	69.9410	69.3944	69.3944	69.2932	69.6050	69.9410	70.1786	70.4269	(39)
Average = Sum(39)m / 12 =												70.0579	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2594	1.2570	1.2546	1.2435	1.2414	1.2317	1.2317	1.2299	1.2354	1.2414	1.2456	1.2500	(40)
HLP (average)												1.2435	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	19.2735	16.8567	17.3946	15.1650	14.5512	12.5566	11.6355	13.3519	13.5114	15.7462	17.1883	18.6653	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7649	10.6122	11.7267	11.3230	11.6819	11.2837	11.6465	11.6695	11.3051	11.7082	11.3600	11.7575 (61)
Total heat required for water heating calculated for each month												
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931 (64)
								Total per year (kWh/year) = Sum(64)m =				1377.1487 (64)
Heat gains from water heating, kWh/month												
	45.6641	40.0188	41.4897	36.4466	35.1757	30.6547	28.7037	32.5142	32.7766	37.8312	40.9406	44.3142 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.5881	32.4972	26.4285	20.0081	14.9563	12.6267	13.6436	17.7345	23.8032	30.2236	35.2754	37.6050	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.2262	246.7605	240.3741	226.7783	209.6160	193.4859	182.7100	180.1757	186.5621	200.1579	217.3202	233.4503	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	61.3765	59.5517	55.7658	50.6203	47.2792	42.5760	38.5803	43.7019	45.5230	50.8484	56.8620	59.5621	(72)
Total internal gains													
	430.8562	427.4749	411.2339	386.0722	360.5170	337.3541	323.5994	330.2775	344.5538	369.8954	398.1231	419.2828	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	10.6334	0.7400	0.7000	0.7700	4.1225	(74)
East	4.1400	19.6403	0.7400	0.7000	0.7700	29.1884	(76)
South	2.9400	46.7521	0.7400	0.7000	0.7700	49.3414	(78)
West	3.5900	19.6403	0.7400	0.7000	0.7700	25.3107	(80)

Solar gains	107.9630	195.2986	291.8974	393.9079	464.0172	468.9280	448.7867	396.3864	327.8246	223.0416	131.5260	90.8896	(83)
Total gains	538.8192	622.7735	703.1313	779.9800	824.5341	806.2821	772.3861	726.6639	672.3784	592.9370	529.6491	510.1725	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1398	55.2460	55.3504	55.8462	55.9400	56.3806	56.3806	56.4630	56.2101	55.9400	55.7506	55.5541	
alpha	4.6760	4.6831	4.6900	4.7231	4.7293	4.7587	4.7587	4.7642	4.7473	4.7293	4.7167	4.7036	
util living area													
	0.9862	0.9724	0.9393	0.8578	0.7158	0.5359	0.3924	0.4337	0.6660	0.8981	0.9736	0.9890	(86)
MIT	19.9318	20.1259	20.4037	20.7072	20.9013	20.9802	20.9963	20.9942	20.9467	20.6805	20.2466	19.8891	(87)
Th 2	19.8728	19.8747	19.8765	19.8854	19.8870	19.8947	19.8947	19.8961	19.8917	19.8870	19.8837	19.8802	(88)
util rest of house													
	0.9819	0.9641	0.9216	0.8197	0.6513	0.4497	0.2954	0.3322	0.5772	0.8609	0.9641	0.9856	(89)
MIT 2	18.4941	18.7729	19.1636	19.5726	19.8015	19.8832	19.8935	19.8941	19.8556	19.5529	18.9562	18.4379	(90)
Living area fraction										fLA = Living area / (4) =		0.4959	(91)
MIT	19.2071	19.4439	19.7786	20.1353	20.3469	20.4272	20.4404	20.4396	20.3967	20.1121	19.5961	19.1576	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2071	19.4439	19.7786	20.1353	20.3469	20.4272	20.4404	20.4396	20.3967	20.1121	19.5961	19.1576	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9786	0.9602	0.9198	0.8290	0.6791	0.4920	0.3436	0.3827	0.6193	0.8694	0.9611	0.9827	(94)
Useful gains	527.2863	598.0170	646.7130	646.6118	559.9752	396.6749	265.3982	278.0827	416.4046	515.4789	509.0509	501.3410	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1057.7451	1029.9908	938.6130	787.1258	604.7738	404.3744	266.5041	279.9180	438.2819	665.2858	876.9608	1053.4155	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	394.6614	290.2864	217.1736	101.1701	33.3302	0.0000	0.0000	0.0000	0.0000	111.4564	264.8951	410.7434	(98)
Space heating												1823.7164	(98)
Space heating per m2											(98) / (4) =	32.3698	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.3000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1954.6799	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	394.6614	290.2864	217.1736	101.1701	33.3302	0.0000	0.0000	0.0000	0.0000	111.4564	264.8951	410.7434	(98)
Space heating efficiency (main heating system 1)	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)	423.0025	311.1323	232.7691	108.4353	35.7236	0.0000	0.0000	0.0000	0.0000	119.4602	283.9176	440.2394	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.3275	89.1978	88.9327	88.3687	87.5188	86.7000	86.7000	86.7000	86.7000	88.4222	89.1077	89.3759	(217)
Fuel for water heating, kWh/month	157.0119	137.8849	143.5814	127.2207	124.1905	109.5668	102.9029	116.1274	116.9333	131.9614	141.3441	152.3823	(219)
Water heating fuel used												1561.1075	(219)

Annual totals kWh/year		
Space heating fuel - main system	1954.6799	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	75.0000	(231)
Electricity for lighting (calculated in Appendix L)	258.4628	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.73 * 853 * 1.00) =	-498.1695	(233)
Total delivered energy for all uses	3351.0808	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1954.6799	3.4800	68.0229	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1561.1075	3.4800	54.3265	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	258.4628	13.1900	34.0912	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			286.3331	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1867	(257)
SAP value	83.4456	
SAP rating (Section 12)	83	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1954.6799	0.2160	422.2109	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1561.1075	0.2160	337.1992	(264)
Space and water heating			759.4101	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.4628	0.5190	134.1422	(268)
Energy saving/generation technologies				
PV Unit	-498.1695	0.5190	-258.5500	(269)
Total kg/year			673.9273	(272)
CO2 emissions per m2			11.9600	(273)
EI value			91.0888	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9030 = 3.854, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9030 = 0.2392, stars = 4
Water heating energy efficiency	3.48 / 0.8809 = 3.951, stars = 4
Water heating environmental impact	0.216 / 0.8809 = 0.2452, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0700	(1b)	x 2.7000	(2b) =	10.9890	(1b) - (3b)
First floor	52.2700	(1c)	x 2.3100	(2c) =	120.7437	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		131.7327	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1518	(8)
Pressure test		Yes	
Measured/design AP50		4.3800	
Infiltration rate		0.3708	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3152	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)
Adj infilt rate	0.3310	0.3073	0.3152	0.2994	0.2994	0.2916	0.2837	0.2758	0.2679	0.2916	0.2758	0.2916	(22b)
Effective ac	0.5548	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.30)			11.7500	1.2357	14.5200			(27)
Opening Type 7			2.1200	1.5000	3.1800			(26a)
Floor 1			4.0700	0.1800	0.7326			(28b)
External Wall	63.0300	13.8700	49.1600	0.2700	13.2732			(29a)
Roof 1	57.2700		57.2700	0.1600	9.1632			(30)
Total net area of external elements Aum(A, m2)			124.3700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.8690			(33)
Party Wall			38.9500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.8406	(36)
Total fabric heat loss (33) + (36) =	45.7096	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.1167	23.7887	23.8954	23.6848	23.6848	23.5836	23.4851	23.3892	23.2961	23.5836	23.3892	23.5836	(38)
Heat transfer coeff	69.8263	69.4983	69.6050	69.3944	69.3944	69.2932	69.1947	69.0988	69.0057	69.2932	69.0988	69.2932	(39)
Average = Sum(39)m / 12 =												69.3330	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2394	1.2336	1.2354	1.2317	1.2317	1.2299	1.2282	1.2265	1.2248	1.2299	1.2265	1.2299	(40)
HLP (average)												1.2306	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8765 (42)
Average daily hot water use (litres/day)	78.7669 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	86.6436	83.4929	80.3422	77.1915	74.0409	70.8902	70.8902	74.0409	77.1915	80.3422	83.4929	86.6436	(44)
Energy conte	128.4899	112.3781	115.9641	101.1003	97.0082	83.7107	77.5702	89.0130	90.0761	104.9750	114.5884	124.4356	(45)
Energy content (annual)										Total = Sum(45)m =		1239.3095	(45)
Distribution loss (46)m = 0.15 x (45)m	19.2735	16.8567	17.3946	15.1650	14.5512	12.5566	11.6355	13.3519	13.5114	15.7462	17.1883	18.6653	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	11.7649	10.6122	11.7267	11.3230	11.6819	11.2837	11.6465	11.6695	11.3051	11.7082	11.3600	11.7575	(61)
Total heat required for water heating calculated for each month													
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(64)
								Total per year (kWh/year) = Sum(64)m =				1377.1487	(64)
Heat gains from water heating, kWh/month													
	45.6641	40.0188	41.4897	36.4466	35.1757	30.6547	28.7037	32.5142	32.7766	37.8312	40.9406	44.3142	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	112.5900	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.5881	32.4972	26.4285	20.0081	14.9563	12.6267	13.6436	17.7345	23.8032	30.2236	35.2754	37.6050	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.2262	246.7605	240.3741	226.7783	209.6160	193.4859	182.7100	180.1757	186.5621	200.1579	217.3202	233.4503	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	48.1355	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	-75.0600	(71)
Water heating gains (Table 5)													
	61.3765	59.5517	55.7658	50.6203	47.2792	42.5760	38.5803	43.7019	45.5230	50.8484	56.8620	59.5621	(72)
Total internal gains													
	430.8562	427.4749	411.2339	386.0722	360.5170	337.3541	323.5994	330.2775	344.5538	369.8954	398.1231	419.2828	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.0800	13.4839	0.7400	0.7000	0.7700	5.2276	(74)
East	4.1400	25.1925	0.7400	0.7000	0.7700	37.4400	(76)
South	2.9400	56.7559	0.7400	0.7000	0.7700	59.8992	(78)
West	3.5900	25.1925	0.7400	0.7000	0.7700	32.4660	(80)

Solar gains	135.0328	208.1237	314.1118	427.3766	479.3225	526.6152	499.8643	451.7448	372.8909	256.5990	164.0202	111.7143	(83)
Total gains	565.8890	635.5986	725.3457	813.4487	839.8395	863.9693	823.4637	782.0224	717.4447	626.4944	562.1433	530.9972	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0319	56.2963	56.2101	56.3806	56.3806	56.4630	56.5434	56.6218	56.6982	56.4630	56.6218	56.4630	
alpha	4.7355	4.7531	4.7473	4.7587	4.7587	4.7642	4.7696	4.7748	4.7799	4.7642	4.7748	4.7642	
util living area													
	0.9804	0.9665	0.9229	0.8184	0.6576	0.4511	0.3266	0.3432	0.5829	0.8503	0.9584	0.9842	(86)
MIT	20.0660	20.2171	20.4993	20.7826	20.9383	20.9914	20.9985	20.9982	20.9728	20.7823	20.3975	20.0370	(87)
Th 2	19.8886	19.8933	19.8917	19.8947	19.8947	19.8961	19.8975	19.8989	19.9002	19.8961	19.8989	19.8961	(88)
util rest of house													
	0.9743	0.9565	0.9011	0.7733	0.5868	0.3666	0.2349	0.2471	0.4909	0.7999	0.9437	0.9791	(89)
MIT 2	18.6988	18.9163	19.3058	19.6726	19.8458	19.8920	19.8972	19.8984	19.8842	19.6853	19.1798	18.6633	(90)
Living area fraction									fLA = Living area / (4) =			0.4959	(91)
MIT	19.3768	19.5614	19.8977	20.2231	20.3876	20.4372	20.4434	20.4438	20.4240	20.2293	19.7837	19.3445	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3768	19.5614	19.8977	20.2231	20.3876	20.4372	20.4434	20.4438	20.4240	20.2293	19.7837	19.3445	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9707	0.9529	0.9012	0.7876	0.6194	0.4085	0.2805	0.2948	0.5358	0.8166	0.9418	0.9759	(94)
Useful gains	549.3278	605.6827	653.6925	640.6885	520.1909	352.8923	230.9526	230.5723	384.4148	511.5776	529.4423	518.1761	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
	1010.8627	991.1430	897.7433	744.1232	547.3530	355.9741	231.3429	231.0550	394.9911	611.8124	821.1495	993.9786	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	343.3820	259.0293	181.5738	74.4729	20.2086	0.0000	0.0000	0.0000	0.0000	74.5747	210.0291	353.9970	(98)
Space heating												1517.2675	(98)
Space heating per m2											(98) / (4) =	26.9306	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.3000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1626.2245	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	343.3820	259.0293	181.5738	74.4729	20.2086	0.0000	0.0000	0.0000	0.0000	74.5747	210.0291	353.9970	(98)
Space heating efficiency (main heating system 1)													
	93.3000	93.3000	93.3000	93.3000	93.3000	0.0000	0.0000	0.0000	0.0000	93.3000	93.3000	93.3000	(210)
Space heating fuel (main heating system)													
	368.0407	277.6306	194.6129	79.8209	21.6598	0.0000	0.0000	0.0000	0.0000	79.9300	225.1116	379.4180	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	140.2547	122.9903	127.6908	112.4233	108.6901	94.9944	89.2168	100.6825	101.3812	116.6832	125.9484	136.1931	(64)
Efficiency of water heater												86.7000	(216)
(217)m	89.2256	89.1088	88.7780	88.0995	87.2453	86.7000	86.7000	86.7000	86.7000	88.0690	88.9160	89.2701	(217)
Fuel for water heating, kWh/month													
	157.1912	138.0226	143.8316	127.6094	124.5798	109.5668	102.9029	116.1274	116.9333	132.4906	141.6488	152.5629	(219)
Water heating fuel used												1563.4673	(219)
Annual totals kWh/year													
Space heating fuel - main system												1626.2245	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												258.4628	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.73 * 967 * 1.00) =												-564.6053	(233)
Total delivered energy for all uses												2958.5493	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1626.2245	7.3800	120.0154	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1563.4673	7.3800	115.3839	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	258.4628	28.6600	74.0754	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			437.9697	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1626.2245	0.2160	351.2645	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1563.4673	0.2160	337.7089	(264)
Space and water heating			688.9734	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	258.4628	0.5190	134.1422	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	0.5190	-293.0302	(269)
Total kg/year			569.0105	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1626.2245	1.2200	1983.9939	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1563.4673	1.2200	1907.4301	(264)
Space and water heating			3891.4240	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	258.4628	3.0700	793.4807	(268)
Energy saving/generation technologies				
PV Unit	-564.6053	3.0700	-1733.3383	(269)
Primary energy kWh/year			3181.8164	(272)
Primary energy kWh/m2/year			56.4753	(273)

SAP 2012 EPC IMPROVEMENTS

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 83
Current environmental impact rating: B 91

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£96	£96	£0
Mains gas	£342	£342	£0
Space heating	£249	£249	£0
Water heating	£115	£115	£0
Lighting	£74	£74	£0
Total cost of fuels	£438	£438	£0
Total cost of uses	£438	£438	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Built)   (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING      09 Jan 2014
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No improvements selected / applicable


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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	347.77 (P1)
Transmission heat loss coefficient	45.71 (37)
Summer heat loss coefficient	393.48 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.985	0.90	1.000	0.887 (P8)
East	0.985	0.90	1.000	0.887 (P8)
South	0.985	0.90	1.000	0.887 (P8)
West	0.985	0.90	1.000	0.887 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.0800	87.1704	0.7400	0.7000	0.8865	38.9085
East	4.1400	125.2818	0.7400	0.7000	0.8865	214.3578
South	2.9400	118.5567	0.7400	0.7000	0.8865	144.0537
West	3.5900	125.2818	0.7400	0.7000	0.8865	185.8803
total:						583.2002

	Jun	Jul	Aug	
Solar gains	625	583	525	(P3)
Internal gains	334	321	327	
Total summer gains	959	904	853	(P5)
Summer gain/loss ratio	2.44	2.30	2.17	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.09	19.85	19.72	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Built)

Energy & Design

Property Reference	Plot 680 - BO	**Issued on Date**	07/08/2024
Assessment Reference	Plot 680 - EPC	**Prop Type Ref**	
Property	43 Kittiwake Place, Boorley Green, Southampton, SO32 2ZB		

SAP Rating	83 B	**DER**	13.87	**TER**	20.23
Environmental	91 B	**% DER<TER**	31.44		
CO_2 Emissions (t/year)	0.57	**DFEE**	46.49	**TFEE**	53.68
General Requirements Compliance	Pass	**% DFEE<TFEE**	13.39		

Assessor Details	Mr. Matthew Hurd, Energy & Design Limited, Tel: 01543547771, matthew@energyanddesign.net	**Assessor ID**	H278-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	20.23	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	13.87	$kgCO_2/m^2$	Pass
	-6.36 (-31.4%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.68	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	46.49	$kWh/m^2/yr$	
	-7.2 (-13.4%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.33 (max. 2.00)	1.50 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Baxi ASSURE 530 COMBI 2 Combi boiler Efficiency: 89.4% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	1.08 m², No overhang 4.14 m², No overhang 2.94 m², No overhang 3.59 m², No overhang		
Air change rate	8.00 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 10% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	4.38 (measured in this dwelling)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Thermal bridging y-value	0.039	W/m²K
Photovoltaic array	0.73	kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

APPENDIX C – BRE WATER CALCULATOR TOOL

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 1 - 2, 3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Utitlity/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	No white goods installed

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	109.38104
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**99.5**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**104.5**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 1 - 2, 3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Utitlity/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	With Washing Machine & Dishwasher

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	104.11004
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**94.7**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**99.7**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 1 - 2, 3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Utitlity/ Kitchen)
Date:	04/08/2025
Assessor:	Stephane Baker
Notes:	With dishwasher

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			107.61704
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**97.9**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**102.9**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 1 - 2, 3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Utitlity/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	With washing machine

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			105.87404
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**96.3**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**101.3**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 2 - 2 ,3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	No white good installed

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			109.38104
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**99.5**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**104.5**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 2 - 2 ,3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Washing Machine & Dishwasher Included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	104.11004
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**94.7**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**99.7**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 2 - 2 ,3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Dishwasher included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	107.61704
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**97.9**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**102.9**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 2 - 2 ,3 or 4 Bed Houses (1 Bathroom / 1 Ensuite/ WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Washing Machine included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			105.87404
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**96.3**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**101.3**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 3 - 2 & 3 Bed Houses (1 Bathroom / WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	No white goods included.

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			109.38104
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**99.5**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**104.5**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 3 - 2 & 3 Bed Houses (1 Bathroom / WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Washing Machine & Dishwasher included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			104.11004
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**94.7**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**99.7**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 3 - 2 & 3 Bed Houses (1 Bathroom / WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Dishwasher Included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	107.61704
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**97.9**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**102.9**

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 3 - 2 & 3 Bed Houses (1 Bathroom / WC room/ Kitchen)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Washing Machine included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			105.87404
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**96.3**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**101.3**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 4 - 1 & 2 Bed Apartments (1 Bathroom / Kitchen/ with or without WC room)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	No white goods included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			109.38104
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**99.5**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**104.5**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 4 - 1 & 2 Bed Apartments (1 Bathroom / Kitchen/ with or without WC room)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Dishwasher and washing machine included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	104.11004
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**94.7**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**99.7**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 4 - 1 & 2 Bed Apartments (1 Bathroom / Kitchen/ with or without WC room)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Dishwasher included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** Yes	0.76	3.60	0.00	2.74
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00

(5)		Total calculated use = (Sum column 4)	107.61704
(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6	0.00
(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5	0.00
(8)		Normalisation factor	0.91
(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**	**97.9**
(10)		External water use	5
(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**	**102.9**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	1782 - Boorley Gardens
Project Name:	Type 4 - 1 & 2 Bed Apartments (1 Bathroom / Kitchen/ with or without WC room)
Date:	04/08/2025
Assessor:	Stephanie Baker
Notes:	Washing Machine included

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		3.00	1.58	1.58	6.32
Bath (where shower also present)	Capacity to overflow (litres)		181.00	0.11	0.00	19.91
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		6.00	0.44	10.36	13.00
Washing machine	Litres/kg dry load	**Washing machine installed?** Yes	6.50	2.10	0.00	13.65
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			105.87404
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**96.3**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**101.3**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Ammendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.

APPENDIX D – WATER BUTT LOCATION PLAN

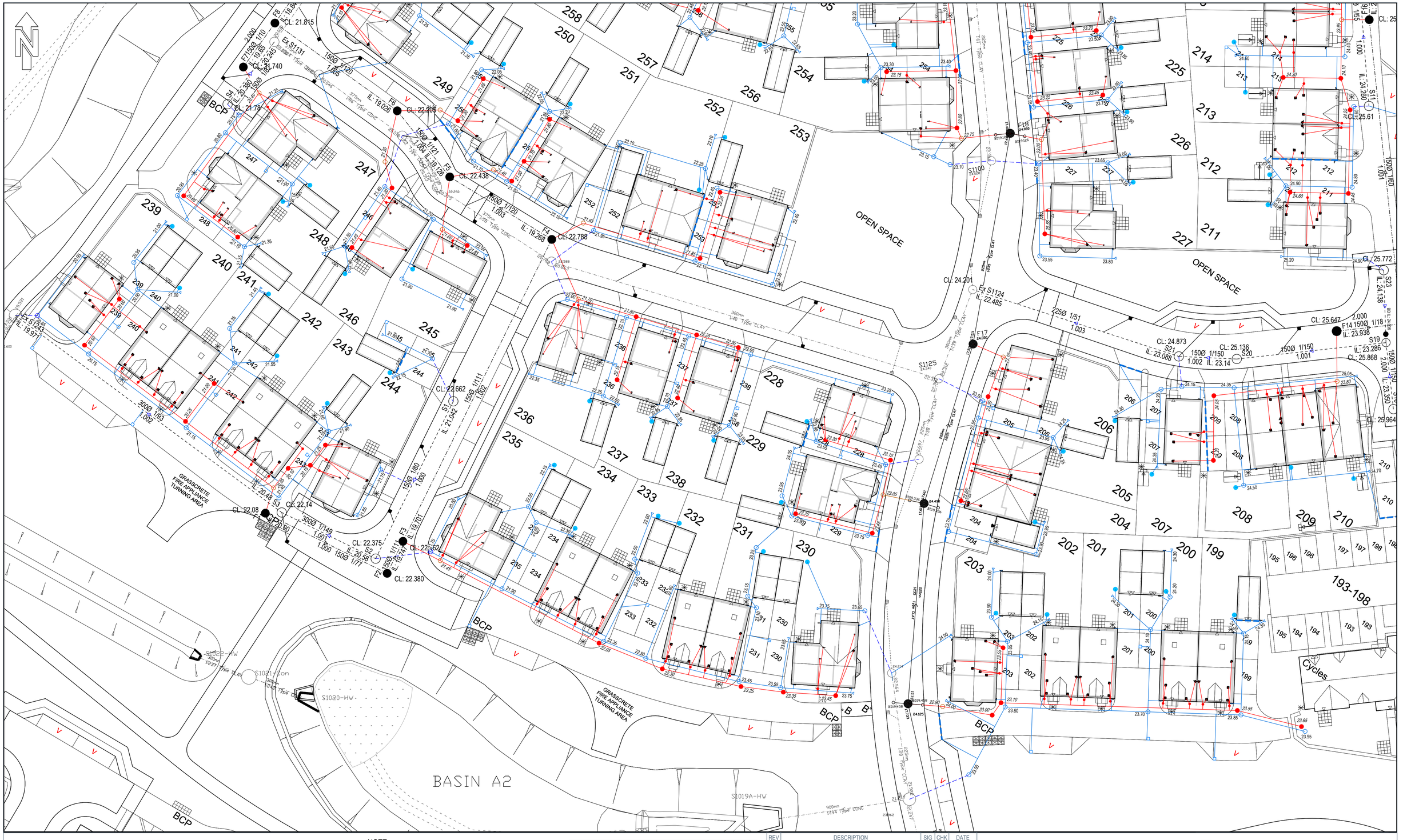

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80,
   Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
12. High velocity discharges e.g. discharge from SVP's should use the main channel when connected to inspection chambers wherever practicable. Chambers to be orientated to suit.
13. Refer to manufacturers instructions for installation details

NOTE

ADDITIONAL CHAMBERS & INSPECTION POINTS MAY BE REQUIRED TO SUIT MANUFACTURERS DETAILS AND/OR CONTRACTORS PREFERRED METHOD OF WORKING. SHOULD THE DESIGN ALTER SIGNIFICANTLY, CONTACT SHOULD BE MADE WITH THE ENGINEER.

REFERENCE

- 0.00 — Private surface water drain
- 0.00 — Private foul water drain
- Storm Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Storm Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Foul Mini Access Chamber <0.60m deep (0.300m dia)
- Foul Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Foul Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Proposed rodding eye
- Proposed linear drainage channel
- Proposed private gully
- Proposed surface water lateral
- Proposed foul water lateral
- Water Butt (Additional RWP to be installed where water butt is located if required).

REV	DESCRIPTION	SIG	CHK	DATE
P01	First Issue.	CB	GT	16.11.2022
P02	Water butts added.	CD	CB	29.01.2023
P03	Part L private drainage updated.	CD	CB	29.04.2024
P04	Gullies to shared surface reviewed.	CD	CB	10.05.2024

MILLER HOMES

PHASE 2 (1E)
BOORLEY GARDENS

PLOT DRAINAGE
SHEET 1

Eastwood
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eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
46130	1:250m	S0	Initial

DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
46130	- ECE - XX - XX - DR - C -					525	P04

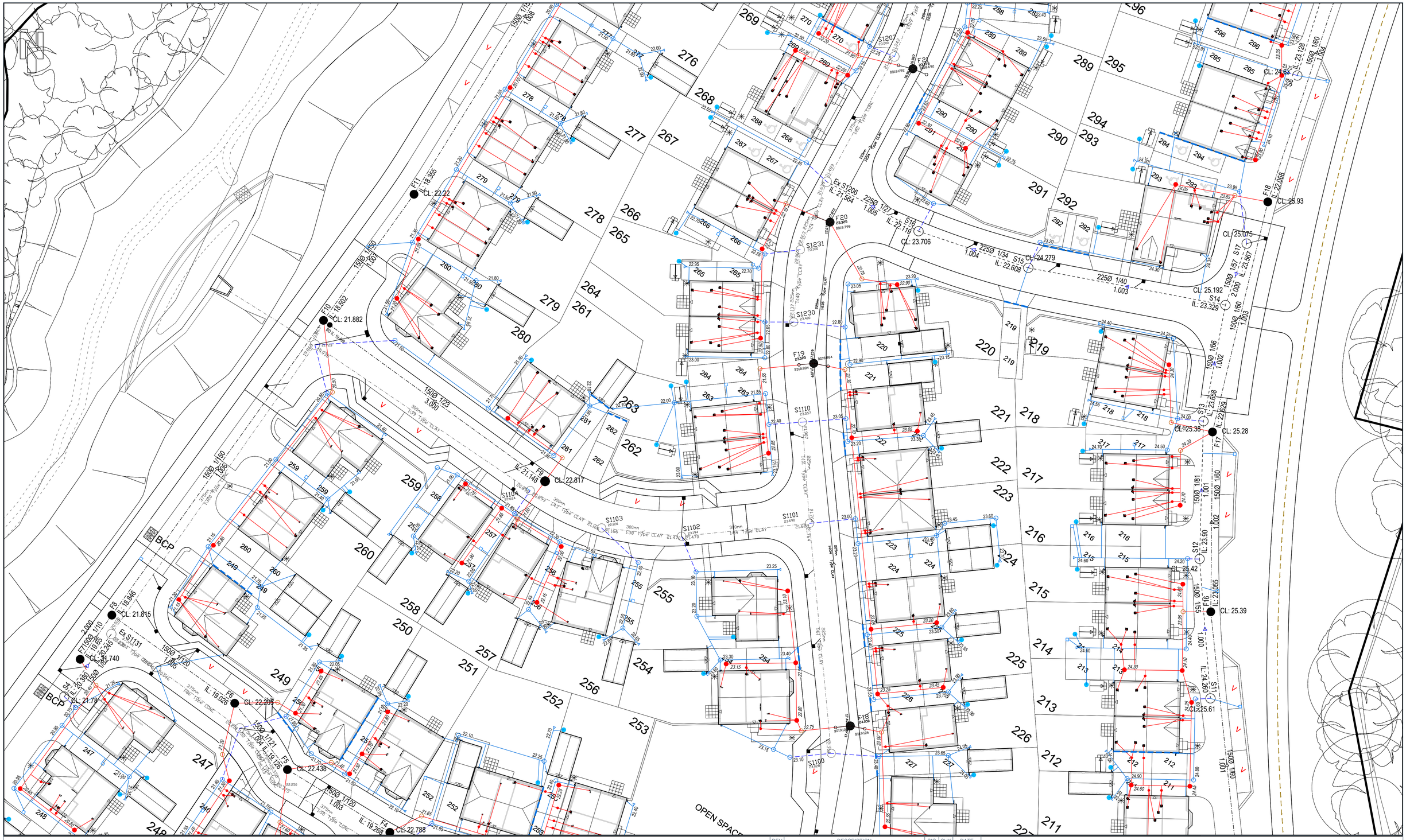
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CL: 22.22
F10 IL: 18.502
CL: 21.882
F9 IL: 21.148
CL: 22.817
F8 IL: 19.846
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F7 IL: 20.245
CL: 21.740
F6 IL: 19.026
CL: 22.205
F5 IL: 19.126
CL: 22.438
F4 IL: 19.268
CL: 22.788
F20 IL: 21.564
F21 IL: 21.892
F22 IL: 22.119
CL: 23.706
S15 IL: 22.608
CL: 24.279
S14 IL: 23.329
CL: 25.192
S13 IL: 23.658
CL: 25.38
S12 IL: 23.900
CL: 25.42
S11 IL: 24.260
CL: 25.61
F18 IL: 22.066
CL: 25.93
F17 IL: 22.822
CL: 25.28
F16 IL: 23.065
CL: 25.39
F19 IL: 21.929
F18 IL: 21.350
S1100 IL: 21.470
S1101 IL: 21.690
S1102 IL: 21.470
S1103 IL: 21.690
S1104 IL: 21.824
S1230 IL: 23.400
S1231 IL: 23.300
S1110 IL: 23.557
S1207 IL: 23.300
Ex S1206 IL: 21.564
Ex S1131 IL: 20.360
OPEN SPACE
BCP
1500 1/50 1.007
1500 1/23 3.000
1500 1/10 2.000
1500 1/120 1.005
1500 1/121 1.004
1500 1/120 1.003
2250 1/27 1.005
2250 1/34 1.004
2250 1/40 1.003
1500 1/57 2.000
1500 1/66 1.002
1500 1/81 1.001
1500 1/60 1.003
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1500 1/60 1.001
1500 1/60 1.000

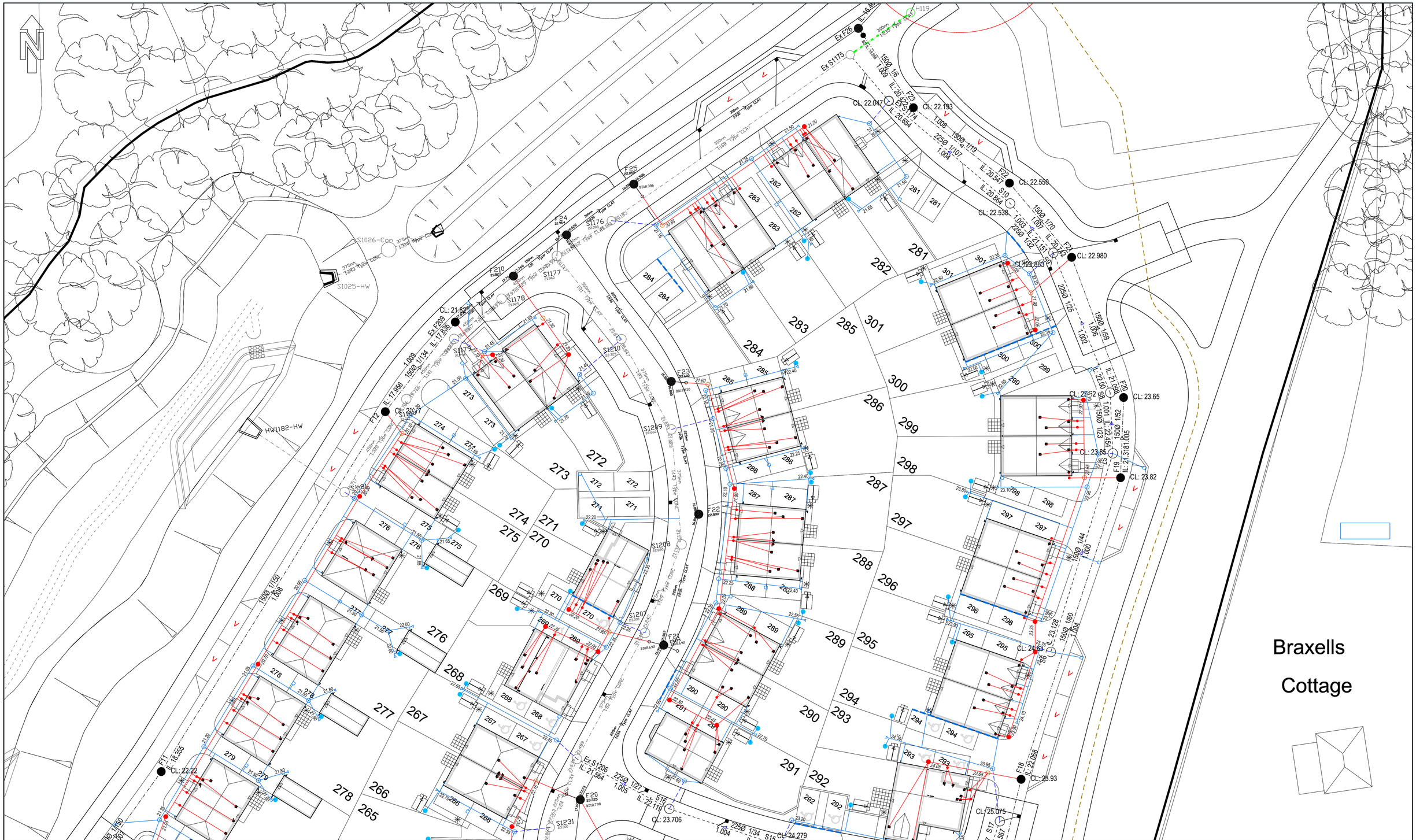

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80,
   Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
12. Refer to manufacturers instructions for installation details

NOTE
ADDITIONAL CHAMBERS & INSPECTION POINTS MAY BE REQUIRED TO SUIT MANUFACTURERS DETAILS AND/OR CONTRACTORS PREFERRED METHOD OF WORKING. SHOULD THE DESIGN ALTER SIGNIFICANTLY, CONTACT SHOULD BE MADE WITH THE ENGINEER.

REFERENCE

- 0.00 — Private surface water drain
- 0.00 — Private foul water drain
- Storm Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Storm Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Foul Mini Access Chamber <0.60m deep (0.300m dia)
- Foul Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Foul Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Proposed rodding eye
- Proposed linear drainage channel
- Proposed private gully
- Proposed surface water lateral
- Proposed foul water lateral
- Water Butt (Additional RWP to be installed where water butt is located if required).

REV	DESCRIPTION	SIG	CHK	DATE
P01	First Issue.	CB	GT	16.11.2022
P02	Private drainage updated.	CD	CB	15.04.2024

MILLER HOMES

PHASE 2 (1E)
BOORLEY GARDENS

PLOT DRAINAGE
SHEET 3

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ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
46130	1:250m	S0	Initial

DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
46130	- ECE -	XX -	XX -	DR -	C -	527	P02

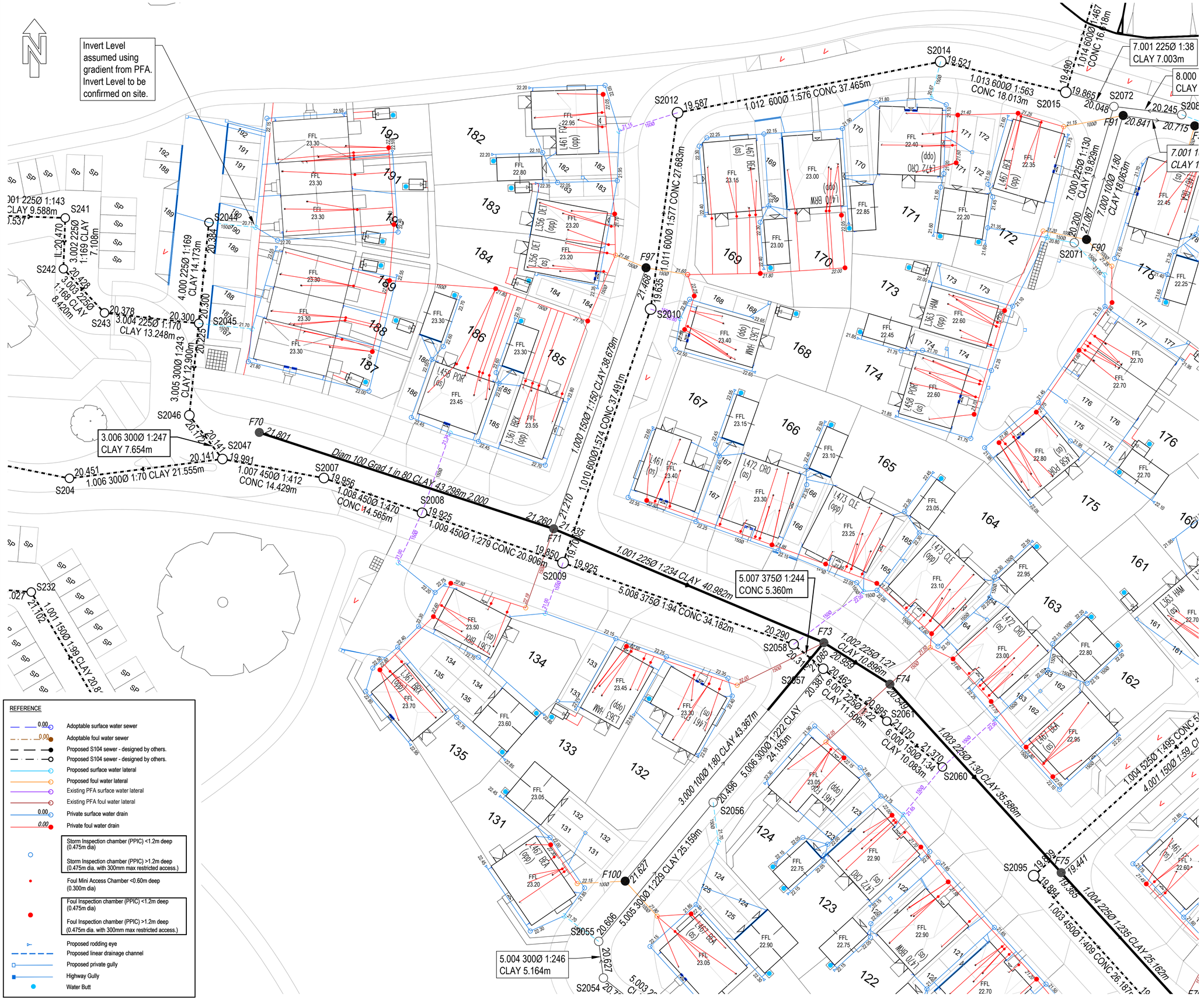

NOTES:

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80, Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. High velocity discharges e.g. discharge from SVP's should use the main channel when connected to inspection chambers wherever practicable. Chambers to be orientated to suit.
12. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
13. Refer to manufacturers instructions for installation details.
14. Additional chambers & inspection points may be required to suit manufacturers details and/or contractors preferred method of working. should the design alter significantly, contact should be made with the engineer.

REV	DESCRIPTION	SIG	CHK	DATE
P03	Surface water manhole references added.	JAE	CB	23.04.2025
P02	Minor amendments to plot drainage to plots 182-184. Minor amendments to sewer colours. Key relocated.	PWAH	CB	19.02.2025
P01	First issue.	CD	PWAH	16/01/2025

MILLER HOMES

PHASE 1H & 1I
BOORLEY GARDENS

PLOT DRAINAGE
SHEET 1 OF 3

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ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
49203	1:250	S3	Comment

DRAWING NUMBER

Project	Originator	Zone	Level	Type	Role	Number	REV
49203	- ECE -	XX -	XX -	DR -	C -	0114	P03

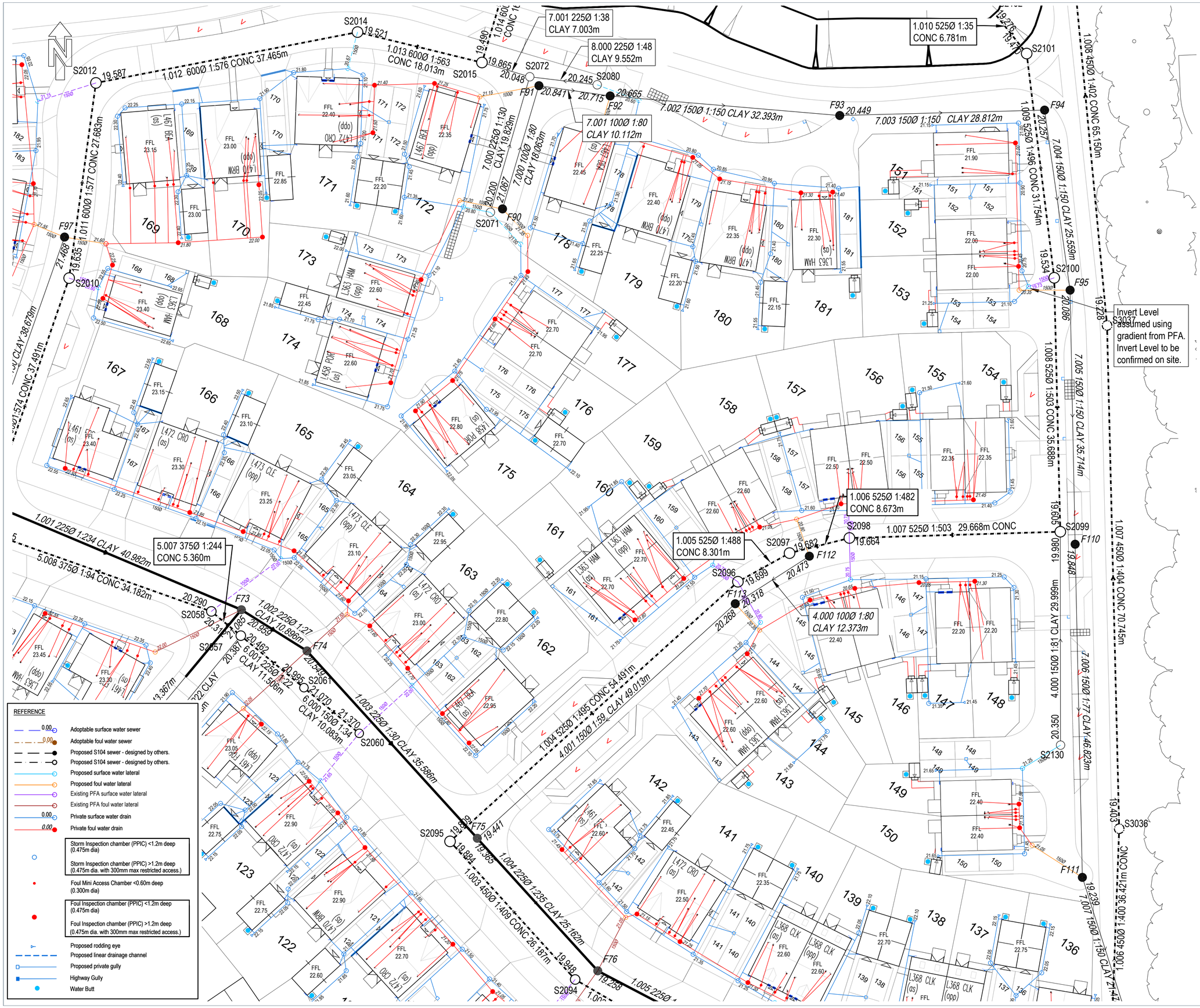

NOTES:

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80, Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. High velocity discharges e.g. discharge from SVP's should use the main channel when connected to inspection chambers wherever practicable. Chambers to be orientated to suit.
12. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
13. Refer to manufacturers instructions for installation details.
14. Additional chambers & inspection points may be required to suit manufacturers details and/or contractors preferred method of working. should the design alter significantly, contact should be made with the engineer.

REV	DESCRIPTION	SIG	CHK	DATE
P03	Surface water manhole references added.	JAE	CB	23.04.2025
P02	Minor amendments to plot drainage to plots 182-184. Minor amendments to sewer colours. Key relocated.	PWAH	CB	19.02.2025
P01	First issue.	CD	PWAH	16/01/2025

MILLER HOMES

PHASE 1H & 1I
BOORLEY GARDENS

PLOT DRAINAGE
SHEET 2 OF 3

Eastwood
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ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
49203	1:250	S3	Comment

DRAWING NUMBER: 49203 - ECE - XX - XX - DR - C - 0115 (Project - Originator - Zone - Level - Type - Role - Number) REV P03

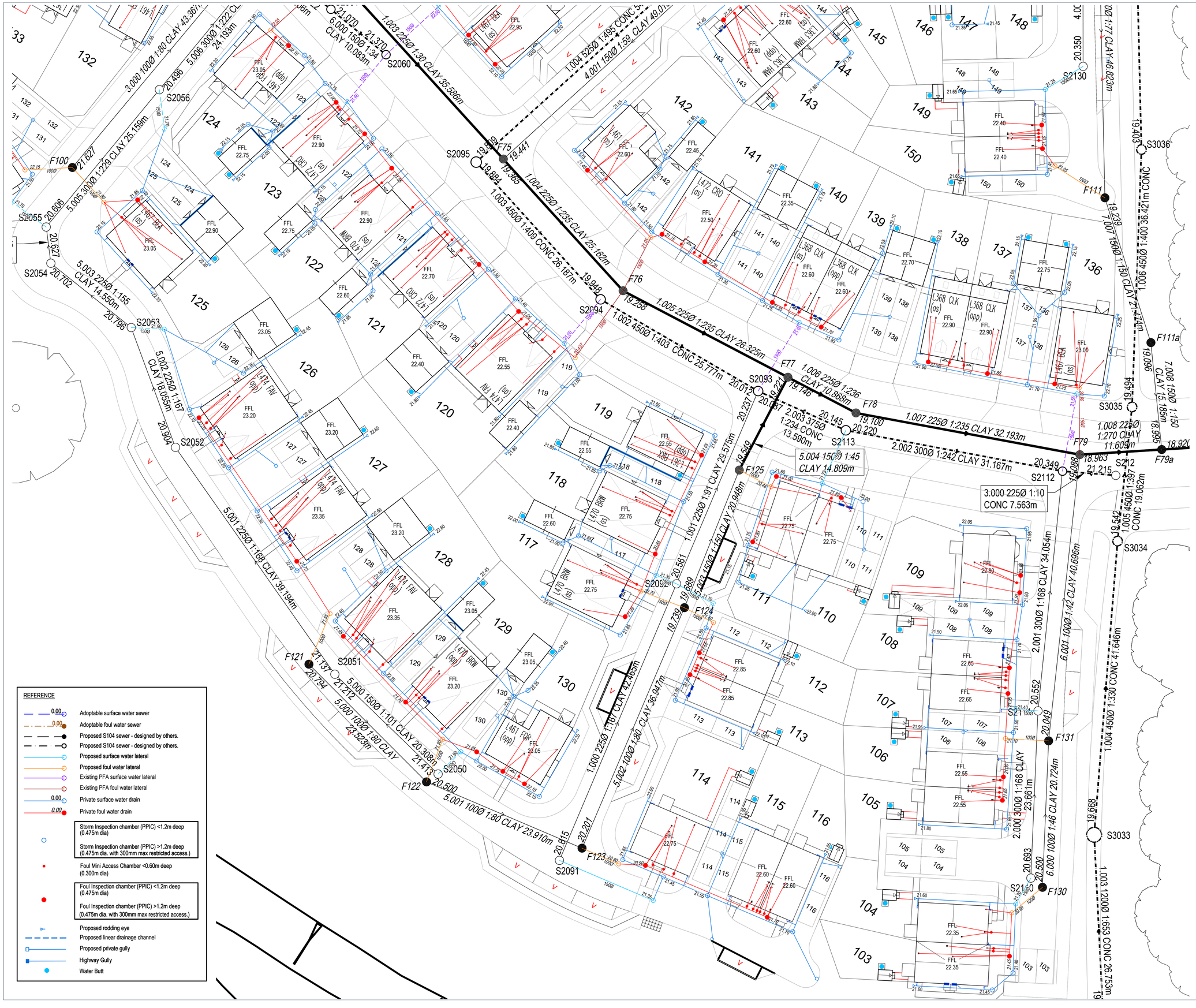

NOTES:

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80, Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. High velocity discharges e.g. discharge from SVP's should use the main channel when connected to inspection chambers wherever practicable. Chambers to be orientated to suit.
12. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
13. Refer to manufacturers instructions for installation details.
14. Additional chambers & inspection points may be required to suit manufacturers details and/or contractors preferred method of working. should the design alter significantly, contact should be made with the engineer.

REV	DESCRIPTION	SIG	CHK	DATE
P04	Plot 110 foul drainage amended.	CB	CB	07.05.2025
P03	Surface water manhole references added.	JAE	CB	23.04.2025
P02	Minor amendments to sewer colours. Key relocated.	PWAH	CB	19.02.2025
P01	First issue.	CD	PWAH	16/01/2025

MILLER HOMES

PHASE 1H & 1I
BOORLEY GARDENS

PLOT DRAINAGE
SHEET 3 OF 3

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ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
49203	1:250	S3	Comment

DRAWING NUMBER: 49203 - ECE - XX - XX - DR - C - 0116 (Project - Originator - Zone - Level - Type - Role - Number) REV: P04

Adoptable Main Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
HW3164*	Type 3	24.022	23.070	600mm Diameter Pipe Headwall
HW3243*	Type 3	23.922	22.930	300mm Diameter Pipe Headwall
S3156	Type B	26.132	23.734	1500mm Diameter S104 Manhole
S3157	Type B	26.356	23.527	1500mm Diameter S104 Manhole
S3158	Type B	26.315	23.496	1500mm Diameter S104 Manhole
S3159	Type B	25.590	23.370	1500mm Diameter S104 Manhole
S3160	Type B	25.675	23.337	1500mm Diameter S104 Manhole
S3161	Type B	25.057	23.257	1500mm Diameter S104 Manhole
S3162	Type B	24.790	23.164	1500mm Diameter S104 Manhole
S3163	Type B	24.165	23.090	1500mm Diameter S104 Manhole
S3172	Type 2	22.700	21.465	525mm Diameter Culvert
S3173	Type 2	22.700	21.440	525mm Diameter Culvert
S3200	Type B	27.248	25.448	1200mm Diameter S104 Manhole
S3201	Type B	26.960	25.160	1200mm Diameter S104 Manhole
S3202	Type B	26.657	24.422	1200mm Diameter S104 Manhole
S3210	Type B	26.390	24.815	1200mm Diameter S104 Manhole
S3211	Type B	26.300	24.168	1200mm Diameter S104 Manhole

Adoptable Main Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
S3212	Type B	26.040	23.966	1200mm Diameter S104 Manhole
S3213	Type B	25.820	23.774	1200mm Diameter S104 Manhole
S3220	Type B	26.231	24.656	1200mm Diameter S104 Manhole
S3230	Type C	25.150	23.680	1200mm Diameter S104 Manhole
S3231	Type C	24.920	23.580	1200mm Diameter S104 Manhole
S3242	Type C	24.000	22.994	1200mm Diameter S104 Manhole
S3298	Type B	27.141	24.303	1350mm Diameter S104 Manhole
S3299	Type B	27.239	24.276	1350mm Diameter S104 Manhole
S3300	Type B	26.728	24.172	1350mm Diameter S104 Manhole
S3301	Type B	25.786	23.406	1500mm Diameter S104 Manhole
S3302	Type B	25.425	23.346	1500mm Diameter S104 Manhole
S3312	Type 2	23.650	21.995	450mm Diameter Culvert
S3313	Type 2	23.650	21.985	450mm Diameter Culvert
S3320	Type B	27.291	25.569	1500mm Diameter S104 Manhole
S3330	Type B	25.706	24.143	1200mm Diameter S104 Manhole
H323	HCC Type C1A **	25.259	23.759	1200mm Diameter S3B Manhole

** Type C1A Catchpit in accordance with HCC Standard Detail Drawing No. HCC/D/040.

Adoptable Main Foul Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
F512	Type A2	26.598	20.142	1200mm Diameter S104 Manhole
F513	Type A2	25.738	19.842	1200mm Diameter S104 Manhole
F655	Type A2	27.246	22.730	1200mm Diameter S104 Manhole
F656	Type A2	27.087	22.672	1200mm Diameter S104 Manhole
F657	Type A2	26.870	22.535	1200mm Diameter S104 Manhole
F667	Type B	26.123	23.720	1200mm Diameter S104 Manhole
F668	Type B	26.386	23.496	1200mm Diameter S104 Manhole
F669	Type A2	26.797	23.275	1200mm Diameter S104 Manhole
F670	Type A2	27.099	23.112	1200mm Diameter S104 Manhole
F700	Type B	25.650	22.795	1200mm Diameter S104 Manhole
F720	Type B	26.369	24.769	1200mm Diameter S104 Manhole
F721	Type B	25.740	24.090	1200mm Diameter S104 Manhole
F722	Type B	25.582	23.932	1200mm Diameter S104 Manhole
F723	Type B	25.214	23.564	1200mm Diameter S104 Manhole
F724	Type B	24.815	23.147	1200mm Diameter S104 Manhole
F725	Type B	24.319	22.669	1200mm Diameter S104 Manhole
F726	Type B	23.916	22.266	1200mm Diameter S104 Manhole
F740	Type B	25.162	23.562	1200mm Diameter S104 Manhole

Minor Foul Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
F512a	S104	26.720	23.720	N–Inspection Chamber 500mm dia
F656a	S104	27.215	24.000	N–Inspection Chamber 500mm dia
F668a	S104	26.000	25.350	U–Inspection Chamber 450mm dia
F669a	S104	26.876	25.750	U–Inspection Chamber 450mm dia
F670a	S104	27.300	25.450	N–Inspection Chamber 500mm dia
F670b	Private	27.150	25.850	N–Inspection Chamber 500mm dia
F700a	S104	25.900	24.450	N–Inspection Chamber 500mm dia
F700b	Private	26.250	25.600	U–Inspection Chamber 450mm dia
F720a	S104	26.495	25.550	U–Inspection Chamber 450mm dia
F721a	S104	25.880	25.000	U–Inspection Chamber 450mm dia
F721b	S104	26.000	25.050	U–Inspection Chamber 450mm dia
F721c	Private	26.010	25.500	U–Inspection Chamber 450mm dia
F723a	S104	25.300	24.300	U–Inspection Chamber 450mm dia
F740a	S104	25.475	23.590	N–Inspection Chamber 500mm dia

Minor Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
S3161a	104	25.150	24.050	U–Inspection Chamber 450mm dia
S3161b	Private	25.200	24.200	U–Inspection Chamber 450mm dia
S3161c	Private	25.550	24.700	U–Inspection Chamber 450mm dia
S3161d	Private	25.520	24.900	U–Inspection Chamber 450mm dia
S3200a	104	27.445	25.950	N–Inspection Chamber 500mm dia
S3200b	Private	27.360	26.060	U–Inspection Chamber 450mm dia
S3200c	Private	26.980	26.120	U–Inspection Chamber 450mm dia
S3200d	Private	27.200	26.310	U–Inspection Chamber 450mm dia
S3200e	Private	27.445	26.250	U–Inspection Chamber 450mm dia
S3200f	Private	27.350	26.400	U–Inspection Chamber 450mm dia
S3202a	104	26.876	25.300	N–Inspection Chamber 500mm dia
S3202b	Private	26.945	25.500	U–Inspection Chamber 450mm dia
S3202c	Private	27.315	26.000	U–Inspection Chamber 450mm dia
S3202d	Private	26.868	26.150	U–Inspection Chamber 450mm dia
S3202e	Private	27.000	26.320	U–Inspection Chamber 450mm dia
S3202f	Private	26.745	25.640	U–Inspection Chamber 450mm dia
S3202g	Private	26.850	25.810	U–Inspection Chamber 450mm dia
S3202h	Private	26.825	25.810	U–Inspection Chamber 450mm dia
S3202i	Private	26.720	25.400	N–Inspection Chamber 500mm dia
S3202j	Private	26.541	25.550	U–Inspection Chamber 450mm dia
S3202k	Private	26.600	25.930	U–Inspection Chamber 450mm dia
S3210a	104	26.530	25.150	U–Inspection Chamber 450mm dia
S3210b	Private	26.480	25.350	U–Inspection Chamber 450mm dia
S3212a	104	26.100	25.000	U–Inspection Chamber 450mm dia
S3212b	104	26.050	25.000	U–Inspection Chamber 450mm dia
S3213a	104	26.000	24.800	N–Inspection Chamber 500mm dia
S3213b	Private	25.850	24.950	U–Inspection Chamber 450mm dia
S3213c	Private	25.850	25.200	U–Inspection Chamber 450mm dia
S3220a	104	26.420	25.000	N–Inspection Chamber 500mm dia
S3220b	Private	26.335	25.650	U–Inspection Chamber 450mm dia
S3230a	104	25.285	23.900	N–Inspection Chamber 500mm dia
S3230b	Private	25.300	24.000	N–Inspection Chamber 500mm dia
S3230c	Private	25.450	24.130	N–Inspection Chamber 500mm dia
S3230d	Private	25.550	24.380	U–Inspection Chamber 450mm dia
S3230e	Private	25.440	24.800	U–Inspection Chamber 450mm dia
S3230f	Private	25.340	24.800	U–Inspection Chamber 450mm dia
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S3231a	104	25.100	24.500	U–Inspection Chamber 450mm dia
S3300a	104	26.900	25.645	U–Inspection Chamber 450mm dia
S3300b	Private	26.700	25.800	U–Inspection Chamber 450mm dia
S3300c	Private	26.710	26.000	U–Inspection Chamber 450mm dia
S3300d	Private	26.870	26.200	U–Inspection Chamber 450mm dia
S3301a	104	25.975	24.880	U–Inspection Chamber 450mm dia
S3301b	Private	26.200	25.150	U–Inspection Chamber 450mm dia
S3301c	Private	26.355	25.320	U–Inspection Chamber 450mm dia
S3301d	Private	26.565	25.700	U–Inspection Chamber 450mm dia
S3301e	Private	26.560	25.900	U–Inspection Chamber 450mm dia
S3301f	Private	26.250	25.500	U–Inspection Chamber 450mm dia
S3301g	Private	26.600	25.600	U–Inspection Chamber 450mm dia
S3301h	Private	25.780	25.100	U–Inspection Chamber 450mm dia
S3301i	Private	25.800	25.200	U–Inspection Chamber 450mm dia
S3301j	Private	25.850	25.200	U–Inspection Chamber 450mm dia
S3320a	S104	27.450	26.380	U–Inspection Chamber 450mm dia
S3320b	Private	27.490	26.485	U–Inspection Chamber 450mm dia
S3320c	Private	27.250	26.535	U–Inspection Chamber 450mm dia
S3330a	104	25.835	25.000	U–Inspection Chamber 450mm dia

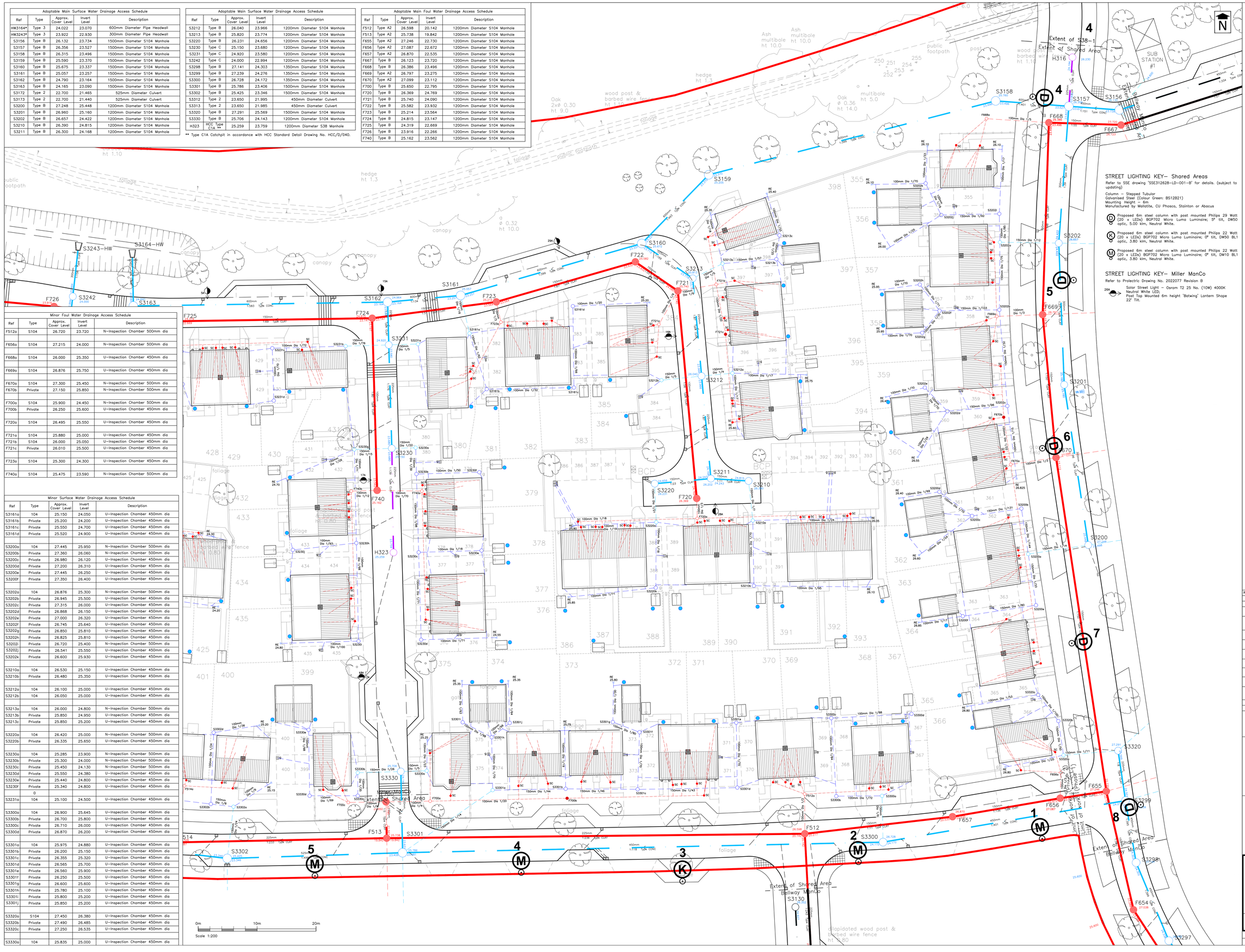

ADOPTABLE 'MAIN' DRAINAGE KEY

- F740 — Foul Water Sewer & Manhole (S104)
- S3163 — Surface Water Sewer & Manhole (S104)
- H323 — Highway Drainage & Manhole (S3B)
- F654 — Foul Water Sewer & Manhole (Subsequent Phase)
- S3297 — Surface Water Sewer & Manhole (Subsequent Phase)
- Proposed Type 1 Gully and Connection (HCC)*
- F740a — Foul Water Lateral (PVC–U)
- S3163a — Surface Water Lateral (PVC–U)

PRIVATE 'MINOR' DRAINAGE KEY

- SC — Foul Shallow Access Chamber
- F730a — Foul Water IC (PVC–U)
- S3216 — Surface Water IC (PVC–U)
- RE 41.95 — Rodding Eye
- Gully (OSMA Ref 4D.800)*
- SVP; all external SVP's with connection running under property to have access point
- Water Butt – 1 & 2 Bed– 150ltr; 3 & 4 Bed– 200ltr

* All trapped gullies to incorporate amphibian escape ramps, as manufactured by The British Herpetological Society or similar, as found at: https://www.thebhs.org/the–bhs–amphibian–gully–pot–ladder

DRAINAGE SCHEDULE KEY:

U–Inspection Chamber — Universal Inspection Chamber (UIC) Max. 1.2m deep

N–Inspection Chamber — Non–Entry Inspection Chamber (NIC) Max 3.0m deep

All U–PVC pipes to be in accordance with Clause E2.21, E2.22 and E5.9.5 of DCG version 2.1 dated 25 May 2021.

PFA consulting

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Website
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For Construction
These drawings are produced, together with any related data, to inform the setting out and construction of the works. To be read in conjunction with all working drawings.

NOTES

1. Drawing based on Topographical Survey by Anthony Brookes Surveys Ltd, drawing number A258/7834/1 dated June 2014.
2. On–site road layout based on AAP Drawing No. P1388.02 Revision ZE dated 5th October 2021.
3. The works shown on this drawing could affect Statutory Undertaker's apparatus and the Contractor is required to verify the location and depth of all such apparatus prior to commencement of the works and to take any precautions necessary when working in the vicinity of any such apparatus.
4. All adoptable highway works to be in accordance with the Hampshire County Council's 'Companion Document to Manual for Streets' and the Specification for Highway Works (SHW) November 2009 as amended published by The Stationery Office.

Rev	Date	Description	Drawn	Check
#	03/01/22	First Issue.	BDC	DRB
A	26/01/22	Drawing updated for S38–2 submission.	JW	DRB
B	18/02/22	Drawing revised to 'For Construction', as instructed by Miller Homes.	JM	DRB
C	17/03/22	Cover levels to chambers S3158, S3159 and F668a amended, and the invert level to F668a adjusted accordingly.	DRB	CJ
D	18/07/22	Phase 2 Street Lighting updated to show Prolectric design.	JM	DRB
E	03/11/22	Drawing updated to accord with other amended drawings.	JW	DRB
F	11/11/22	Cover levels to IC S3230e and S3230f adjusted as necessary.	DRB	CJ
G	12/01/23	Water Butts added as instructed by Miller Homes.	JM	DRB
H	23/02/23	Culverts S3172, S3173, S3312 and S3313 added to schedule.	JM	DRB
I	22/03/23	Updated issue to concur with Surface Treatment drawings issued 27/01/23.	JM	DRB
J	09/05/23	Note added regarding amphibian escape ramps in gullies, as required by the Ecology Officer.	DRB	CJ
K	24/11/23	F713 added to access schedule.	DRB	CJ
L	16/12/25	Water butts added to plots 387 & 392	CS	DRB

Status
FOR CONSTRUCTION

Client
miller homes

Project
Boorley Gardens
Winchester Road
Hedge End
Phase 2

Drawing Title
Proposed Drainage and Lighting Plan Sheet 1 of 2

Drawing No. **M434/05** Rev L

Date: January 2022 Scale: 1:200 @ A0

E-Mail: dbrock@pfaplc.com

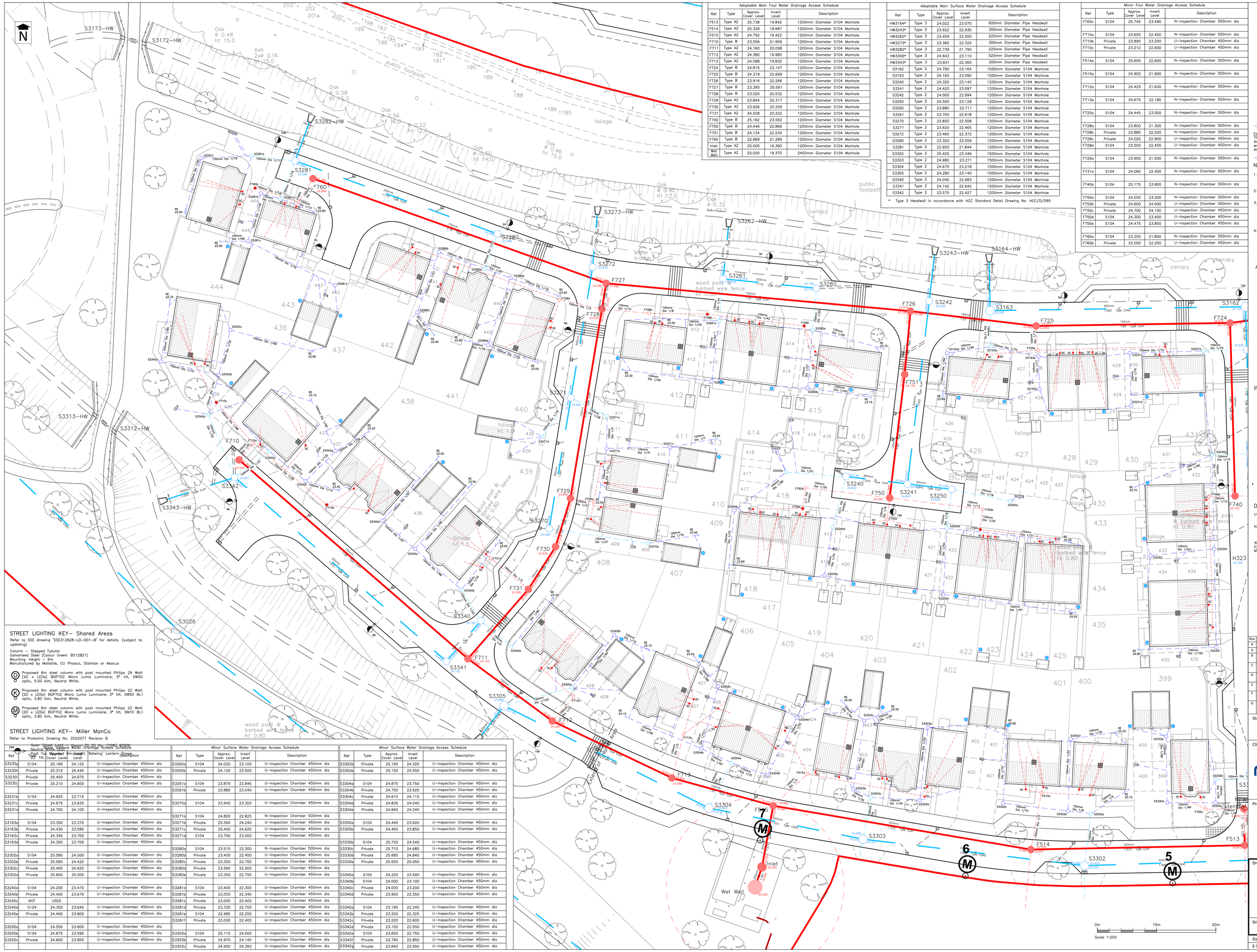

Adoptable Main Foul Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
F513	Type A2	25.738	19.842	1200mm Diameter S104 Manhole
F514	Type A2	25.326	19.687	1200mm Diameter S104 Manhole
F515	Type A2	24.792	19.422	1200mm Diameter S104 Manhole
F710	Type B	23.556	21.956	1200mm Diameter S104 Manhole
F711	Type A2	24.160	20.098	1200mm Diameter S104 Manhole
F712	Type A2	24.380	19.980	1200mm Diameter S104 Manhole
F713	Type A2	24.588	19.832	1200mm Diameter S104 Manhole
F724	Type B	24.815	23.147	1200mm Diameter S104 Manhole
F725	Type B	24.319	22.669	1200mm Diameter S104 Manhole
F726	Type B	23.916	22.266	1200mm Diameter S104 Manhole
F727	Type B	23.390	20.561	1200mm Diameter S104 Manhole
F728	Type B	23.520	20.532	1200mm Diameter S104 Manhole
F729	Type A2	23.844	20.317	1200mm Diameter S104 Manhole
F730	Type A2	23.926	20.259	1200mm Diameter S104 Manhole
F731	Type A2	24.008	20.202	1200mm Diameter S104 Manhole
F740	Type B	25.162	23.562	1200mm Diameter S104 Manhole
F750	Type B	24.446	22.866	1200mm Diameter S104 Manhole
F751	Type B	24.134	22.534	1200mm Diameter S104 Manhole
F760	Type B	22.889	21.289	1200mm Diameter S104 Manhole
Inlet	Type A2	25.000	19.390	1200mm Diameter S104 Manhole
Wet Well	Type A2	25.000	19.370	2400mm Diameter S104 Manhole

Adoptable Main Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
HW3164*	Type 3	24.022	23.070	600mm Diameter Pipe Headwall
HW3243*	Type 3	23.922	22.930	300mm Diameter Pipe Headwall
HW3262*	Type 3	23.459	22.550	225mm Diameter Pipe Headwall
HW3273*	Type 3	23.365	22.325	300mm Diameter Pipe Headwall
HW3282*	Type 3	22.739	21.790	225mm Diameter Pipe Headwall
HW3306*	Type 3	24.643	23.110	525mm Diameter Pipe Headwall
HW3343*	Type 3	23.831	22.365	300mm Diameter Pipe Headwall
S3162	Type 2	24.790	23.164	1500mm Diameter S104 Manhole
S3163	Type 2	24.165	23.090	1500mm Diameter S104 Manhole
S3240	Type 2	24.320	23.140	1200mm Diameter S104 Manhole
S3241	Type 2	24.420	23.097	1200mm Diameter S104 Manhole
S3242	Type 2	24.000	22.994	1200mm Diameter S104 Manhole
S3250	Type 2	24.500	23.128	1200mm Diameter S104 Manhole
S3260	Type 2	23.880	22.711	1200mm Diameter S104 Manhole
S3261	Type 2	23.700	22.618	1200mm Diameter S104 Manhole
S3270	Type 2	23.850	22.558	1200mm Diameter S104 Manhole
S3271	Type 2	23.620	22.465	1200mm Diameter S104 Manhole
S3272	Type 2	23.460	22.372	1200mm Diameter S104 Manhole
S3280	Type 2	23.320	22.059	1200mm Diameter S104 Manhole
S3281	Type 2	22.950	21.844	1200mm Diameter S104 Manhole
S3302	Type 2	25.425	23.346	1500mm Diameter S104 Manhole
S3303	Type 2	24.980	23.271	1500mm Diameter S104 Manhole
S3304	Type 2	24.675	23.218	1500mm Diameter S104 Manhole
S3305	Type 2	24.280	23.140	1500mm Diameter S104 Manhole
S3340	Type 2	24.040	22.683	1200mm Diameter S104 Manhole
S3341	Type 2	24.142	22.642	1200mm Diameter S104 Manhole
S3342	Type 2	23.575	22.427	1200mm Diameter S104 Manhole

* Type 3 Headwall in accordance with HCC Standard Detail Drawing No. HCC/D/095

Minor Foul Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
F700c	S104	25.745	23.490	N–Inspection Chamber 500mm dia
F710a	S104	23.650	22.450	N–Inspection Chamber 500mm dia
F710b	Private	23.890	23.250	U–Inspection Chamber 450mm dia
F710c	Private	23.212	22.600	U–Inspection Chamber 450mm dia
F514a	S104	25.600	22.600	N–Inspection Chamber 500mm dia
F515a	S104	24.900	21.900	N–Inspection Chamber 500mm dia
F712a	S104	24.425	21.630	N–Inspection Chamber 500mm dia
F713a	S104	24.675	22.180	N–Inspection Chamber 500mm dia
F725a	S104	24.445	23.000	N–Inspection Chamber 500mm dia
F728a	S104	23.800	21.300	N–Inspection Chamber 500mm dia
F728b	Private	23.880	22.520	N–Inspection Chamber 500mm dia
F728c	Private	24.020	22.900	U–Inspection Chamber 450mm dia
F728d	S104	23.500	22.455	U–Inspection Chamber 450mm dia
F729a	S104	23.950	21.500	N–Inspection Chamber 500mm dia
F731a	S104	24.060	22.400	N–Inspection Chamber 500mm dia
F740b	S104	25.175	23.900	N–Inspection Chamber 500mm dia
F750a	S104	24.550	23.200	N–Inspection Chamber 500mm dia
F750b	Private	24.600	24.000	U–Inspection Chamber 450mm dia
F750c	Private	24.700	24.100	U–Inspection Chamber 450mm dia
F750d	S104	24.300	23.400	U–Inspection Chamber 450mm dia
F750e	S104	24.475	23.850	U–Inspection Chamber 450mm dia
F760a	S104	23.200	21.850	N–Inspection Chamber 500mm dia
F760b	Private	23.050	22.250	U–Inspection Chamber 450mm dia

STREET LIGHTING KEY– Shared Areas

Refer to SSE drawing 'SSE312628–LD–001–B' for details. (subject to updating)

Column – Stepped Tubular
Galvanised Steel (Colour Green: BS12B21)
Mounting Height – 6m
Manufactured by Mallatite, CU Phosco, Stainton or Abacus

(D) Proposed 6m steel column with post mounted Philips 29 Watt (20 x LEDs) BGP702 Micro Luma Luminaire; 5° tilt, DW50 optic, 5.00 klm, Neutral White.

(K) Proposed 6m steel column with post mounted Philips 22 Watt (20 x LEDs) BGP702 Micro Luma Luminaire; 0° tilt, DW50 BL1 optic, 3.80 klm, Neutral White.

(M) Proposed 6m steel column with post mounted Philips 22 Watt (20 x LEDs) BGP702 Micro Luma Luminaire; 0° tilt, DM10 BL1 optic, 3.80 klm, Neutral White.

STREET LIGHTING KEY– Miller ManCo

Refer to Prolectric Drawing No. 2022077 Revision B

26A Solar Street Light – Design SL 25 No. Hrs (100%: 8000) Neutral White, Opaque Post Top Mounted Luminaire 3.2m Tilt, 0° Tilt, Cover Level: 24.125 Invert Level: 23.100 Batwing' Lantern Shape

Minor Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
S3230g	S104	25.160	24.125	U–Inspection Chamber 450mm dia
S3230h	Private	25.310	24.440	U–Inspection Chamber 450mm dia
S3230i	Private	25.450	24.675	U–Inspection Chamber 450mm dia
S3230j	Private	25.210	24.600	U–Inspection Chamber 450mm dia
S3231b	S104	24.925	23.715	U–Inspection Chamber 450mm dia
S3231c	Private	24.675	23.930	U–Inspection Chamber 450mm dia
S3231d	Private	24.700	24.100	U–Inspection Chamber 450mm dia
S3163a	S104	23.350	23.370	U–Inspection Chamber 450mm dia
S3163b	Private	24.430	23.580	U–Inspection Chamber 450mm dia
S3163c	Private	24.340	23.700	U–Inspection Chamber 450mm dia
S3163d	Private	24.300	23.700	U–Inspection Chamber 450mm dia
S3302a	S104	25.585	24.000	U–Inspection Chamber 450mm dia
S3302b	Private	25.560	24.420	U–Inspection Chamber 450mm dia
S3302c	Private	25.400	24.620	U–Inspection Chamber 450mm dia
S3302d	Private	25.650	25.000	U–Inspection Chamber 450mm dia
S3240a	S104	24.200	23.470	U–Inspection Chamber 450mm dia
S3240b	Private	24.400	23.670	U–Inspection Chamber 450mm dia
S3240c	NOT	USED		
S3240d	S104	24.350	23.640	U–Inspection Chamber 450mm dia
S3240e	Private	24.400	23.800	U–Inspection Chamber 450mm dia
S3250a	S104	24.550	23.800	U–Inspection Chamber 450mm dia
S3250b	S104	24.675	23.590	U–Inspection Chamber 450mm dia
S3250c	Private	24.600	23.800	U–Inspection Chamber 450mm dia

Minor Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
S3260a	S104	24.020	23.100	U–Inspection Chamber 450mm dia
S3260b	Private	24.120	23.500	U–Inspection Chamber 450mm dia
S3261a	S104	23.875	22.845	U–Inspection Chamber 450mm dia
S3261b	Private	23.880	23.040	U–Inspection Chamber 450mm dia
S3270a	S104	23.940	23.300	U–Inspection Chamber 450mm dia
S3271a	S104	24.800	22.825	N–Inspection Chamber 500mm dia
S3271b	Private	25.560	24.240	U–Inspection Chamber 450mm dia
S3271c	Private	25.400	24.620	U–Inspection Chamber 450mm dia
S3271d	S104	23.750	23.000	U–Inspection Chamber 450mm dia
S3280a	S104	23.515	22.300	N–Inspection Chamber 500mm dia
S3280b	Private	23.400	22.450	U–Inspection Chamber 450mm dia
S3280c	Private	23.300	22.700	U–Inspection Chamber 450mm dia
S3280d	Private	23.560	22.500	U–Inspection Chamber 450mm dia
S3280e	Private	23.350	22.750	U–Inspection Chamber 450mm dia
S3281a	S104	23.400	22.300	U–Inspection Chamber 450mm dia
S3281b	Private	23.050	22.340	U–Inspection Chamber 450mm dia
S3281c	Private	23.000	22.400	U–Inspection Chamber 450mm dia
S3281d	Private	23.330	22.700	U–Inspection Chamber 450mm dia
S3281e	S104	22.985	22.250	U–Inspection Chamber 450mm dia
S3281f	Private	23.000	22.400	U–Inspection Chamber 450mm dia
S3303a	S104	25.115	24.000	U–Inspection Chamber 450mm dia
S3303b	Private	24.970	24.140	U–Inspection Chamber 450mm dia
S3303c	Private	24.950	24.350	U–Inspection Chamber 450mm dia

Minor Surface Water Drainage Access Schedule				
Ref	Type	Approx. Cover Level	Invert Level	Description
S3303d	Private	25.195	24.325	U–Inspection Chamber 450mm dia
S3303e	Private	25.150	24.550	U–Inspection Chamber 450mm dia
S3304a	S104	24.875	23.750	U–Inspection Chamber 450mm dia
S3304b	Private	24.750	23.925	U–Inspection Chamber 450mm dia
S3304c	Private	24.610	24.115	U–Inspection Chamber 450mm dia
S3304d	Private	24.835	24.040	U–Inspection Chamber 450mm dia
S3304e	Private	24.840	24.240	U–Inspection Chamber 450mm dia
S3305a	S104	24.440	23.620	U–Inspection Chamber 450mm dia
S3305b	Private	24.450	23.850	U–Inspection Chamber 450mm dia
S3330b	S104	25.725	24.540	U–Inspection Chamber 450mm dia
S3330c	Private	25.710	24.685	U–Inspection Chamber 450mm dia
S3330d	Private	25.665	24.845	U–Inspection Chamber 450mm dia
S3330e	Private	25.650	25.050	U–Inspection Chamber 450mm dia
S3340a	S104	24.225	23.500	U–Inspection Chamber 450mm dia
S3340b	S104	24.000	23.100	U–Inspection Chamber 450mm dia
S3340c	Private	24.000	23.200	U–Inspection Chamber 450mm dia
S3340d	Private	23.950	23.350	U–Inspection Chamber 450mm dia
S3342a	S104	23.195	22.245	U–Inspection Chamber 450mm dia
S3342b	Private	23.200	22.325	U–Inspection Chamber 450mm dia
S3342c	Private	23.200	22.600	U–Inspection Chamber 450mm dia
S3342d	Private	23.150	22.550	U–Inspection Chamber 450mm dia
S3342e	S104	23.650	22.750	U–Inspection Chamber 450mm dia
S3342f	Private	23.790	22.850	U–Inspection Chamber 450mm dia
S3342g	Private	23.640	22.950	U–Inspection Chamber 450mm dia

PFA consulting
Stratton Park House, Wanborough Road
Swindon, SN3 4HG
Telephone
01793 828000
Website
www.pfaplc.com

For Construction
These drawings are produced, together with any related data, to inform the setting out and construction of the works. To be read in conjunction with all working drawings.

NOTES

1. Drawing based on Topographical Survey by Anthony Brookes Surveys Ltd, drawing number A258/7834/1 dated June 2014.
2. On–site road layout based on AAP Drawing No. P1388.02 Revision ZE dated 5th October 2021.
3. The works shown on this drawing could affect Statutory Undertaker's apparatus and the Contractor is required to verify the location and depth of all such apparatus prior to commencement of the works and to take any precautions necessary when working in the vicinity of any such apparatus.
4. All adoptable highway works to be in accordance with the Hampshire County Council's 'Companion Document to Manual for Streets' and the Specification for Highway Works (SHW) November 2009 as amended published by The Stationery Office.

ADOPTABLE 'MAIN' DRAINAGE KEY

- F740 — Foul Water Sewer & Manhole (S104)
- S3163 — Surface Water Sewer & Manhole (S104)
- H323 — Highway Drainage & Manhole (S38)
- F654 — Foul Water Sewer & Manhole (Subsequent Phase)
- S3297 — Surface Water Sewer & Manhole (Subsequent Phase)
- Proposed Type 1 Gully and Connection (HCC)
- F740a — Foul Water Lateral (PVC–U)
- S3163a — Surface Water Lateral (PVC–U)

PRIVATE 'MINOR' DRAINAGE KEY

- SC — Foul Shallow Access Chamber
- F730a — Foul Water IC (PVC–U)
- S3231e — Surface Water IC (PVC–U)
- Rodding Eye
- RE 41.95 — Gully (DSMA Ref 40.800)
- SVP; all external SVP's with connection running under property to have access point
- Water Butt – 1 & 2 Bed– 150ltr; 3 & 4 Bed– 200ltr

* All trapped gullies to incorporate amphibian escape ramps, as manufactured by The British Herpetological Society or similar, as found at: https://www.thebhs.org/the–bhs–amphibian–gully–pot–ladder

DRAINAGE SCHEDULE KEY:

U–Inspection Chamber — Universal Inspection Chamber (UIC) Max. 1.2m deep

N–Inspection Chamber — Non–Entry Inspection Chamber (NIC) Max 3.0m deep

All U–PVC pipes to be in accordance with Clause E2.21, E2.22 and E5.9.5 of DCG version 2.1 dated 25 May 2021.

Rev	Date	Description	Drawn	Check
#	03/01/22	First Issue.	BOC	DRB
A	26/01/22	Drawing updated for S38-2 submission.	JW	DRB
B	18/02/22	Drawing revised to 'For Construction', as instructed by Miller Homes.	JM	DRB
C	18/07/22	Headwall references update. Phase 2 Street Lighting updated to show Prolectric design.	JM	DRB
D	03/11/22	Drawing updated to accord with other amended drawings.	JW	DRB
E	12/01/23	Water Butts added as instructed by Miller Homes.	JM	DRB
F	22/03/23	Updated issue to concur with Surface Treatment drawings issued 27/01/23.	JM	DRB
G	09/05/23	Note added regarding amphibian escape ramps in gullies, as required by the Ecology Officer.	DRB	CI

Status
FOR CONSTRUCTION

Client
miller homes

Project
Boorley Gardens
Winchester Road
Hedge End
Phase 2

Drawing Title
Proposed Drainage and Lighting Plan Sheet 2 of 2

Drawing No.
M434/06 Rev G

Date: January 2022 Scale: 1:200 @ A0
E–Mail: dbrock@pfaplc.com

KEY:

- Site Boundary
- xx.xx — Polypropylene Private Storm Water Drain & Invert Level.
- xx.xx — Polypropylene Private Foul Water Drain & Invert Level.
- Polypropylene 280mm dia Foul Water Access Chamber ≤0.60m deep.
- Polypropylene 450mm dia Foul Water Access Chamber ≤3.00m deep.
- Polypropylene 450mm dia Storm Water Access Chamber ≤3.00m deep.
- XX.XX — Polypropylene 450mm dia foul water demarcation chamber and lateral.
- XX.XX — Polypropylene 450mm dia foul water demarcation chamber and lateral.
- 110mm Sealed rodding eye.
- Linear ACO drain with silt bucket.
- Slot drainage to threshold
- Trapped yard gully.
- Adoptable storm water manhole to ICOSA Water specification
- Adoptable storm water sewer to ICOSA Water specification
- Adoptable foul water manhole to ICOSA Water specification
- Adoptable foul water sewer to ICOSA Water specification
- Storm water manhole to ICOSA Water specification by others
- Storm water sewer to ICOSA Water specification by others
- Foul water manhole to ICOSA Water specification by others
- Foul water sewer to ICOSA Water specification by others
- Tree protection zone extents. Hand dig only construction where in close proximity to roots. Additional protection barriers may be required.
- Tree protection fencing
- Water Butt

This drawing should be read in conjunction with all other design drawings and reports. In particular, the following drawings:

49204-ECE-XX-XX-DR-C-0000 - Drainage Calcs
49204-ECE-XX-XX-DR-C-0001 - S104 Layout
49204-ECE-XX-XX-DR-C-0003 - Impermeable Areas Plan
49204-ECE-XX-XX-DR-C-0004-0006 - S104 Construction Details
49204-ECE-XX-XX-DR-C-0007 - Adoptable Drainage Schedule
49204-ECE-XX-XX-DR-C-0008 - Private Drainage Construction Details
49204-ECE-XX-XX-DR-C-0010 - External Levels
49204-ECE-XX-XX-DR-C-0013-0015 - Longitudinal Sections

'Phase 3D' foul drainage manhole F8 to connect along sewer alignment between F145/F146 (master drainage). Sewer part constructed based on as built information provided by site (24.10.24). Master drainage design as per drawing S104 adoption plan drawing M434/109 by PFA consulting . Master drainage network offered for adoption under a separate agreement.

Saddle connection to main sewer. IL: 20.147 (150Ø) IL: 19.847 (450Ø)

'Phase 3D' storm drainage to connect into manhole S3032. Master drainage design as per drawing S104 adoption plan ref M434/109 by PFA consulting . Master drainage network offered for adoption under a separate agreement.

Shallow foul drainage. Concrete encasement required to pipes and chambers.

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types:
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80, Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. High velocity discharges e.g. discharge from SVP's should use the main channel when connected to inspection chambers wherever practicable. Chambers to be orientated to suit.
12. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
13. Refer to manufacturers instructions for installation details

NOTE

ADDITIONAL CHAMBERS & INSPECTION POINTS MAY BE REQUIRED TO SUIT MANUFACTURERS DETAILS AND/OR CONTRACTORS PREFERRED METHOD OF WORKING. SHOULD THE DESIGN ALTER SIGNIFICANTLY, CONTACT SHOULD BE MADE WITH THE ENGINEER.

REV	DESCRIPTION	SIG	CHK	DATE
P04	Water butt and RWP updated to suit clients comments.	CB	CB	02/01/2025
P03	Updated to suit revised site layout received on 20.11.24	MA	CB	02/12/2024
P02	Updated to suit revised site layout received on 10.10.24	MA	CB	31/10/2024
P01	First Issue.	AT	CB	05/09/2024

MILLER HOMES

BOORLEY GARDENS PHASE 3D, WINCHESTER ROAD, BOORLEY GREEN, HAMPSHIRE

PLOT DRAINAGE LAYOUT

Eastwood CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
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eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR
49204	1:250	S3	Comment

DRAWING NUMBER: 49204 - ECE - XX - XX - DR - C - 0002 (Project - Originator - Zone - Level - Type - Role - Number) REV: P04

INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE.
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

NOTES

1. All pipes to be either vitrified clay in accordance with BS EN 295, and having a crushing strength of 40kN/m, or class 120 concrete (54kN/m min) to BS 5911, bedded on a class B granular bed and haunch, or Polysewer or similar bedded on a class S granular bed and surround. Where pipes are in the public highway they are to be bedded on a class S granular bed and surround.
2. If the cover to the pipe is less than 600mm a class Z concrete bed and surround must be used.
3. All trenches in roads, paved areas and below slabs shall be backfilled with Type 1 or Type 2 DOT granular sub-base material.
4. All pipes to be laid soffit to soffit at manholes unless noted otherwise.
5. All insitu concrete to be designated mix FND2 conforming to BS 8500-2 unless agreed otherwise.
6. All private drainage to be 100mm diameter unless otherwise stated.
7. Demarcation chamber types;
   Type G = <1.2m depth to soffit
   Type H = >1.2m depth to soffit
8. Minimum gradients:
   Foul Water 1/80,
   Storm Water 1/100
9. All surface water connecting pipes to be 150mm diameter minimum and all foul water connecting pipes to be 150mm diameter minimum to adoptable drains unless noted otherwise.
10. All rainwater pipes must be fitted with a roddable access above ground.
11. All private drainage to be installed in accordance with Part H of the Building Regulations and BS EN 752 & 12056.
12. Refer to manufacturers instructions for installation details

NOTE

ADDITIONAL CHAMBERS & INSPECTION POINTS MAY BE REQUIRED TO SUIT MANUFACTURERS DETAILS AND/OR CONTRACTORS PREFERRED METHOD OF WORKING. SHOULD THE DESIGN ALTER SIGNIFICANTLY, CONTACT SHOULD BE MADE WITH THE ENGINEER.

REFERENCE

- 0.00 — Private surface water drain
- 0.00 — Private foul water drain
- Storm Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Storm Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Foul Mini Access Chamber <0.60m deep (0.300m dia)
- Foul Inspection chamber (PPIC) <1.2m deep (0.475m dia)
- Foul Inspection chamber (PPIC) >1.2m deep (0.475m dia. with 300mm max restricted access.)
- Proposed rodding eye
- Proposed linear drainage channel
- Proposed private gully
- Proposed surface water lateral
- Proposed foul water lateral
- Proposed S104 sewer - designed by others.
- Proposed S104 sewer - designed by others.

REV	DESCRIPTION	SIG	CHK	DATE
C	Construction Issue.	CB	-	06.06.22
B	Slot drainage added to entrance of apartment block.	CB	TB	04.05.22
A	First Issue.			

MILLER HOMES

BOORLEY GARDENS
PHASE 1A

PLOT DRAINAGE

SK221205/Ph1A/DR
PROPOSED WATER BUTT
LOCATION LAYOUT

WATER BUTT -
150ltr 1 & 2 Bed unit
200ltr 3 & 4 bed unit

Eastwood & Partners
CONSULTING ENGINEERS
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SCALE WHEN PLOTTED AT A1	DRAWING STATUS
1:200	CONSTRUCTION

DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
CB	TB	18.02.2022	46130/303	C

APPENDIX E – DETAILS OF PV AND SITE PLAN OF PV LOCATIONS

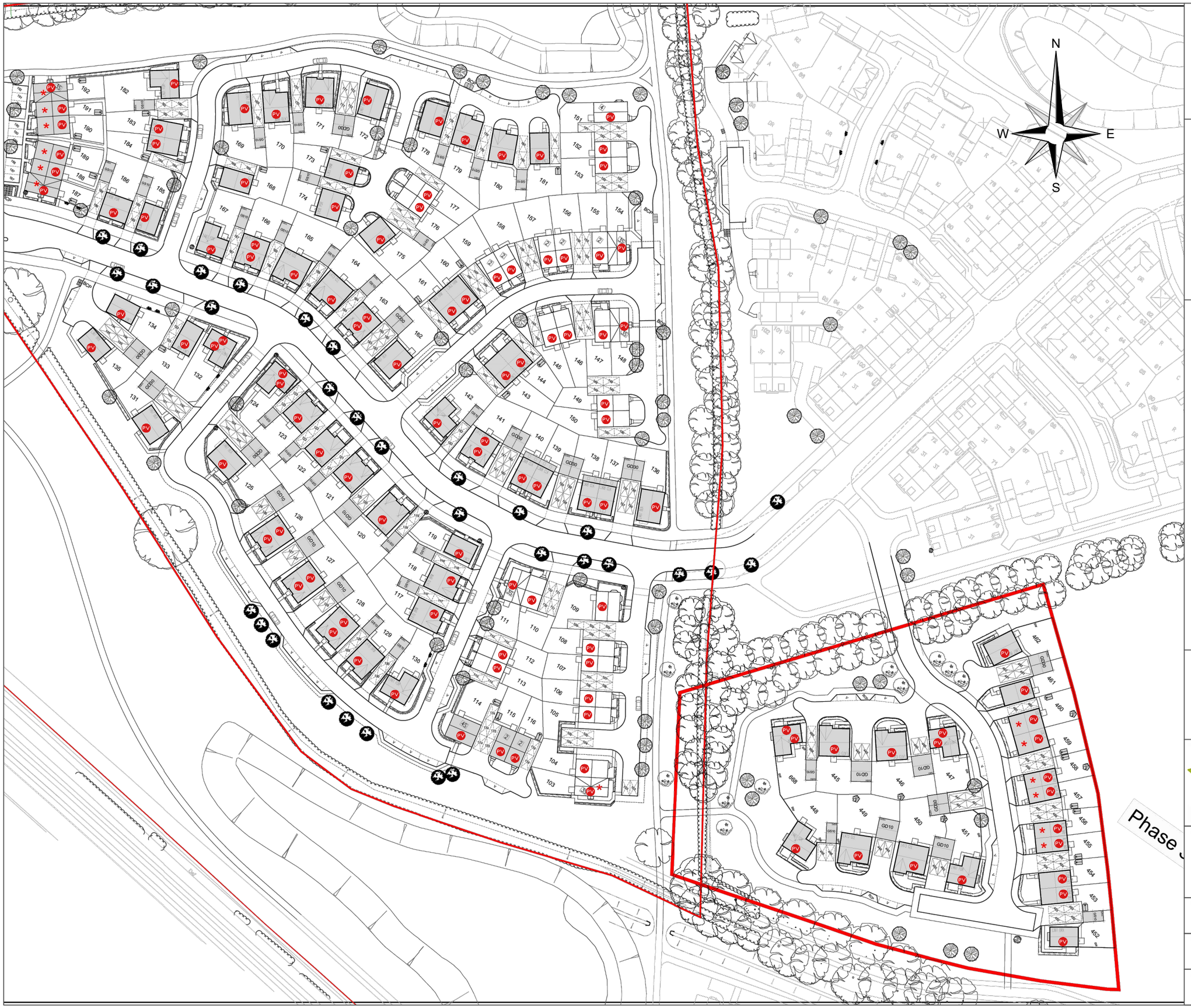

Note:
Viridian Solar has produced this design based on information and drawings supplied by the client. It remains the client's responsibility to ensure that shading from nearby buildings and trees does not affect the system.

Weight of solar panels:

PV16-M10	(Fusion PV)	25kg
PV16-G1	(Fusion PV)	22kg

Where the panels are fitted into a pitched tiled/slate roof, they sit directly on the roof battens with a uniformly distributed load of 13kg per m² for PV16. Therefore, they almost certainly weigh less than the roof covering they replace. Roof structure modifications are unlikely to be necessary.

Notes:

PV Location of PV Array

Source Drawing:

Project Title
Land to the North West of
Boorley Green, Hedge End

Drawing Title
Phase 1H, 1i & 3D
Planning Layout

Scale	Drawn By	Checked By	Authorised By
1:500	Date 14.03.25	Date	Date

Job No.	Drawing No.	Revision
817072	PH1H_1i & 3D_PLANNING_LAYOUT	-

Original Sheet Size A0

Revisions: Date: By:

Viridian Solar
Atlas Building, 68 Stirling Way
Papworth Everard, Cambs.

Tel: 01480 839 865
sales@viridiansolar.co.uk
www.viridiansolar.co.uk

TITLE
Viridian Clearline fusion
PV Site Plan for Miller Homes
Boorley Gardens Phase 3

DRAWN	CHECKED
RP	N/A

DRAWING NUMBER	SHEET NUMBER
34653 / SK1	1 of 1

DATE	SCALE
16.04.25	NTS

Track

Winchester Road - B3354

TREATMENT WORKS

Alternative route for footpath / cycleway link

Braxells Cottage

26.5m

WORKS PROVIDED BY N.B.G.

OPEN SPACE

Section only to be constructed to enable School Access

PH2 ACCESS ROAD INSERT

Drain

Braxells Farm

PV panels

Miller Homes - Boorley Gardens 1E

PV Site Layout

Miller Homes - Boorley gardens 1A - MCS Zone 1 - Rev C - 20/06/2022

PLOT NO	PANEL kWp	ROOF INCLINE	VARIATION° FROM SOUTH	Cardinal Direction	OVERSHADING FACTOR	kWp	kWh	CO_2 EQUIVALENT
355	0.325	40	0	S	1	0.98	960.38	498.43
356	0.365	45	90	E/W	1	1.10	822.35	426.80
357	0.365	45	90	E/W	1	1.10	822.35	426.80
358	0.365	45	85	E/W	1	1.10	846.44	439.30
359	0.365	45	85	E/W	1	1.10	846.44	439.30
360	0.365	45	80	E/W	1	1.10	868.34	450.67
361	0.365	45	80	E/W	1	1.10	868.34	450.67
362	0.365	45	80	E/W	1	1.10	868.34	450.67
363	0.365	45	80	E/W	1	1.10	868.34	450.67
364	0.405	35	80	E/W	1	0.81	663.39	344.30
365	0.405	35	80	E/W	1	0.81	663.39	344.30
366	0.405	40	10	S	1	0.81	795.42	412.82
367	0.365	35	5	S	1	0.73	717.59	372.43
368	0.365	35	5	S	1	0.73	717.59	372.43
369	0.365	35	5	S	1	0.73	717.59	372.43
370	0.365	35	5	S	1	0.73	717.59	372.43
371	0.365	35	0	S	1	0.73	718.32	372.81
372	0.365	35	0	S	1	0.73	718.32	372.81
373	0.365	40	0	S	1	1.10	1078.58	559.78
374	0.365	40	0	S	1	1.10	1078.58	559.78
375	0.405	40	90	E/W	1	0.81	622.08	322.86
376	0.405	35	90	E/W	1	0.81	634.23	329.17
377	0.405	35	90	E/W	1	0.81	634.23	329.17
378	0.405	35	90	E/W	1	0.81	634.23	329.17
379	0.405	35	90	E/W	1	0.81	634.23	329.17
380	0.405	40	90	E/W	1	0.81	622.08	322.86
381	0.405	40	90	E/W	1	0.81	622.08	322.86
382	0.405	35	0	S	1	0.81	797.04	413.66
383	0.405	35	0	S	1	0.81	797.04	413.66
384	0.405	40	90	E/W	1	0.81	622.08	322.86
385	0.405	40	90	E/W	1	0.81	622.08	322.86
386	0.365	35	0	S	1	0.73	718.32	372.81
387	0.365	35	0	S	1	0.73	718.32	372.81
388	0.365	35	0	S	1	0.73	718.32	372.81
389	0.405	35	0	S	1	0.81	797.04	413.66
390	0.405	35	0	S	1	0.81	797.04	413.66
391	0.365	35	0	S	1	0.73	718.32	372.81
392	0.365	35	0	S	1	0.73	718.32	372.81
393	0.365	35	0	S	1	0.73	718.32	372.81
394	0.405	35	85	E/W	1	0.81	648.81	336.73
395	0.405	35	85	E/W	1	0.81	648.81	336.73
396	0.405	35	85	E/W	1	0.81	648.81	336.73
397	0.405	35	85	E/W	1	0.81	648.81	336.73
398	0.405	40	20	S	1	0.81	788.13	409.04
399	0.405	40	90	E/W	1	0.81	622.08	322.86
400	0.365	40	5	S	1	1.10	1077.48	559.21
401	0.365	40	5	S	1	1.10	1077.48	559.21
402	0.405	35	5	S	1	0.81	796.23	413.24
403	0.365	35	5	S	1	1.10	1076.39	558.64
404	0.405	35	10	S	1	0.81	794.61	412.40
405	0.365	35	20	S	1	0.73	709.56	368.26
406	0.365	35	20	S	1	0.73	709.56	368.26
407	0.365	35	20	SSE/SSW	1	1.10	1064.34	552.39
408	0.365	35	40	SE/SW	1	1.10	1027.11	533.07
409	0.405	35	80	E/W	1	0.81	663.39	344.30
410	0.405	35	80	E/W	1	0.81	663.39	344.30
411	0.365	40	5	S	1	0.73	718.32	372.81
412	0.365	40	5	S	1	0.73	718.32	372.81
413	0.365	35	5	S	1	0.73	717.59	372.43
414	0.365	35	5	S	1	0.73	717.59	372.43
415	0.365	40	5	S	1	0.73	718.32	372.81
416	0.365	40	5	S	1	0.73	718.32	372.81
417	0.365	35	5	S	1	0.73	717.59	372.43
418	0.365	35	5	S	1	0.73	717.59	372.43
419	0.365	35	5	S	1	0.73	717.59	372.43
420	0.405	35	5	S	1	0.81	796.23	413.24
421	0.405	35	5	S	1	0.81	796.23	413.24

PLOT NO	PANEL kWp	ROOF INCLINE	VARIATION° FROM SOUTH	Cardinal Direction	OVERSHADING FACTOR	kWp	kWh	CO_2 EQUIVALENT
422	0.365	35	5	S	1	0.73	717.59	372.43
423	0.365	35	5	S	1	0.73	717.59	372.43
424	0.365	35	5	S	1	0.73	717.59	372.43
425	0.365	35	5	S	1	0.73	717.59	372.43
426	0.365	40	5	S	1	0.73	718.32	372.81
427	0.365	40	5	S	1	0.73	718.32	372.81
428	0.365	35	0	S	1	0.73	718.32	372.81
429	0.365	35	0	S	1	0.73	718.32	372.81
430	0.365	40	0	S	1	0.73	719.05	373.19
431	0.365	40	0	S	1	0.73	719.05	373.19
432	0.405	35	90	E/W	1	0.81	634.23	329.17
433	0.405	35	90	E/W	1	0.81	634.23	329.17
434	0.405	35	90	E/W	1	0.81	634.23	329.17
435	0.405	35	90	E/W	1	0.81	634.23	329.17
436	0.365	40	80	E/W	1	1.10	884.76	459.19
437	0.365	40	40	SE/SW	1	1.10	1024.92	531.93
438	0.365	35	40	SE/SW	1	1.10	1027.11	533.07
439	0.365	40	50	SE/SW	1	1.10	996.45	517.16
440	0.365	40	70	ESE/WSW	1	1.10	925.28	480.22
441	0.365	35	20	SSE/SSW	1	1.10	1064.34	552.39
442	0.405	40	20	SSE/SSW	1	0.81	788.13	409.04
443	0.405	40	15	S	1	0.81	792.18	411.14
444	0.365	40	75	E/W	1	1.10	905.57	469.99
Totals						**76.69**	**69349.09**	**35992.18**

The Performance of solar PV systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate, based upon the MCS procedure, is given as guidance only. It should not be considered as a guarantee of performance.

This system performance calculation has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated results.

JOB CODE: MIL-BOO
POST CODE: SO32 2BX
IN/ON/FLAT: IN ROOF
PANEL: 365W & 405W

325W Half Cell
365W Half Cell
405W Half Cell

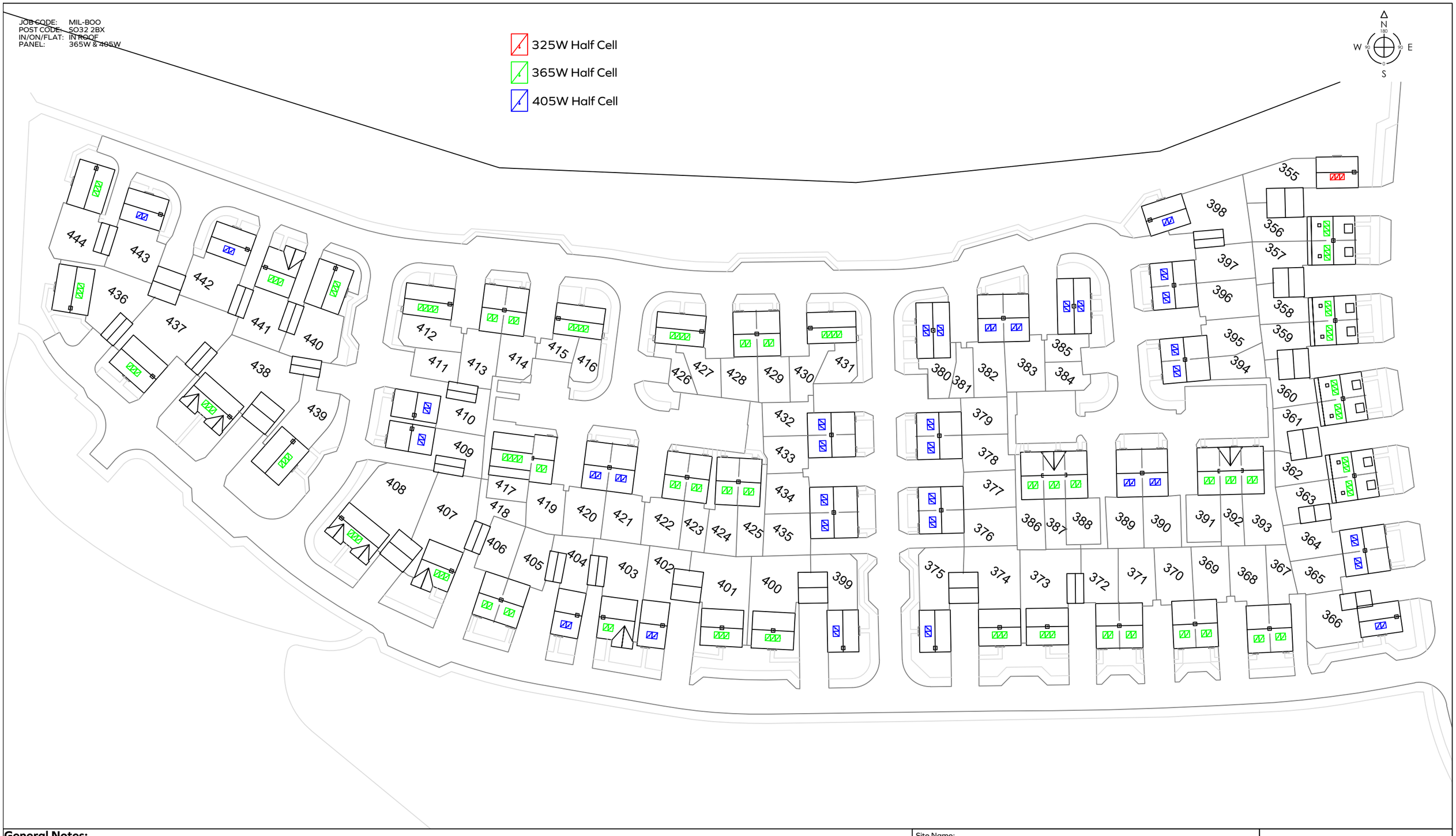

General Notes:

1. All Dimensions are in mm.
2. All Dimensions in abeyance and subject to confirmation by HBS NE Limited T/A UPOWA following design.
3. Images are for general information only.
4. HBS NE Limited T/A UPOWA reserve the right to revise this drawing in the interests of system development.
5. Inverters are to be located by the loft hatch on fire board in the loft space to minimise D.C cable runs and therefore minimise D.C losses.
6. Refer to manufacturers details for further product information.
7. This drawing layout does not account for any mansafe, plant, penetrations or miscellaneous equipment not shown.
8. It is the clients responsibility to notify HBS NE Limited T/A UPOWA of anything which may restrict the area available to the system or adjacent structures which would shade the system.
9. This drawing remains the intellectual property of HBS NE Limited T/A UPOWA and may be distributed only with permission expressed in writing.

Site Name: MILLER HOMES - BOORLEY GARDENS 1A			
Drawing Title: MIL-BOO-500 - PV SITE LAYOUT			
Drawing No: MIL-BOO-500	Revision: C	Scale: NTS	Papersize: A3
Drawn By / Date: EF - 20/06/22	Checked By: MS	Status: DES	Sheet: 001

upowa

Miller - Boorley Green - Plots 650-67 & 669-89 - MCS Zone 3 - Rev A - 27/10/2022

PLOT NO	Housetype	ROOF INCLINE	VARIATION° FROM SOUTH	CARDINAL DIRECTION	OVERSHADING FACTOR	NO# PANELS	kWp	kWh	CO_2 EQUIVALENT
659	Lomond - Semi	35	75	E/W	1	2	0.73	632.91	328.48
660	Morley - Semi	45	15	S	1	2	0.73	737.30	382.66
661	3S2 - Semi	50	15	S	1	2	0.73	730.00	378.87
662	3S2 - Semi	50	15	S	1	2	0.73	730.00	378.87
663	Downshire - Det	40	75	E/W	1	3	1.10	938.42	487.04
664	Edale - Semi	45	15	S	1	2	0.73	737.30	382.66
665	Edale - Semi	45	15	S	1	2	0.73	737.30	382.66
666	Edale - Semi	45	15	S	1	2	0.73	737.30	382.66
667	Edale - Semi	45	15	S	1	2	0.73	737.30	382.66
669	Block D	48	70	ESE/WSW	1	2	0.73	623.42	323.55
670	Block D	48	70	ESE/WSW	1	2	0.73	623.42	323.55
671	Block D	48	20	S	1	2	0.73	728.54	378.11
672	Block D	48	20	S	1	2	0.73	728.54	378.11
673	Block D	48	70	ESE/WSW	1	1	0.37	311.71	161.78
674	Block D	48	20	S	1	1	0.37	364.27	189.06
675	Block E	40	70	ESE/WSW	1	1	0.37	319.74	165.95
676	Block E	40	70	ESE/WSW	1	2	0.73	639.48	331.89
677	Block E	40	70	ESE/WSW	1	1	0.37	319.74	165.95
678	Block E	40	70	ESE/WSW	1	2	0.73	639.48	331.89
679	Block E	40	70	ESE/WSW	1	1	0.37	319.74	165.95
680	Block E	40	70	ESE/WSW	1	2	0.73	639.48	331.89
Totals						**38**	**13.87**	**12975.39**	**6734.22**

The Performance of solar PV systems is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate, based upon the MCS procedure, is given as guidance only. It should not be considered as a guarantee of performance.

This system performance calculation has been undertaken using estimated values for array orientation, inclination or shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated results.

Boor 08/03/2024 Rev A

Assessment Reference	Property Type	SAP Rating	Environmental Rating	PV orientation	PV kW peak	PV battery capacity	PV Diverter (yes/no)	Mechanical Ventilation Type	Mechanical Ventilation Manufacturer	Mechanical Ventilation Model	Boiler Manufacturer	Boiler Model	FGHRS Manufacturer	FGHRS Model	WWHRS Manufacturer	WWHRS Model	Cylinder Volume	Cylinder Measured Loss	Air Permeability
Plot 211	House,Detached	92	90	South	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 212	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 213	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 214	House,SemiDetached	91	91	West	1.40	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 215	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 216	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 217	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 218	House,SemiDetached	91	91	West	1.40	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 219	House,SemiDetached	91	91	West	1.40	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 261	House,Detached	94	90	Southwest	2.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 262	House,SemiDetached	91	90	West	1.40	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 263	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 264	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 265	House,SemiDetached	91	91	West	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 266	House,SemiDetached	91	90	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 267	House,SemiDetached	91	90	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 268	Maisonette,SemiDetached	90	90	Southeast	1.20	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 269	Maisonette,SemiDetached	89	90	Southeast	0.80	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 270	Maisonette,SemiDetached	88	90	Southeast	0.70	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 271	Maisonette,SemiDetached	89	90	Southeast	0.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 272	House,SemiDetached	92	91	Southwest	1.80	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 273	House,SemiDetached	92	91	Southeast	1.60	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 274	House,SemiDetached	91	91	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 275	House,SemiDetached	91	91	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 276	House,Detached	94	90	Southeast	2.70	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 277	House,Detached	94	91	Southeast	2.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 278	House,Detached	94	91	Southeast	2.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 279	House,Detached	94	91	Southeast	2.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 280	House,Detached	93	90	Southeast	2.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 281	House,SemiDetached	92	91	Southwest	1.80	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 282	House,SemiDetached	92	91	Southeast	1.60	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 283	House,SemiDetached	92	91	Southeast	1.70	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 284	House,SemiDetached	93	91	Southwest	1.80	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 285	House,SemiDetached	91	91	East	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 286	House,SemiDetached	91	91	East	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 287	House,SemiDetached	91	91	East	1.50	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 288	House,SemiDetached	91	91	East	1.40	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 289	House,SemiDetached	91	91	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 290	House,SemiDetached	91	91	Southeast	1.30	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 291	House,Detached	92	90	Southwest	2.10	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 292	Maisonette,SemiDetached	91	90	South	1.20	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 293	Maisonette,SemiDetached	90	90	South	1.00	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 294	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 295	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 296	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 297	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 298	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 299	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 300	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50
Plot 301	House,SemiDetached	92	91	West	1.90	0.00	No	MEVDecentralised	Vent Axia Ltd	Lo-Carbon NBR dMEV C 100	Baxi Heating	ASSURE 36	N/A	N/A	N/A	N/A	0.00	0.00	4.50

Boorley Gardens 2 0.365kWp Panels **Rev -** 09/06/2023

Plot Number	House Type	Air Permeability	Panel Quanitity*	kWp Amount	PV Orientation	DER PVEnergyProduced	Emission factor kg CO2/kWh	Emissions kg CO2/year	TER TotalCO2	TFA	DER PV Only	DER Fabric Only	PV % Reduction	DER	TER	DER/TER Variance achieves 19%
Plot 199	Botley Semi RITR	4.5	2	0.73	S	623.75	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 200	Botley Semi RITR	4.5	2	0.73	S	623.75	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 201	Botley Semi RITR	4.5	2	0.73	S	623.75	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 202	Botley Semi RITR	4.5	2	0.73	S	623.75	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 203	Downshire Det	4.5	3	1.095	E	750.67	0.519	389.60	1789.45	97.2	4.01	17.92	21.77%	13.91	18.41	-24.44%
Plot 204	Melbourne 1 Semi	4.5	2	0.73	E	530.19	0.519	275.17	1642.77	95.51	2.88	16.47	16.75%	13.59	17.2	-20.99%
Plot 205	Melbourne 1 Semi	4.5	2	0.73	E	530.19	0.519	275.17	1653.28	95.51	2.88	16.59	16.64%	13.71	17.31	-20.80%
Plot 206	Ingleby Det	4.5	3	1.095	E	798.91	0.519	414.64	1871.27	100.66	4.12	18.20	22.16%	14.08	18.59	-24.26%
Plot 207	Lomond Det	4.5	2	0.73	S	623.75	0.519	323.73	1442.78	79.1	4.09	17.64	22.44%	13.55	18.24	-25.71%
Plot 208	2A End	4.5	2	0.73	S	630.4424	0.519	327.20	1446.56	80.32	4.07	16.95	22.62%	12.88	18.01	-28.48%
Plot 209	3 Mid	4.5	2	0.73	S	630.4424	0.519	327.20	1483.11	93.16	3.51	14.64	22.06%	11.13	15.92	-30.09%
Plot 210	3S End	4.5	2	0.73	E	530.1869	0.519	275.17	1656.02	97.7	2.82	15.87	16.62%	13.05	16.95	-23.01%
Plot 220	Downshire Det	4.5	2	0.73	S	623.7532	0.519	323.73	1833.19	97.2	3.33	18.46	17.66%	15.13	18.86	-19.78%
Plot 221	Melbourne Det	4.5	3	1.095	E	798.9117	0.519	414.64	1753.56	95.51	4.34	18.19	23.65%	13.85	18.36	-24.56%
Plot 222	Melbourne 1 Semi	4.5	2	0.73	E	530.1869	0.519	275.17	1653.28	95.51	2.88	16.59	16.64%	13.71	17.31	-20.80%
Plot 223	Melbourne 1 Semi	4.5	2	0.73	E	530.1869	0.519	275.17	1642.77	95.51	2.88	16.47	16.75%	13.59	17.2	-20.99%
Plot 224	Melbourne Det	4.5	3	1.095	E	798.9117	0.519	414.64	1753.56	95.51	4.34	18.19	23.65%	13.85	18.36	-24.56%
Plot 225	Melbourne Det	4.5	3	1.095	E	798.9117	0.519	414.64	1753.56	95.51	4.34	18.19	23.65%	13.85	18.36	-24.56%
Plot 226	Melbourne Det	4.5	3	1.095	E	791.6489	0.519	410.87	1753.56	95.51	4.30	18.19	23.43%	13.89	18.36	-24.35%
Plot 227	Darley Det	4.5	3	1.095	E	798.9117	0.519	414.64	2012.59	119.94	3.46	16.12	20.60%	12.66	16.78	-24.55%
Plot 228	Downshire Det	4.5	2	0.73	S	623.7532	0.519	323.73	1833.19	97.2	3.33	18.46	17.66%	15.13	18.86	-19.78%
Plot 229	Calver Det	4.5	3	1.095	W	798.9117	0.519	414.64	2171.44	128.26	3.23	16.77	19.09%	13.54	16.93	-20.02%
Plot 230	Darley Det	4.5	2	0.73	S	630.4424	0.519	327.20	2064.17	119.94	2.73	16.60	15.85%	13.87	17.21	-19.41%
Plot 231	Botley Semi RITR	4.5	2	0.73	S	623.7532	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 232	Botley Semi RITR	4.5	2	0.73	S	623.7532	0.519	323.73	2030.18	123.34	2.62	15.87	15.95%	13.25	16.46	-19.50%
Plot 233	Botley Semi RITR	4.5	3	1.095	SW	883.5167	0.519	458.55	2025.24	123.34	3.72	15.83	22.64%	12.11	16.42	-26.25%
Plot 234	Botley Semi RITR	4.5	3	1.095	SW	883.5167	0.519	458.55	2040.04	123.34	3.72	15.97	22.48%	12.25	16.54	-25.94%
Plot 235	Darley Det	4.5	3	1.095	SW	905.6843	0.519	470.05	2108.55	119.94	3.92	17.03	22.29%	13.11	17.58	-25.43%
Plot 236	Darley Det	4.5	2	0.73	S	630.4424	0.519	327.20	2048.58	119.94	2.73	16.46	15.97%	13.73	17.08	-19.61%
Plot 237	Melbourne Det	4.5	2	0.73	S	630.4424	0.519	327.20	1721.09	95.51	3.43	17.81	19.01%	14.38	18.02	-20.20%
Plot 238	Melbourne Det	4.5	2	0.73	S	630.4424	0.519	327.20	1721.09	95.51	3.43	17.81	19.01%	14.38	18.02	-20.20%
Plot 239	Downshire Det	4.5	2	0.73	SE	586.3338	0.519	304.31	1818.61	97.2	3.13	18.28	16.73%	15.15	18.71	-19.03%
Plot 240	Botley Semi RITR	4.5	3	1.095	SW	875.4847	0.519	454.38	2040.04	123.34	3.68	15.96	22.27%	12.28	16.54	-25.76%
Plot 241	Botley Semi RITR	4.5	3	1.095	SW	875.4847	0.519	454.38	2025.24	123.34	3.68	15.82	22.44%	12.14	16.42	-26.07%
Plot 242	Botley Semi RITR	4.5	3	1.095	SW	875.4847	0.519	454.38	2040.04	123.34	3.68	15.96	22.27%	12.28	16.54	-25.76%
Plot 243	Botley Semi RITR	4.5	3	1.095	SW	875.4847	0.519	454.38	2025.24	123.34	3.68	15.82	22.44%	12.14	16.42	-26.07%
Plot 244	Downshire Det	4.5	2	0.73	SE	586.3338	0.519	304.31	1770.01	97.2	3.13	17.68	17.19%	14.55	18.21	-20.10%
Plot 245	Morley 1 Det	4.5	2	0.73	SW	601.045	0.519	311.94	1535.77	78.96	3.95	18.59	20.31%	14.64	19.45	-24.73%
Plot 246	Melbourne Det	4.5	2	0.73	SW	601.045	0.519	311.94	1734.46	95.51	3.27	17.97	17.98%	14.7	18.16	-19.05%
Plot 247	Darley Det	4.5	3	1.095	SE	897.4508	0.519	465.78	2097.75	119.94	3.88	16.92	22.20%	13.04	17.49	-25.44%
Plot 248	Calver Det	4.5	3	1.095	SE	897.4508	0.519	465.78	2172.72	128.26	3.63	16.78	21.44%	13.15	16.94	-22.37%
Plot 249	Darley Det	4.5	3	1.095	SE	897.4508	0.519	465.78	2097.75	119.94	3.88	16.92	22.20%	13.04	17.49	-25.44%
Plot 250	Calver Det	4.5	3	1.095	SW	897.4508	0.519	465.78	2161.18	128.26	3.63	16.68	21.55%	13.05	16.85	-22.55%
Plot 251	Calver Det	4.5	3	1.095	SW	897.4508	0.519	465.78	2161.18	128.26	3.63	16.68	21.55%	13.05	16.85	-22.55%
Plot 252	Ridgeway Det	4.5	3	1.095	S	941.3455	0.519	488.56	2157.26	129.1	3.78	16.62	22.65%	12.84	16.71	-23.16%
Plot 253	Sterndale Det	4.5	3	1.095	W	791.6489	0.519	410.87	2162.65	130.28	3.15	16.16	19.00%	13.01	16.6	-21.63%
Plot 254	Sterndale Det	4.5	3	1.095	S	941.3455	0.519	488.56	2117.05	130.28	3.75	15.76	23.08%	12.01	16.25	-26.09%
Plot 255	Darley Det	4.5	3	1.095	W	791.6489	0.519	410.87	2124.14	119.94	3.43	17.17	19.34%	13.74	17.71	-22.42%
Plot 256	Calver Det	4.5	3	1.095	S	941.3455	0.519	488.56	2167.59	128.26	3.81	16.74	22.54%	12.93	16.9	-23.49%
Plot 257	Melbourne Det	4.5	2	0.73	SW	601.045	0.519	311.94	1734.46	95.51	3.27	17.97	17.98%	14.7	18.16	-19.05%
Plot 258	Melbourne Det	4.5	2	0.73	SW	601.045	0.519	311.94	1734.46	95.51	3.27	17.97	17.98%	14.7	18.16	-19.05%
Plot 259	Darley Det	4.5	3	1.095	SE	897.4508	0.519	465.78	2097.75	119.94	3.88	16.92	22.20%	13.04	17.49	-25.44%
Plot 260	Ridgeway Det	4.5	3	1.095	SE	897.4508	0.519	465.78	2130.15	129.1	3.61	16.39	21.87%	12.78	16.5	-22.55%
	Total		133	48.545												

**Lowest possible panel/kWp amount that still reaches the required targets*

Clearline fusion - PV Schedule

34653 - Boorley Gardens Phase 3

Miller Homes

16/04/2025

					Portrait Flashings								Landscape Flashings								ArcBox™		PV Information				Inverter	
Plot No.	Block / Plot Type	Solar Panel Orientation	Elevation	Portrait Panel Layout (Row x Column) or (x,x,x,,, top down)	F16-TL-M10	F16-TC-M10	F16-TR-M10	F16-TY-M10	F16-J-M10	VAT16-M10	Corner F16-CRB-M10	Corner F16-CLB-S-M10	F16-LL-M10	F16-LC-M10	F16-LR-M10	F16-LY-M10	F16-LJ-M10	VAL16-M10	Corner F16-LCRB-M10	Corner F16-LCLB-S-M10	Units ARC04-01	Units ARC-BM-25-01	Clearline fusion PV Panel Code	Rated PV Power	Customer Requirement	Difference	Clearline INVERTER	Notes
				Landscape																			# Type	Wp	Wp	Wp	# Type	
103	Type 3S	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
104	Type 3	West	Rear	3 over 2 (aligned right)	2		1		2			1									2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
105	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
106	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
107	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
108	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
109	Type 4S	West	Rear	1 x 7	1	5	1														2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
110	Type 3	South	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
111	Type 3S	West	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
112	Type 2	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
113	Type 2	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
114	Type 4S	South West	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
115	Type 2	South West	Front	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
116	Type 2	South West	Front	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
117	Briarwood	South East	Front	2,2,2,1 (aligned right)									1			2	3	1		1	2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
118	Briarwood	South East	Front	2,2,2,1 (aligned right)									1			2	3	1		1	2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
119	Braxton	South West	Rear	1 x 5	1	3	1														2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
120	Faverwood	South West	Rear	2 x 4	1	2	1	1	3												2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
121	Crosswood	South West	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
122	Briarwood	South West	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
123	Crosswood	South West	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
124	Fordwood	South West	Rear	2 x 2									1		1	1	1				4	4	4 PV16-405-M10	1,620	2,430	-810	1 CSI3000D	Two elevations used SAP assessor to check compliance.
		North East	Front	1 x 3	1	1	1																3 PV16-405-M10	1,215	0	1,215		
125	Beauwood	South West	Front	1 x 7	1	5	1														2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
126	Faverwood	South West	Front	2 x 2	1		1	1	1												4	4	4 PV16-405-M10	1,620	3,240	-1,620	1 CSI3600D	Two elevations used SAP assessor to check compliance.
		North East	Rear	2 x 3	1	1	1	1	2														6 PV16-405-M10	2,430	0	2,430		
127	Faverwood	South West	Front	2 x 2	1		1	1	1												4	4	4 PV16-405-M10	1,620	3,240	-1,620	1 CSI3600D	Two elevations used SAP assessor to check compliance.
		North East	Rear	2 x 3	1	1	1	1	2														6 PV16-405-M10	2,430	0	2,430		
128	Faverwood	South West	Front	2 x 2	1		1	1	1												4	4	4 PV16-405-M10	1,620	3,240	-1,620	1 CSI3600D	Two elevations used SAP assessor to check compliance.
		North East	Rear	2 x 3	1	1	1	1	2														6 PV16-405-M10	2,430	0	2,430		
129	Briarwood	South West	Front	2,2,2,1 (aligned left)											1	3	2	1	1		2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
130	Fordwood	South West	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	

Plot No.	Block / Plot Type	Solar Panel Orientation	Elevation	Portrait Panel Layout (Row x Column) or (x,x,x,,, top down) / Landscape	Portrait Flashings								Landscape Flashings								ArcBox™		PV Information				Inverter	Notes
					F16-TL-M10	F16-TC-M10	F16-TR-M10	F16-TY-M10	F16-J-M10	VAT16-M10	Corner F16-CRB-M10	Corner F16-CLB-S-M10	F16-LL-M10	F16-LC-M10	F16-LR-M10	F16-LY-M10	F16-LJ-M10	VAL16-M10	Corner F16-LCRB-M10	Corner F16-LCLB-S-M10	Units ARC04-01	Units ARC-BM-25-01	Clearline fusion PV Panel Code	Rated PV Power	Customer Requirement	Difference	Clearline INVERTER	
																							# Type	Wp	Wp	Wp	# Type	
131	Beauwood	South West	Front	1 x 7	1	5	1						1								2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
132	Fordwood	South West	Rear	2 x 2									1		1	1	1				4	4	4 PV16-405-M10	1,620	2,430	-810	1 CSI3000D	Two elevations used SAP assessor to check compliance.
		North East	Front	1 x 3	1	1	1																3 PV16-405-M10	1,215	0	1,215		
133	Hampton	South West	Rear	3 over 2 (aligned left)	1		2	1	1		1										2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
134	Braxton	South West	Rear	1 x 5	1	3	1														2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
135	Braxton	South West	Front	1 x 5	1	3	1														2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
136	Beauwood	West	Rear	2 x 4									1	2	1	1	3				2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
137	Clarkston	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
138	Clarkston	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
139	Clarkston	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
140	Clarkston	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
141	Crosswood	South West	Front	3 over 1 (centred)	1		1		1	1	1	1									4	4	4 PV16-405-M10	1,620	2,835	-1,215	1 CSI3600D	Orientation ameneded to SW SAP assessor to check. Two elevations required assessor to check.
		North East	Rear	1 x 4	1	2	1																4 PV16-405-M10	1,620	0	1,620		
142	Fordwood	South West	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	Orientation ameneded to SW SAP assessor to check.
143	Hampton	South East	Rear	3 over 2 (aligned left)	1		2	1	1		1										2	2	5 PV16-405-M10	2,025	2,430	-405	1 CSI1500S	Orientation ameneded to SE SAP assessor to check compliance.
144	Hampton	South East	Rear	3 over 2 (aligned right)	2		1		2			1									2	2	5 PV16-405-M10	2,025	2,430	-405	1 CSI1500S	Orientation ameneded to SE SAP assessor to check compliance.
145	Type 2	South	Rear	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
146	Type 2	South	Rear	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
147	Type 2	South	Rear	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
148	Type 3S	East	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
149	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
150	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
151	Type 4	South	Left	1 x 5	1	3	1														2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
152	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
153	Type 2	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
154	Type 3S	East	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
155	Type 2	South	Front	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
156	Type 2	South	Front	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
157	Type 2	South	Front	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
158	Type 2	South East	Front	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
159	Type 2	South East	Front	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
160	Hampton	South East	Front	3 over 2 (aligned left)	1		2	1	1		1										2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
161	Hampton	South East	Front	3 over 2 (aligned right)	2		1		2			1									2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
162	Beauwood	South East	Front	1 x 7	1	5	1														2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
163	Crosswood	South West	Front	3 over 1 (centred)	1		1		1	1	1	1									4	4	4 PV16-405-M10	1,620	2,835	-1,215	1 CSI3600D	Two elevations used SAP assessor to check compliance.
		North East	Rear	1 x 4	1	2	1																4 PV16-405-M10	1,620	0	1,620		

Plot No.	Block / Plot Type	Solar Panel Orientation	Elevation	Portrait Flashings								Landscape Flashings								ArcBox™		PV Information				Inverter	Notes
				Portrait	F16-TL-M10	F16-TC-M10	F16-TR-M10	F16-TY-M10	F16-J-M10	VAT16-M10	Corner F16-CRB-M10	Corner F16-CLB-S-M10	F16-LL-M10	F16-LC-M10	F16-LR-M10	F16-LY-M10	F16-LJ-M10	VAL16-M10	Corner F16-LCRB-M10	Corner F16-LCLB-S-M10	Units ARC04-01	Units ARC-BM-25-01	Clearline fusion PV Panel Code	Rated PV Power	Customer Requirement	Difference	Clearline INVERTER	
				Panel Layout (Row x Column) or (x,x,x,,, top down)																							
				Landscape																		# Type	Wp	Wp	Wp	# Type	
164	Clearwood	South West	Front	2 x 4	1	2	1	1	3												2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
165	Clearwood	South West	Front	2 x 4	1	2	1	1	3												2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
166	Crosswood	South	Front	3 over 1 (centred)	1		1		1	1	1	1									4	4	4 PV16-405-M10	1,620	2,835	-1,215	1 CSI3600D	Two elevations used SAP assessor to check compliance.
		North	Rear	1 x 4	1	2	1																4 PV16-405-M10	1,620	0	1,620		
167	Fordwood	South	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
168	Hampton	East	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
169	Beauwood	East	Rear	2 x 4									1	2	1	1	3				2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
170	Briarwood	South	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
171	Crosswood	South	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
172	Beauwood	West	Rear	2 x 4									1	2	1	1	3				2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
173	Hampton	West	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
174	Portwood	West	Rear	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
175	Portwood	South East	Rear	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	Orientation ameneded to SE SAP assessor to check.
176	Type 2	South East	Rear	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
177	Type 2	South East	Rear	1 x 3	1	1	1														2	2	3 PV16-405-M10	1,215	1,215	0	1 CSI1000S	
178	Beauwood	East	Rear	2 x 4									1	2	1	1	3				2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
179	Briarwood	South	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
180	Briarwood	South	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
181	Hampton	South	Rear	3 over 2 (aligned left)	1		2	1	1		1										2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
182	Fordwood	East	Front	1 x 7	1	5	1														2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
183	Denton	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
184	Denton	West	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
185	Braxton	West	Rear	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
186	Portwood	South	Front	1 x 5	1	3	1														2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
187	Type 3S	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
188	Type 2	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
189	Type 3	East	Rear	3 over 2 (aligned left)	1		2	1	1		1										2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
190	Type 3	East	Rear	3 over 2 (aligned right)	2		1		2			1									2	2	5 PV16-405-M10	2,025	2,025	0	1 CSI1500S	
191	Type 2	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
192	Type 3S	North	Front	1 x 8	1	6	1														2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	
445	Clearwood	South	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
446	Clearwood	South	Rear	4 over 3 (aligned left)	1	1	2	1	2		1										2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
447	Fordwood	South	Rear	2 x 2									1		1	1	1				4	4	4 PV16-405-M10	1,620	2,430	-810	1 CSI3000D	Two elevations used SAP assessor to check compliance.
		North	Front	1 x 3	1	1	1																3 PV16-405-M10	1,215	0	1,215		
448	Fordwood	South West	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
449	Clearwood	South	Front	4 over 3 (aligned right)	2	1	1		3			1									2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	

					Portrait Flashings								Landscape Flashings								ArcBox™		PV Information				Inverter	
Plot No.	Block / Plot Type	Solar Panel Orientation	Elevation	Portrait Panel Layout (Row x Column) or (x,x,x,,, top down)	F16-TL-M10	F16-TC-M10	F16-TR-M10	F16-TY-M10	F16-J-M10	VAT16-M10	F16-CRB-M10 Corner	F16-CLB-S-M10 Corner	F16-LL-M10	F16-LC-M10	F16-LR-M10	F16-LY-M10	F16-LJ-M10	VAL16-M10	F16-LCRB-M10 Corner	F16-LCLB-S-M10 Corner	ARC04-01 Units	ARC-BM-25-01 Units	Clearline fusion PV Panel Code	Rated PV Power	Customer Requirement	Difference	Clearline INVERTER	Notes
				Landscape																			# Type	Wp	Wp	Wp	# Type	
450	Clearwood	South	Front	4 over 3 (aligned right)	2	1	1		3			1									2	2	7 PV16-405-M10	2,835	2,835	0	1 CSI2000S	
451	Fordwood	South	Front	1 x 6	1	4	1														2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
452	Braxton	South	Front	1 x 4	1	2	1														2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
453	Denton	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
454	Denton	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
455	Lockton	East	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
456	Baymont	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
457	Baymont	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
458	Baymont	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
459	Baymont	East	Rear	2 x 2	1		1	1	1												2	2	4 PV16-405-M10	1,620	1,620	0	1 CSI1500S	
460	Lockton	East	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
461	Hampton	East	Rear	2 x 3	1	1	1	1	2												2	2	6 PV16-405-M10	2,430	2,430	0	1 CSI2000S	
462	Beauwood	South	Rear	2 x 4									1	2	1	1	3				2	2	8 PV16-405-M10	3,240	3,240	0	1 CSI2500S	Orientation ameneded to South SAP assessor to check.
668	Fordwood	South	Rear	2 x 2									1		1	1	1				3	3	4 PV16-405-M10	1,620	2,835	-1,215	1 CSI3000D	Two elevations used SAP assessor to check compliance.
		North	Front	1 x 4	1	2	1																4 PV16-405-M10	1,620	0	1,620		
TOTAL					113	152	118	53	93	3	14	9	11	10	10	16	27	3	1	2	237	237	609	246.65 kWp	242.19 kWp	4.46 kWp	109	
Plot No.	Block / Plot Type	Solar Panel Orientation	Elevation	Panel Layout	F16-TL-M10	F16-TC-M10	F16-TR-M10	F16-TY-M10	F16-J-M10	VAT16-M10	F16-CRB-M10 Corner	F16-CLB-S-M10 Corner	F16-LL-M10	F16-LC-M10	F16-LR-M10	F16-LY-M10	F16-LJ-M10	VAL16-M10	F16-LCRB-M10 Corner	F16-LCLB-S-M10 Corner	ARC04-01 Units	ARC-BM-25-01 Units	Clearline fusion PV Panel Code	Rated PV Power	Customer Requirement	Difference	Clearline INVERTER 6 Inverter Types	Notes
					Portrait Flashings								Landscape Flashings								ArcBox™		PV Information				Inverter	

APPENDIX F – SANITARY MANUFACTURERS DETAILS

SPECIFICATION SHEET

COLLECTION: ECOTURN
PRODUCT CODE: PHA-200FW/CC-CP

DESCRIPTION:
mono basin mixer
single lever
with EcoTurn cold start cartridge
deck mounted
smooth bodied
with universal basin waste
with water flow aerator
ceramic cartridge C-001-C35
2 x 1/2" 400mm flexipipe connections
deck mount drill hole diameter 35mm
minimum operating pressure 0.2 bar LP

FINISH:
Chrome

MINIMUM OPERATING PRESSURE:
0.2 bar LP

FLOW RATE AT 3.0 BAR FLOW PRESSURE:
5.1 l/m

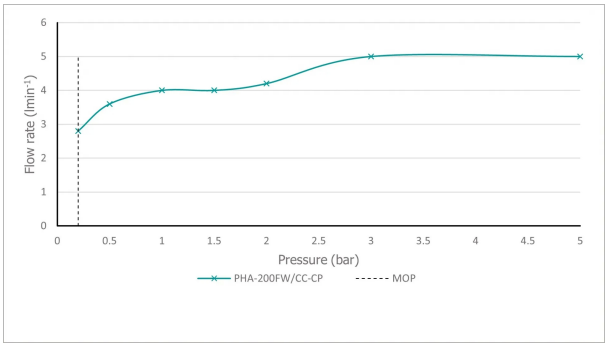

15 year guarantee

tel: 01934 744466
email: sales@vado.com
www.vado.com

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VADO

TECHNICAL DRAWING

COLLECTION: ECOTURN
PRODUCT CODE: PHA-200FW/CC-CP

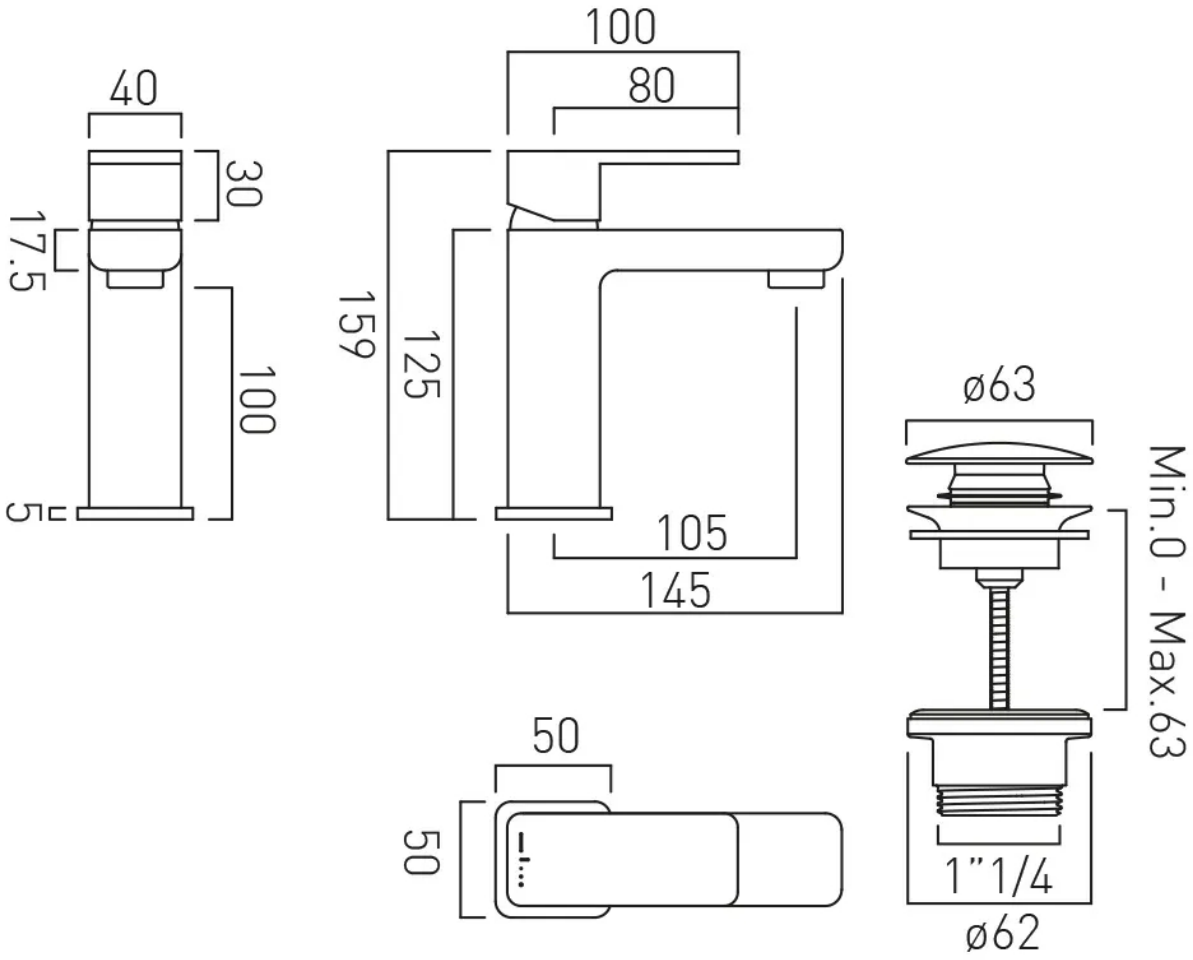

tel: 01934 744466
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VADO

Tempo Arc Idealform Bath 170x70cm No Handgrips 2 Tapholes

ILLUSTRATED

E2564	Tempo Arc 170 x 70cm Idealform bath no handgrips 2 tapholes
B0730	Tempo 2 hole bath filler
E4130	Uniline 170cm front panel
E4140	Uniline 70cm end panel
E1486	Luxury bath pop-up waste and overflow
A5901	TMV thermostatic mixing valve 22mm

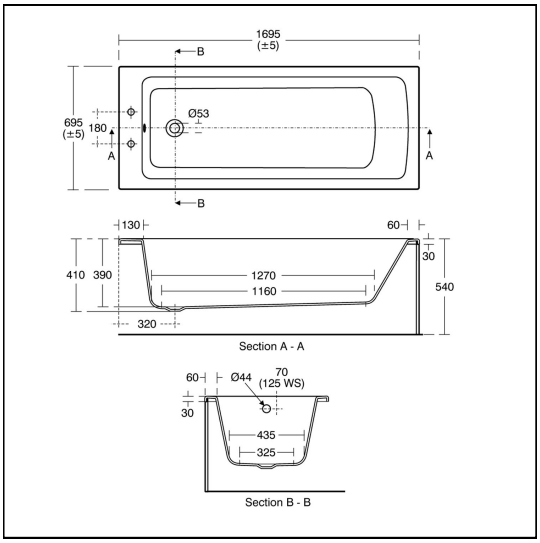

ILLUSTRATED PRODUCT DETAILS

Weights

E2564	23.00 KG
B0730	2.64 KG
E4130	3.60 KG
E4140	1.80 KG
A5901	1.70 KG

Materials

E2564	Idealform
B0730	Chrome Plated
E4130	Acrylic
E4140	Acrylic
E1486	Mixed Material
A5901	Chrome Plated Metal

Finishes

E2564	White (01)
B0730	Chrome (AA)
E4130	White (01)
E4140	White (01)
E1486	Chrome (AA)
A5901	Chrome (AA)

Capacity

E2564 181.0 litres (to overflow)

Flow rates

B0730 50 Litres per minute @ 3 bar pressure

Designer

Robin Levien, RDI

Standards

Constructed to EN 198:2008. EN 14516

Special Notes

Consideration should be given to safe hot water delivery and the use of an appropriate temperature reduction device see A5901AA or Part G for guidance.

ACCREDITATIONS

E2564(01)

Unified Water Label — 181.0 Litres

B0730(AA)

Unified Water Label — 50.00 Litres Per Minute

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VADO

flow regulators

Spout fitted basin

to suit most mono basin mixers

Product code	Colouring	Image
FR-100/1.7-PLA	Lime green	
FR-100/2-PLA	**Black base, white mesh**	
FR-100/3.76-PLA	Blue	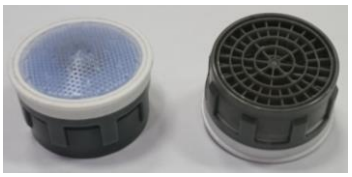
FR-100/5-PLA	Orange	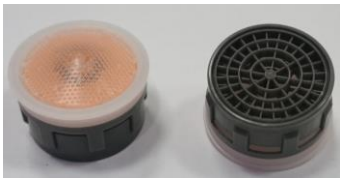
FR-100/6-PLA	**Black base, clear mesh**	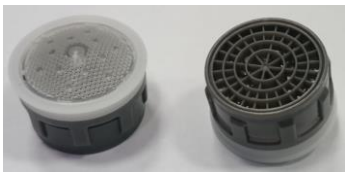
FR-100/8-PLA	White	

VADO

flow regulators

Spout fitted basin

to suit most basin pillar taps

Product code	Colouring	Image
FR-106/2-PLA	Olive green	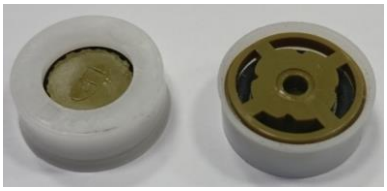
FR-106/3-PLA	Brown	
FR-106/4-PLA	Grey	
FR-106/5-PLA	Yellow	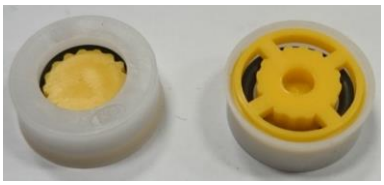
FR-106/6-PLA	Black	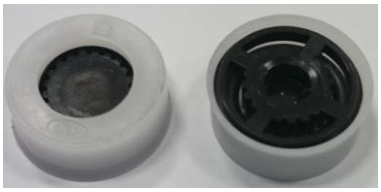
FR-106/8-PLA	White	

flow regulators

Tail fitted basin/shower

to suit certain mono basin mixers & wall mounted basin mixers

Product code	Colouring	Image
FR-FLEXI/2-PLA	Olive green	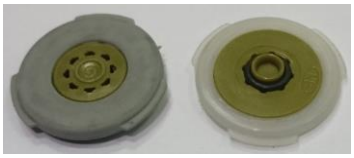
FR-FLEXI/3-PLA	Brown	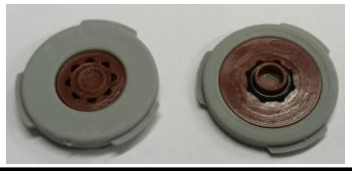
FR-FLEXI/4-PLA	Grey	
FR-FLEXI/5-PLA	Yellow	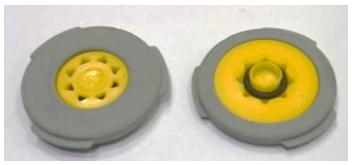
FR-FLEXI/6-PLA	Black	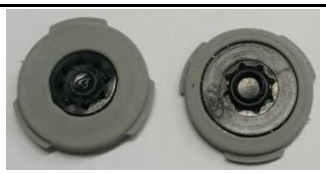
FR-FLEXI/7-PLA	Green	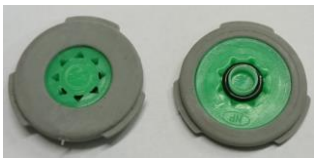
FR-FLEXI/8-PLA	White	
FR-FLEXI/9-PLA	Orange	

flow regulators

Showers

to suit shower heads, handsets & bath shower mixers

Product code	Colouring	Image
FR-SHOWER/4-C/P	Grey	
FR-SHOWER/6-C/P	**Black**	
FR-SHOWER/8-C/P	White	
FR-SHOWER/8-PLA	White	
FR-SHOWER/9-C/P	**Orange**	
FR-SHOWER/9-PLA	**Orange**	
FR-SHOWER/12-C/P	**Red**	
FR-SHOWER/12-PLA	**Red**	

watercolours® by NEOPERL

NEOPERL introduces a consequent colour coding of all aerator models:
"Watercolours by NEOPERL" helps to easily identify

- ▶ the flow rate of the model
- ▶ the stream pattern of the model (aerated or laminar)

The product line and the aerator size can be visually distinguished and thus do not need to be colour-coded.
"Watercolours by NEOPERL" facilitates the production process for the manufacturer and replacement ordering for the end user.

1 Models with restrictor:
colour of the dome screen identifies flow rate

2 PCA®-Models (with flow regulator):
colour of the flow regulator identifies flow rate;
flow regulator visible through transparent dome screen

3 All models: colour of the lower part of the insert identifies flow pattern (aerated or laminar)

1 Dome Screen	Flow Rate		Noise Reduced	EN 246
light green	Z	7.5 - 9.0 l/min at 3 bar	●	●
light blue	A	13.5 - 15.0 l/min at 3 bar	●	●
yellow	S	18.0 - 19.8 l/min at 3 bar	●	●
dark blue	B	22.8 - 25.2 l/min at 3 bar	●	●
dark grey	C	27.0 - 30.0 l/min at 3 bar	●	●
light grey	D	34.8 - 37.8 l/min at 3 bar	●	●
orange	G	60.0 - 70.0 l/min at 1 bar	●	
grey	M	60.0 - 70.0 l/min at 3 bar	●	
ivory		1.0 gpm at 60 psi max		
green	T	1.5 gpm at 60 psi max	●	
brown		1.75 gpm at 60 psi max		
olive		2.0 gpm at 60 psi max		
red	X	2.2 gpm at 60 psi max	●	
beige		3.0 gpm at 60 psi max		
black		3.5 gpm at 60 psi max		
pink	W	4.0 gpm at 60 psi // 7.5 l/min at 1 bar max		
lilac	Y	4.5 gpm at 60 psi // 7.5 l/min at 1 bar max		
blue	V	6.6 gpm at 60 psi max		
white	lam. max			

2 Flow Regulator	Flow Rate	
light green	1.7 l/min	0.5 gpm max
dark grey	2.0 l/min	
green	2.5 l/min	
lilac	3.0 l/min	
dark blue	3.5 l/min	1.0 gpm max
pink	4.0 l/min	
orange	5.0 l/min	1.5 gpm max
black	6.0 l/min	1.75 gpm max
light grey	7.0 l/min	
yellow		2.2 gpm max
white	8.0 l/min	

3 Lower Part of the Insert	Flow Pattern
dark grey	aerated
light grey	laminar

Patents and design patents pending

NEOPERL®
flow, stop and go®

NEOPERL® CASCADE® Aerators

NEOPERL®
flow, stop and go®

Standard Size/ Aerated Models

Features and Benefits:

- improved lime protection => extended life time
- perfect stream quality even under difficult flow situations
- very low noise level
- protected against vandalism: unlike conventional wire-mesh screens, the CASCADE® structure can not be crushed
- extremely high pressure resistance

Models with Restrictor

Flow Rate		Colour Code	Female M22x1	Male M24x1	Insert M22/24x1	Male M28x1	Insert M28x1
Z	7.5 - 9.0 l/min at 3 bar	light green	40.1002.023	40.1002.033	40.1002.000	-	-
A	13.5 - 15.0 l/min at 3 bar	light blue	40.1003.023	40.1003.033	40.1003.000	-	-
S	18.0 - 19.8 l/min at 3 bar	yellow	40.1004.023	40.1004.033	40.1004.000	-	-
B	22.8 - 25.2 l/min at 3 bar	dark blue	40.1005.023	40.1005.033	40.1005.000	41.1005.093	41.1005.000
C	27.0 - 30.0 l/min at 3 bar	dark grey	40.1006.023	40.1006.033	40.1006.000	41.1006.093	41.1006.000
D	34.8 - 37.8 l/min at 3 bar	light grey	40.1007.023	40.1007.033	40.1007.000	41.1007.093	41.1007.000
X	2.2 gpm at 60 psi max	red	40.1001.023	40.1001.033	40.1001.000	-	-

PCA®- Models

Flow Rate		Colour Code	Female M22x1	Male M24x1	Insert M22/24x1
5.0 l/min	1.5 gpm max	orange	40.1051.023	40.1051.033	40.1051.000
6.0 l/min	1.75 gpm max	black	40.1052.023	40.1052.033	40.1052.000
7.0 l/min		light grey	40.1055.023	40.1055.033	40.1055.000
	2.2 gpm max	yellow	40.1053.023	40.1053.033	40.1053.000
8.0 l/min		white	40.1054.023	40.1054.033	40.1054.000

Models with Restrictor

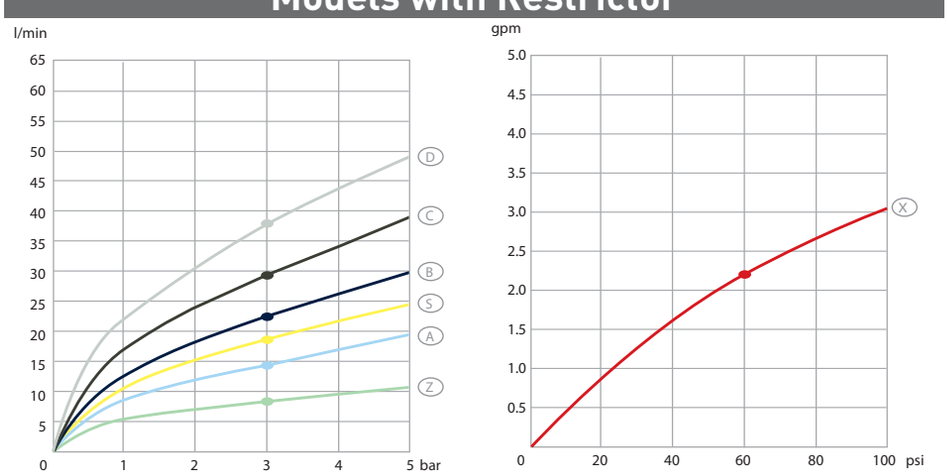

PCA® Flow Rates

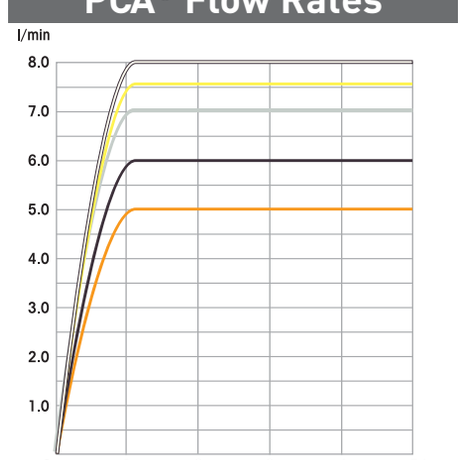

Approvals

For an updated list of approvals and copies of the original certificates, please refer to our website at www.neoperl.net.

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10/2006
79.8467.10000

SPECIFICATION SHEET

COLLECTION: KORI
PRODUCT CODE: CUC-1004-C/P

DESCRIPTION:
Kori
mono kitchen mixer
single lever
deck mounted
with swivel spout
ceramic cartridge CAR-NKS-40B
deck mount drill hole diameter 34mm
minimum operating pressure 0.2 bar LP

FINISH:
Chrome

FLOW REGULATOR:
FR-100/5-PLA

MINIMUM OPERATING PRESSURE:
0.2 bar LP

FLOW RATE AT 3.0 BAR FLOW PRESSURE:
13 l/min

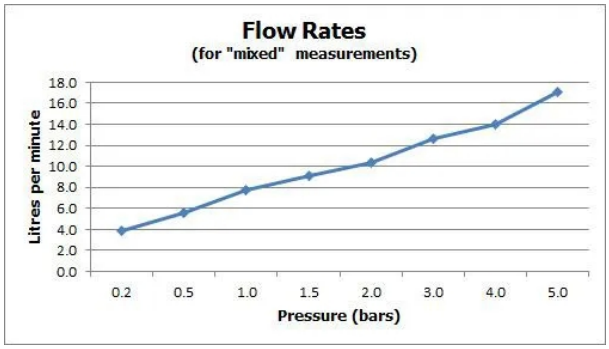

15 year guarantee

tel: 01934 744466
email: sales@vado.com
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VADO

TECHNICAL DRAWING

COLLECTION: KORI
PRODUCT CODE: CUC-1004-C/P

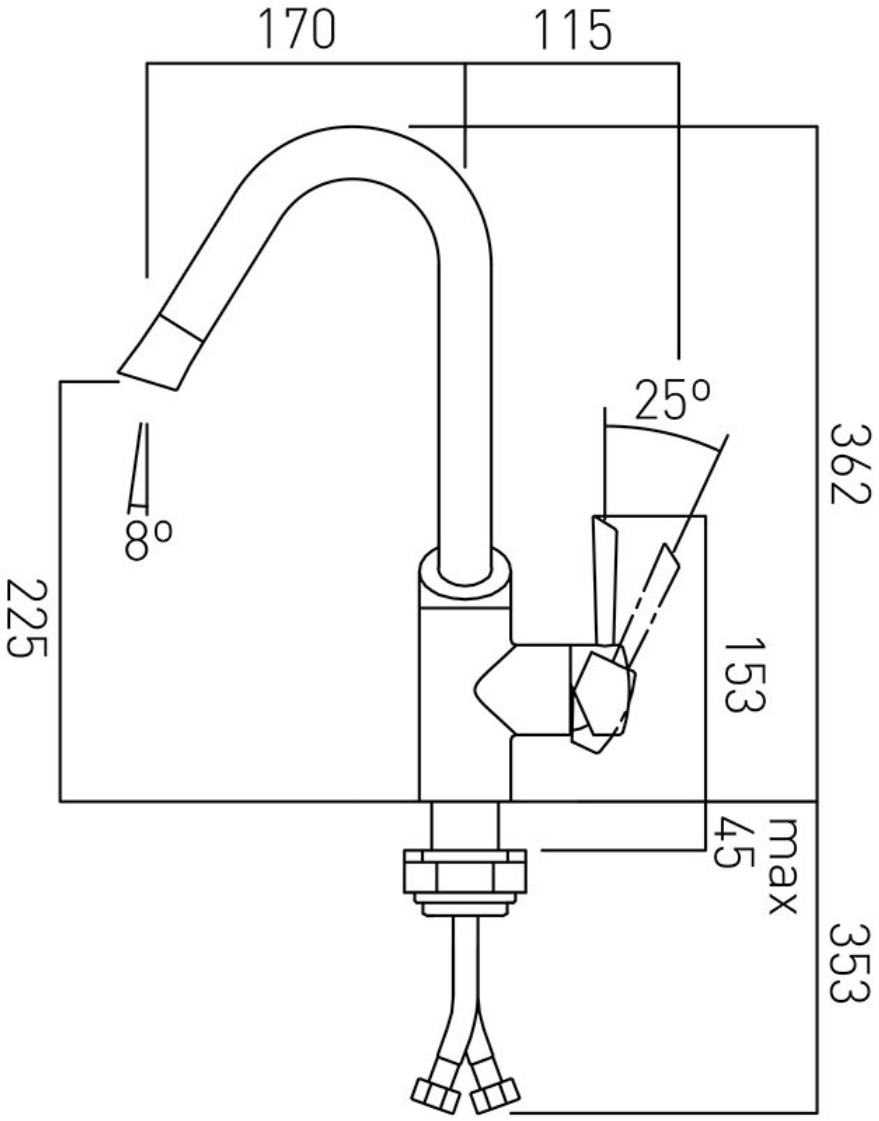

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VADO

Ecotherm thermostatic bar shower valve & kit

INSTALLATION INSTRUCTIONS

WRAS APPROVED PRODUCT

A7255AA & A7256AA

Shower valve pack with three function shower handset, hose & riser rail.

IMPORTANT
BEFORE CONNECTION, FLUSH WATER THROUGH PIPEWORK TO REMOVE ALL DEBRIS ETC. WHICH COULD DAMAGE THE VALVE MECHANISM

INSTALLER: After installation please pass this instruction booklet to user

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Product overview

This Ecotherm product is an exposed two-hole thermostatically controlled shower, designed to provide the user with comfortable and consistent showering temperatures. This product will provide water from ambient cold up to the pre-set safe maximum temperature.

This thermostatic shower mixer is manufactured to the highest standards.

1. PRODUCT BOX CONTENTS

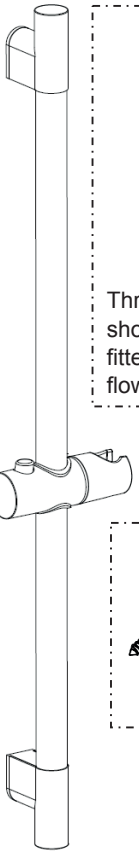

Three function shower handset, fitted with 8 L/min flow regulator

Combined convex strainer & seal, x2

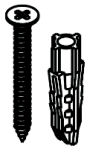

Screw pack for wall kit: Screws x6 (33 long) & wall plugs x6 (Ø6x27 long)

Screw pack for riser rail: Screws x4 (60 long) & wall plugs x4 (26 long)

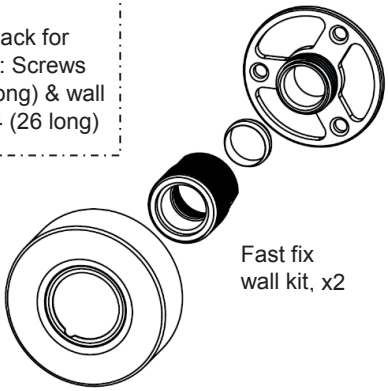

Fast fix wall kit, x2

Shower hose 1350mm long with 2x seals & protective end caps.

Riser kit, complete with sliding rail bracket & wall mount brackets

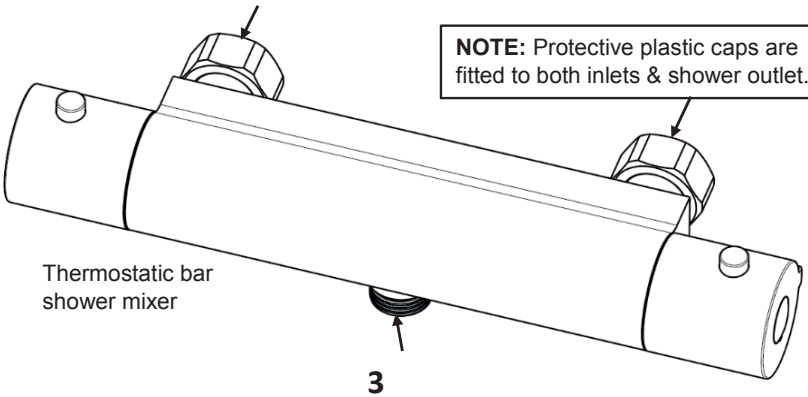

NOTE: Protective plastic caps are fitted to both inlets & shower outlet.

Thermostatic bar shower mixer

2. PRODUCT DIMENSIONS

Dimensions are in millimetres & may vary within permitted tolerances.

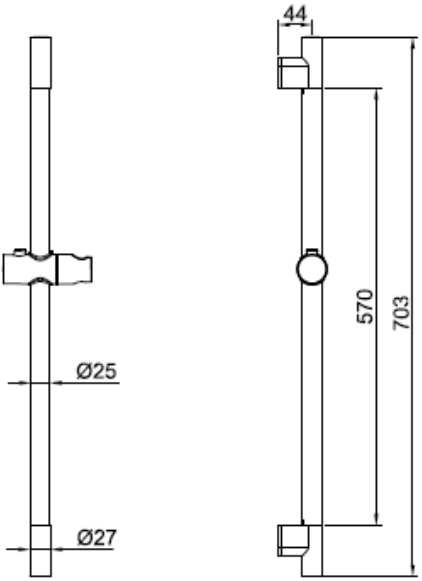

Riser rail, & sliding bracket

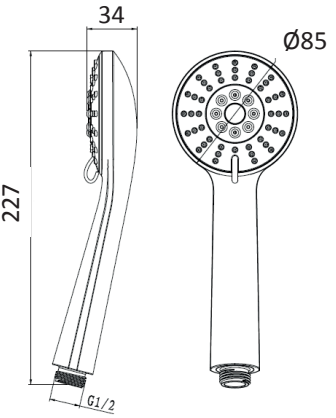

Three function hand shower

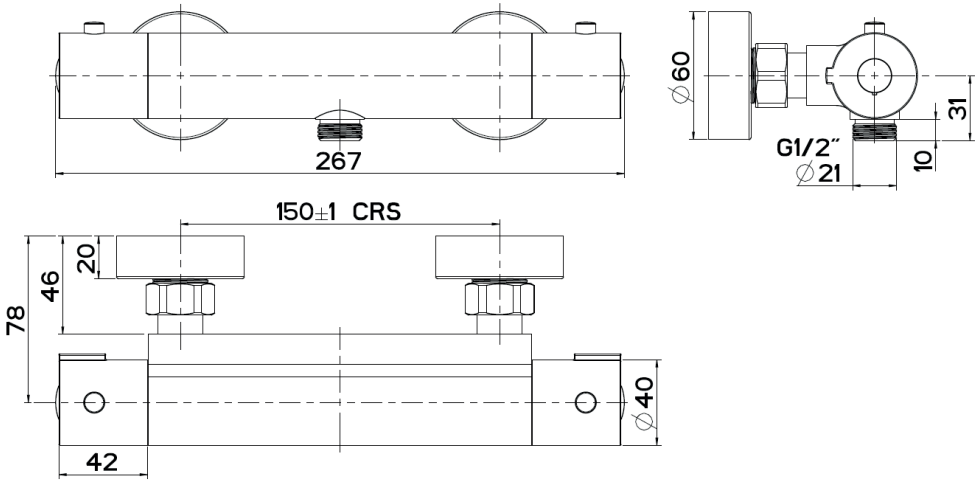

Complete bar shower mixer valve

3. INTRODUCTION

The fittings covered by these instructions should be installed in accordance with the Water Regulations published in 1999*.
Ideal Standard strongly recommends that these fittings are installed by a professional fitter.

*A guide to the Water Supply (Water Fittings) Regulations 1999 and the Water Byelaws 2000, Scotland is published by WRAS (Water Regulations Advisory Scheme) Unit 13, Willow Road, Pen-y-Fan Industrial Estate, Crumlin, Gwent, NP11 4EG. ISBN 0-9539708-0-9

These thermostatic shower mixers are designed to be installed on normal UK low pressure storage tank fed systems, unvented high pressure systems, modulating instantaneous water heaters or modulating combination (combi) boilers. They are suitable for all pumped applications.

WATER REGULATIONS

Hot and cold water supply pressures must be reasonably balanced and from a common source - both from storage or both from a supply pipe. (IRN 101). This mixer will function within specification on unequal pressures up to a ratio of **2:1**, but it is not recommended that the cold supply be connected to the rising main and hot to the tank fed supply as the pressure differential is likely to exceed the **2:1** ratio.
(See table 1) The minimum pressure for correct operation is **0.2 bar** (2m head). Pressure head is measured as the vertical distance between the bottom of the cold water storage tank which feeds the hot water system and the highest point on the shower spray plate. When installing with a shower pump the use of a secondary tapping from the cylinder is highly recommended.

Figure 1 shows the various methods of connecting the hot water pipe to the cylinder - the most preferred on the left and the least preferred on the right.
The fitting should be so installed as to be readily accessible for examination, repair, replacement or operation. (IRN 111).
The temperature of the hot water must not exceed 85ºC but the installer's attention is drawn to code of practice BS 6700 which recommends that stored hot water should normally never exceed 65ºC. For correct operation of the valve, a minimum of 55ºC is required.

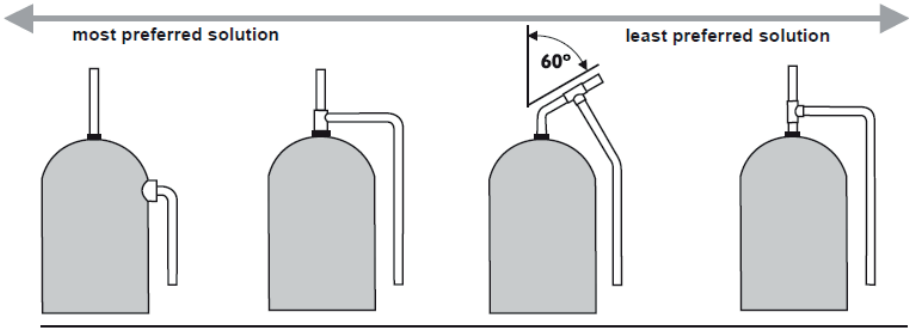

Fig.1
Preferred arrangements for cylinder tapping

Note: If water supply is fed by gravity then supply pressures should be verified to ensure the conditions of use are appropriate for the valve.

4. SUPPLY CONDITIONS

Table 1 Conditions of use

	BSEN1111
Operating pressure range:	High Pressure
Maximum static pressure	10 bar
Flow pressure hot and cold	0.5 to 5.0 bar
Hot supply temperature	55 to 65°C
Cold supply temperature	5 to 20°C
Temperature differential characteristic (TDC)	10 °C

Flow rate table

Pressure (Bar)	Flow Rate (Litres per Min)
0.2	5.6
0.5	8.1
1	11
2	15.2
3	18
4	21.5
5	23.8

MODULATING COMBI BOILER

This thermostatic shower valve is designed for use with modulating combination boilers.

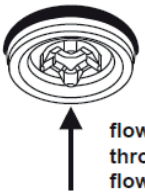

When installing on a modulating combination boiler it is sometimes possible for the interaction of a thermostatic valve with the combi to cause the boiler to cut out and cut in again. With the result that the water will become alternatively cold and hot. To overcome this, a 4 L/min flow regulator should be fitted upstream of the thermostatic valve. It should be fitted in any 15mm compression fitting in the dedicated cold supply pipe.
It is important to choose a compression fitting located in a position which is accessible after installation and it must be fitted the correct way round for the direction of flow. The regulator can be fitted in either the inlet or outlet side of the compression fitting. If fitting in an outlet side, ensure the o-ring is seated fully in the visible rebate around the edge of the regulator. Use the tip of a small screwdriver or similar to achieve this. Ensure the tail of the pipe is not fouling the regulator (shorten if required) and do up the compression fitting as normal. In a minority of cases, where the boiler is of a type which stores a small quantity of very hot water, it may also be necessary to fit a 4 l/min flow regulator in the hot supply. These can be obtained from Customer Care (A962570NU).

Service valves MUST be fitted to the supply pipes to permit future maintenance. Strainers (mesh filters) are integral to the mixer body.

These should be fitted as close as is practicable to the water supply inlets of the thermostatic shower valve. See section 19 for more details.

Both service valves & strainers should be installed in an easily accessible location.

5. WATER REGULATIONS

CATEGORIES OF RISK

The water regulations published in 1999* take a new approach to backflow in that they look at different categories of risk. The installer must assess the risk from the various categories of fluid in adjacent appliances before determining the level of backflow protection required for a particular installation. **Figures 3 & 4** describe the protection required in various installations.

CATEGORY 3 RISK

Water in a shower tray, basin or bathtub is considered to be a fluid category 3 risk which is a fluid which represents a slight health hazard if it were to find it's way back into the supply pipe. For this reason it must not be possible for any flexible shower head to be able to enter any adjacent washbasin, bath or shower tray unless appropriate protection is employed. **(See Figure 3)**. If it is desired to allow the hand spray to be used inside say a bathtub or a basin it is essential that double check valves be fitted to the inlet on both hot and cold supplies to the thermostatic valve. Alternatively single check valves can be fitted at the inlets and an additional check valve should be fitted in the valve outlet.
No check valves need be fitted if the hand spray is prevented from reaching closer than 25mm of the spill over level of any such fixture.

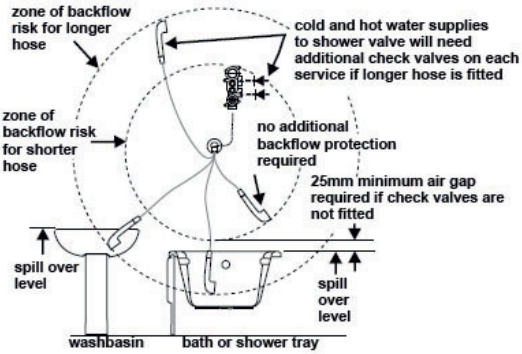

Fig. 3 Backflow risk from a fluid category 3

CATEGORY 5 RISK

Water in a Sink, WC or Bidet is considered to be a fluid category 5 risk which is a fluid which represents a serious health hazard if it were to find it's way back into the supply pipe. For this reason it must not be possible for any flexible shower head to be able to enter any adjacent Sink, WC or Bidet. If the flexible hose to be fitted could reach into any such vessel, the requirements to the system design are so onerous it is better not to fit a flexible. Rather, a fixed overhead showerhead should be considered. **(See Figure 4).**
It will also be seen that this risk could change should the hose be taken out of the restraining device or should a longer replacement hose be fitted at a later date. Installers and householders are advised to take account of these factors when fitting replacement hoses.
For pumped applications the pipe supplying the pump must not in addition supply an ascending spray bidet.

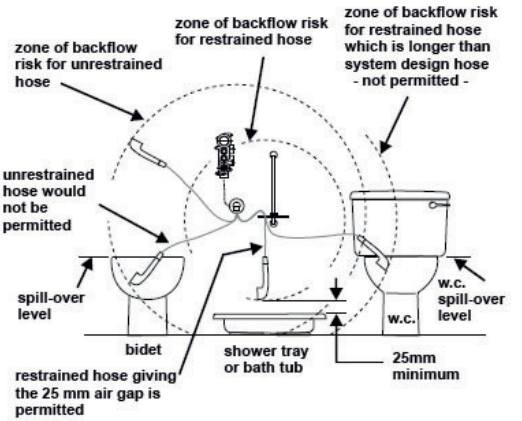

Fig. 4 Backflow risk from a fluid category 5

6. PRE-INSTALLATION NOTES

Product box contents. Ensure you have all the parts shown in section 1.

Product dimensions. Check the dimensions shown in section 2, ensuring the mixer will fit on the intended wall. Plan the fitting location of the shower kit.

Product location. Mixer should be positioned in a suitable location within the showering area. Allow sufficient space around the mixer to permit easy operation of the handles and facilitate easy cleaning. Consider also space to permit cartridge removal for maintenance.

Service Valves. A pair of service valves (for isolating both water supplies) MUST be fitted to permit future maintenance of this product. These should be fitted as close as practicable to the water supply inlets of the mixer & in an easily accessible location. Service valves are no*t* supplied with this product, see section 19.

Supply conditions. Ensure required water supply temperatures & pressures are met. Performance of mixers operating outside these conditions cannot be guaranteed. See section 4.

Mounting. Product is supplied with a pair of wall mount escutcheons. Mixers are intended to be installed on a solid wall or panel. Supply pipes are to be preinstalled at 150mm horizontal centres.

Water Supply Pipes. Both hot & cold water supply pipes should be securely attached to a wall using suitable fixing clips. Supply pipes must be Ø15mm for the fixing kit supplied.

Flow regulation. There are no flow regulators fitted inside the mixer body. The base of the shower hand set has an 8 L/min flow regulator fitted.

Strainers (mesh filters) **& check valves.** Strainers are integral to the inlet seals are intended to protect the check valves from water borne debris. These are fitted inside the inlets of this shower mixer

Shower Kit. This product is supplied with a shower kit. The flexible shower hose from this kit can be screwed onto the G1/2" shower outlet nipple located on the underside of the mixer body. Ensure adequate steps are taken to secure the shower hand set and the arrangements comply with water regulations.

Mixer Controls. The mixer has dual control handles, the right handle allows temperature adjustment of the water, the left handle permits flow control of the mixed water, see section 9.

IMPORTANT: Ensure that any old / existing thermostatic mixing valves (TMVs) that may be fitted in the supply pipes are removed

DO NOT apply heat near this product. Heat generated by soldering could damage plastic parts and seals

7. SHOWER VALVE INSTALLATION

The thermostatic mixing valve must be installed in such a position that maintenance of the TMV and its valves and the commissioning and testing of the TMV can be undertaken.

IMPORTANT
BEFORE CONNECTION, FLUSH WATER THROUGH PIPEWORK TO REMOVE ALL DEBRIS ETC. WHICH COULD DAMAGE THE VALVE MECHANISM

Product is supplied with a pair of wall mount escutcheons. Mixers are intended to be installed on a solid wall or panel. Both hot & cold water supply pipes should be securely attached to a wall using suitable fixing clips.

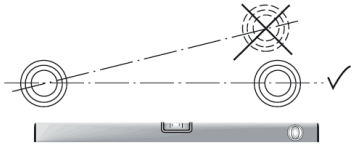

1 **1st fix: pipe installation**

Two 15mm water supply pipes need to be run within the wall cavity at 150mm centres apart to the intended fitting location of the shower mixer. Cut two holes of diameter 20-25mm in the wall board or solid wall. Ensure pipes are level.

During this "first fix" leave 50mm of pipe length protruding from the finished surface (tiles, aqua-board or similar).
Hot supply pipe should be on the left hand side and the cold on the right.

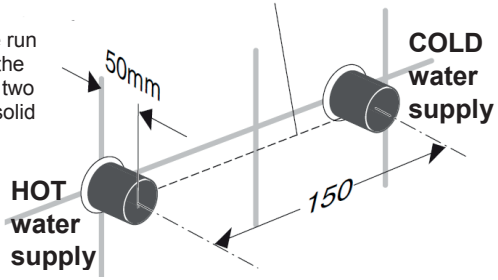

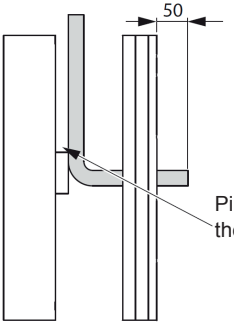

Leave more than 50mm of pipe protruding if the wall is to be tiled. The pipes can be temporarily capped to allow restoration of water supplies for pressure testing of pipe joints etc...

Tile closely to the supply pipes

Pipework should be supported in the cavity, to prevent the pipes slipping backwards during final assembly.

2 When the bar shower is ready to be fitted (after tiling if applicable). Both supply pipes should be trimmed to the final size of 23mm from the finished mounting surface.

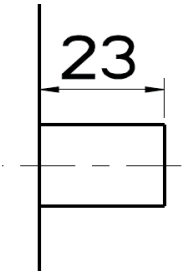

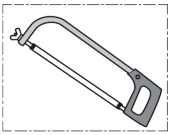

3 Place the mounting brackets over the protruding supply pipes, recheck pipes are still 150mm apart and level.

Mark the three screw hole positions through the mounting brackets onto the mounting surface.

Ensure that the positions of the holes will not result in damage to the pipework inside the wall cavity during drilling.

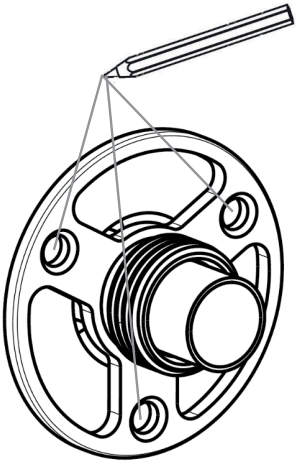

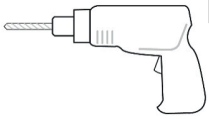

4 Drill holes appropriate for your choice of fixings into the mounting surface. The screws & wall plugs supplied can be used if they are suitable. Tap the wall plugs into the mounting surface until flush.

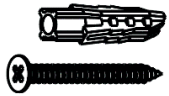

Note:-For plasterboard duct it will be necessary to fit extra strong cavity anchor plasterboard fixings as shown.

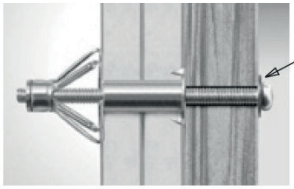

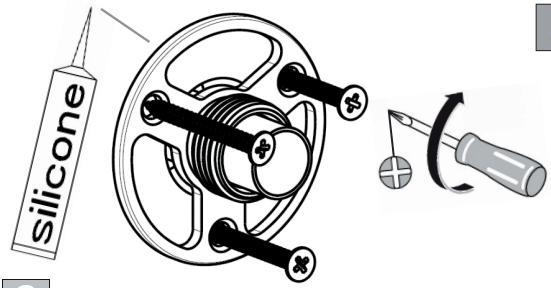

5 Apply a smear of silicone sealant to the rear of the brackets and push them over the pipework.

Screw both brackets to the wall. Check that the correct pipe spacing of 150mm has been maintained.

Clean off excess sealant and flush the pipes to remove any trapped debris.

6 Fit the olives to the pipes prior to screwing the two G3/4“connectors into the wall mount plate using an adjustable spanner (23mm on the two flats). The connectors will have to be securely screwed in - to form the necessary compression joint between the olive, wall plate and connector.

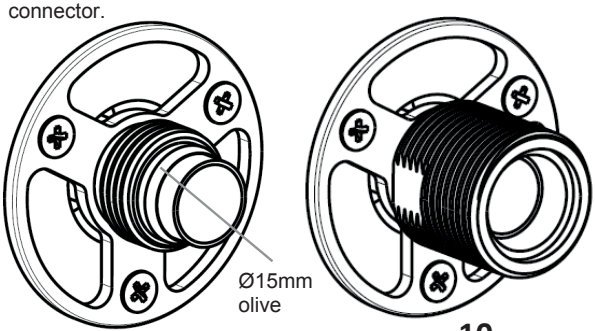

NOTE FOR IRELAND: 15mm olives are supplied with this product. Use ½” olives if ½” supply pipes are fitted.

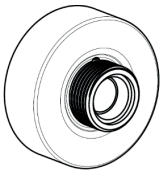

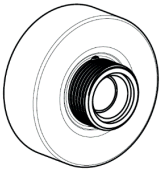

7 When the sealant has set, fit the covers by screwing them onto the adaptors until they are flush with the wall. The covers only need to be hand tight.

8 **NOTE:** First remove the protective plastic caps which are fitted to both inlets & the shower outlet of the mixer

Ensure the sealing washers are placed within the captive nuts of the shower mixer. The domed strainer should point towards the wall .Fit the shower mixer to the mounting bracket as shown.

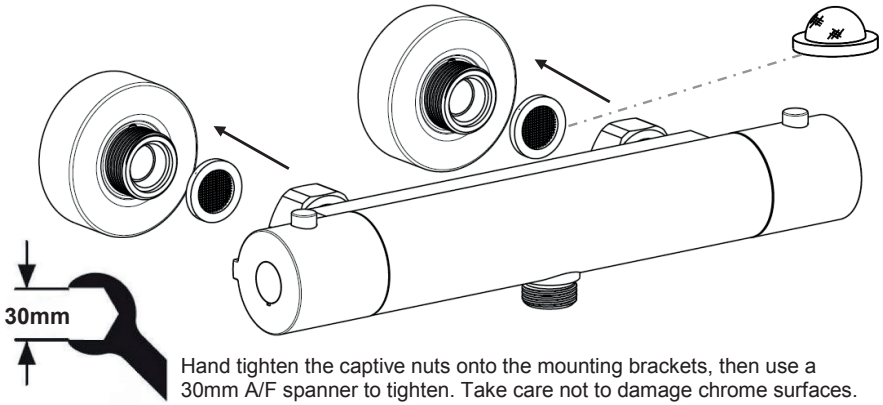

Hand tighten the captive nuts onto the mounting brackets, then use a 30mm A/F spanner to tighten. Take care not to damage chrome surfaces.

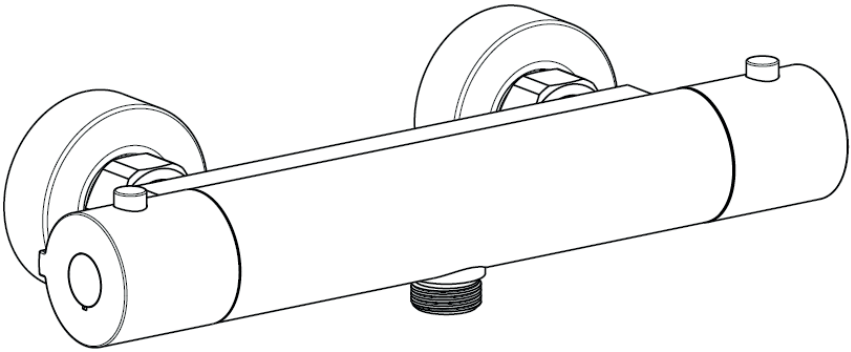

9 The shower hose can be screwed onto the outlet projecting from the bottom of the mixer. Ensure the flat seal is fitted inside the hose nut. Turn on the water supplies & check all joints for leaks.

8 RISER KIT INSTALLATION

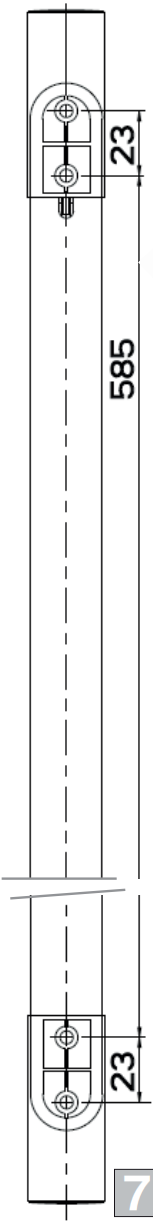

To install the riser rail, it is necessary to screw the upper & lower brackets onto the finished mounting surface at the desired location. Each bracket requires two screws (supplied). The distance between the inner two screws of the mounting brackets is 585mm as shown. The outer screws are then on 23mm centres.

1 Mark all four screw points on the mounting surface. Use a spirit level to check & ensure they are marked vertically. Ensure that the positions of the holes will not result in damage to any pipework inside the wall/cavity.

The type of mounting surface (tiled or aqua board etc...) will determine the type fixings to be used. For example on a tiled wall, wall plugs will be required.

2 For solid walls, drill hole sizes appropriate for your choice of fixings. The screws & wall plugs supplied can be used if they are suitable. Tap the wall plugs into the mounting surface until flush.

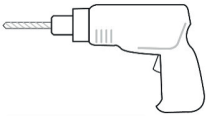

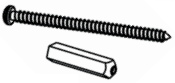

Note: using masking tape can help stop the drill bit from wandering.

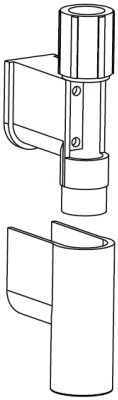

3 Separate the mounting brackets from the chrome covers by sliding apart. Start by fixing the lower bracket first using the fixing screws provided onto the mounting surface. The chrome cover can be replaced.

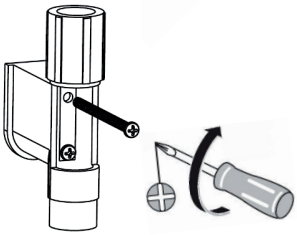

4 Push the riser rail tube (un-notched side) onto the location diameter of the lower bracket.

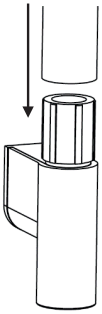

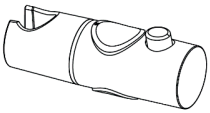

5 Ensure the sliding bracket for the shower handset is fitted to the riser rail tube. The operating button should be upper most, as shown. Can be left or right handed.

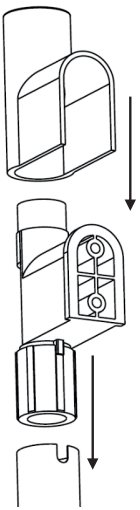

6 Push the location diameter of upper bracket into the riser rail tube. Rotate the riser rail tube until the notch is aligned.

7 Fit the screws into the upper bracket & secure, finally slide the chrome cover over the upper bracket.

One side of the shower hose should be screwed onto the bottom of the shower handset. The other side should be screwed onto the shower outlet on the underside of the shower valve.

9.0 SHOWER VALVE OPERATION

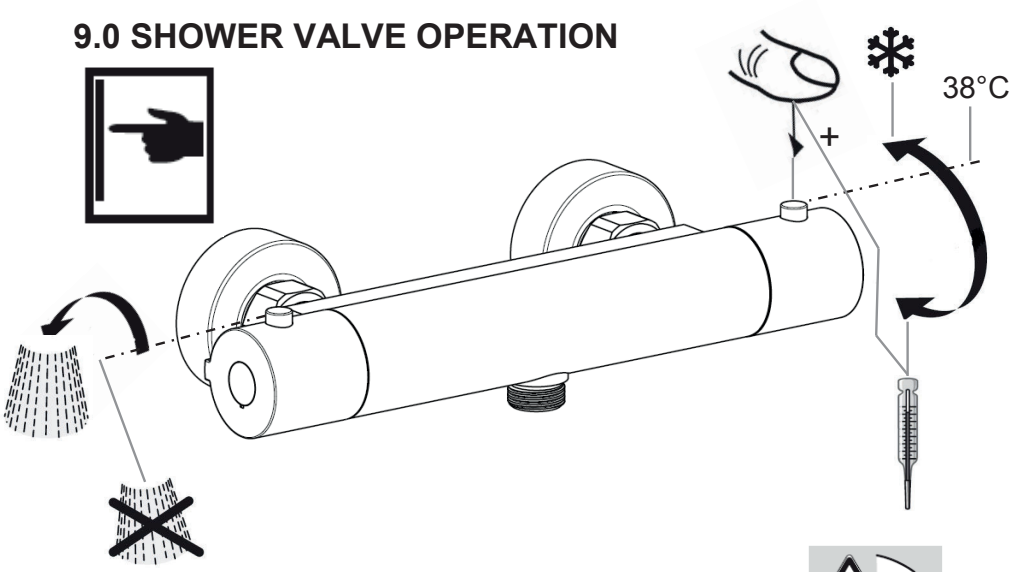

ATTENTION:
TEMPERATURES HIGHER 40°C CAN BE HARMFUL TO YOUR HEALTH.

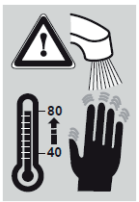

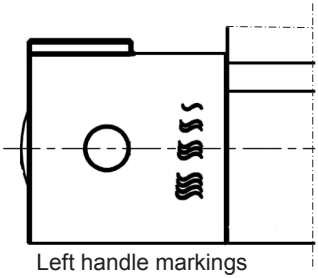

Left handle markings for flow (top view).

Left handle controls water flow rate.

- This handle is shown above parked in the off position.
- Rotating this handle backwards (anti-clockwise) commences water flow. By rotating the handle further backwards to the stop, it will increase the flow to the maximum of the product.
- To turn off the flow, rotate handle upwards up to the top stop.

Right handle controls water temperature.

- This handle is shown above parked in the nominal 38°C temperature “stop” position.
- At this temperature “stop” position mixed water is delivered up-to about 38°C.
- To obtain cooler water rotate handle backwards (clockwise).
- To obtain higher water temperature, press the button and then rotate this handle forwards (anti-clockwise).
- After pressing the override button, maximum water temperature available from the mixer is the nominal 44°C pre-set at the factory.

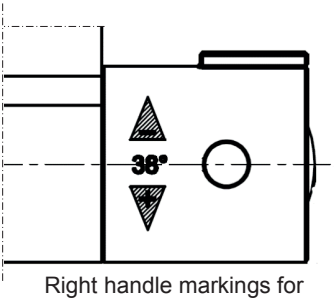

Right handle markings for temperature (top view).

DO NOT FORCE HANDLES BEYOND THE DESCRIBED MOVEMENT RANGES OTHERWISE THIS MAY RESULT IN DAMAGE TO BOTH VALVES AND HANDLES.

9.1 SHOWER HANDSET FUNCTIONS

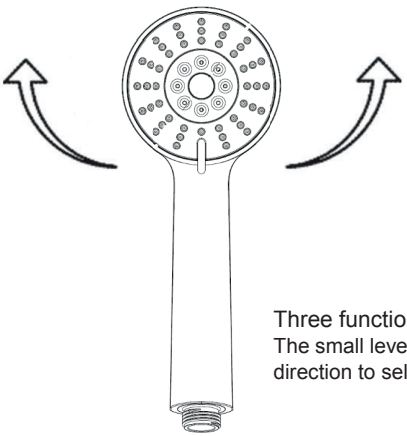

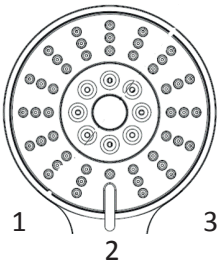

1. Outer spray.
2. Full spray.
3. Massage.

Three function hand shower
The small lever on the handset can be rotated in either direction to select the different jet-spray patterns.

9.2 SHOWER HEIGHT ADJUSTMENT

To adjust the height of the shower handset, simply press & hold the button on the top of the bracket. Slide the bracket along the rail to the desired height & then release the button to lock at this position

10.0 HANDLE REMOVAL

To remove either of the handles

A. Prise off the end cap (3).
B. Remove the screw (4).
C. Slide the handle (5) off from the cartridge spline to remove.

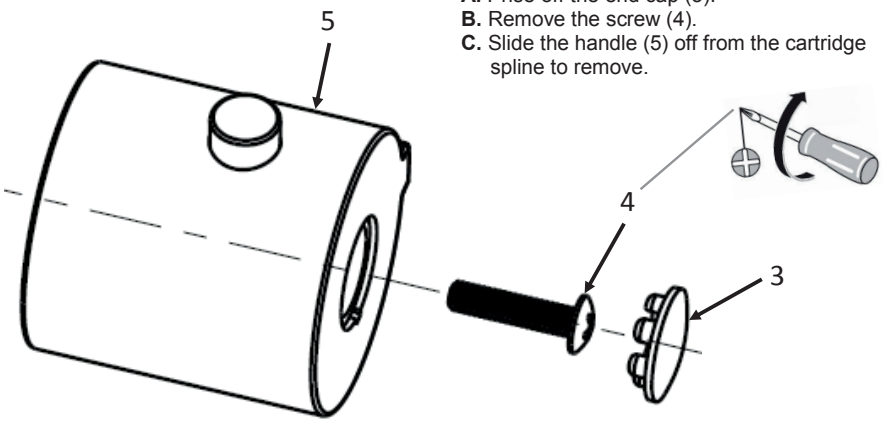

10.1 MAXIMUM TEMPERATURE STOP

Maximum hot water is obtained by pressing the override button & going pass the 38°C marker.

This shower mixer is factory set with the temperature stop at max. 44˚C.If after commissioning, the maximum temperature should be checked & adjusted if necessary.

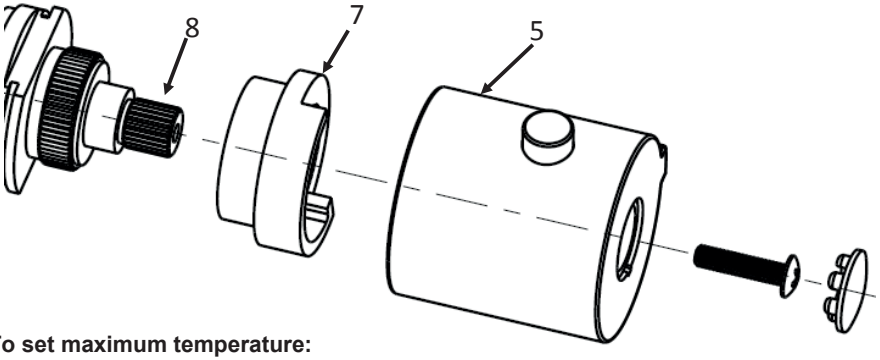

To set maximum temperature:

A. Remove the temperature handle (5) (right hand side), see section 10.0

B. With the temperature stop (7) still fitted to the cartridge spindle (8) turn the cartridge spindle to adjust the water temperature. Turning anticlockwise will increase the maximum temperature output setting whilst turning the spindle clockwise will decrease it.

C. Refit the handle so the handle-stop meets the right hand side of the stop on the temperature stop.

D. Turn on the flow control handle and wait for a few moments. Test the temperature of the water. Repeat this sequence until maximum desired temperature is achieved.

11. MAINTENANCE

The fitting of isolation valves is required as close as is practicable to the water supply inlets of the thermostatic mixing valve. The thermostatic cartridge seldom fails and the possibility of blocked filters should be investigated before contemplating replacing it. Small particles of debris may still find their way past the strainers to the thermostatic cartridge. These should be cleaned and re-fitted. See section 16 on cartridge replacement.

11.1 Thermostatic Cartridge Ageing

Following many years of normal service you may notice the following:
1. The need to carry out more frequent adjustment of mixed temperature.
2. The thermostatic element may not pass the CWI test.

These issues could be due to the ageing of the thermostat which loses some expansion capability over time.

These are the principle objectives of testing, as they serve to indicate to maintenance staff the declining performance capability of the thermostatic cartridge.

For this reason the audit testing flow chart highlights that 2nd Instance CWI test failure or 2nd instance mixed deviation even with stable ‘as commissioned’ supply conditions and correct inlet supply Δt’s, is potentially the first indication of the need to replace the cartridge.

12. COMMISSIONING & PERIODIC CHECKS

The following procedures should be carried out after installation and every 12 months after to ensure that the valve is functioning correctly.

Check that:

1. The application of the thermostatic valve matches the approved designation.
2. The supply pressures are within the recommended range for the application.
3. The supply temperatures are within the permitted range for the application and comply with the guidance for prevention of Legionella.
4. The mixed temperature is as required for the application.

Record:

5. Each hot and cold supply. (Make a note of the measuring device used).
6. The mixed water temperature at the outlet device.

Isolate:

7. The cold supply to the mixing valve and record the mixed water temperature after about 5 seconds. The temperature should not exceed the value given in table (2) below.

Table 2 A guide to maximum temperature sets

Application	Mixed water temperature	Permitted maximum temperature rise during site testing
Shower	41°C	43°C

Note: *46°C is the maximum mixed water temperature from a bath tap. The maximum temperature takes account of the allowable temperature tolerances inherent thermostatic mixing valves and temperature loss in metal baths.* ***It is not a safe bathing temperature for adults and children.***

The British Burns Association recommends 37°C-37.5°C as a comfortable bathing temperature for Children.
In premises covered by the Care Standards Act 2000, the maximum mixed water temperature is 43°C

13. FREQUENCY OF REGULAR SERVICING

The purpose of servicing regularly is to monitor the performance of changes in system and valve set up. This may require the need to adjust either the supply system or the valve. The product should be checked and tested 12 months after commissioning.

Firstly measure the water temperature at the shower outlet.

Carry out the cold water supply isolation test by isolating the cold water supply to the TMV, wait for 5 seconds if water is still flowing check that the temperature is below 46C. If there is no significant change to the set outlet temperature (+/-2ºC or less change from the original settings) and the fail-safe shut off is functioning, then the valve is working correctly and no further service work is required.

Notes:
A residual flow is permitted during the commissioning or the annual verification (cold water supply isolation test), then this is acceptable providing the water temperature is no more than 2ºC above the designated outlet temperature.

Temperature readings should be taken at the normal flow rate after allowing for the system to stabilize.

The sensing part of the thermometer probe must be fully submerged in the water that is to be tested.

Any TMV that has been adjusted or serviced must be re-commissioned and retested in accordance with the instructions detailed above.

14. COLD WATER ISOLATION (CWI) TEST

CWI test is a guide to showing the performance of the thermostat.

Prior to CWI test:

- Make sure the supply temperatures are within the ranges 55 to 65°C for hot, & 5 to 20°C for cold.

To perform a CWI test:

- Turn the product on using the flow handle, & rotate handle to max, giving 100% flow.
- The temperature handle should be positioned such that it gives 40°C to the outlet.

1. Record the steady state temperature of both hot and cold water supplies. Note the Δt.
2. Record the temperature of the mixed water at the outlet (preferably unscrew the shower hand set) should be within range 40±1°C.
3. Isolate the cold water supply (using inline service valve).

If the flow ceases, CWI test passed. An ongoing reduced fine flow of water (pencil stream) from the mixed water outlet is also acceptable as a pass.
Restore the cold supply & recheck the temperature at the mixed water outlet once stabilised.

If the flow has not reduced, the product has failed the CWI test. Product requires maintenance, cartridge should be removed, cleaned & retested.
Additionally, clean all filters, ensure check valves are working, and make sure all isolating valves are fully open.

15. HANDY MAINTENANCE TIPS

Here are a few handy tips which may be helpful when dismantling the mixer for maintenance or repair:

- Isolate both HOT & COLD water supplies first. Use the inline service valves fitted.
- Fully open the flow handle. Unscrew the shower hose from the underside of the product. This will permit water drain down mixer & release water pressure from the outlet.
- Use correct size tools. Take care not to damage chromed surfaces.
- When unscrewing cartridges, expect some trapped water to escape from the mixer.
- Clean all parts before refitting, especially strainers (mesh filters).
- Ensure parts are re-assembled in the correct ‘reverse’ sequence.
- Observe torque settings, where specified.
- Restore both water supplies. Refit shower hose.
- Check all joints for leaks upon completion.
- Run water through the mixer for a few seconds to purge-out any trapped air.

16. THERMOSTATIC CARTRIDGE REPLACEMENT

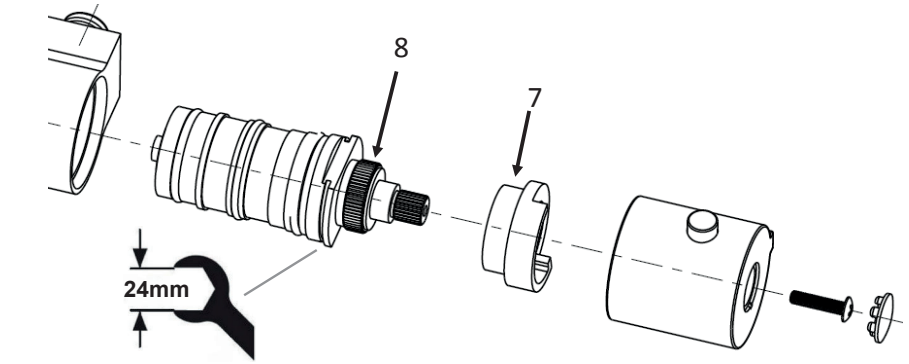

This thermostatic cartridge is protected from water borne debris by mesh filter screens. These should be checked and cleaned before contemplating replacing the cartridge.

To replace the thermostatic cartridge: (FIRST SEE HANDY TIPS, in section 15).

A. Remove the temperature handle (right hand side), see section 10.0
B. Slide off the temperature stop (7) from the cartridge spline. This will expose the thermostatic cartridge (8).
C. Unscrew the cartridge with 24mm A/F spanner and replace if necessary.

To clean the screens remove the O-rings. The screens will then slide off.
When clean replace the screens. The O-rings should be lightly greased with a WRAS approved silicone grease (e.g. Klueber Unisilikon GBU2).

17. FLOW CARTRIDGE REPLACEMENT

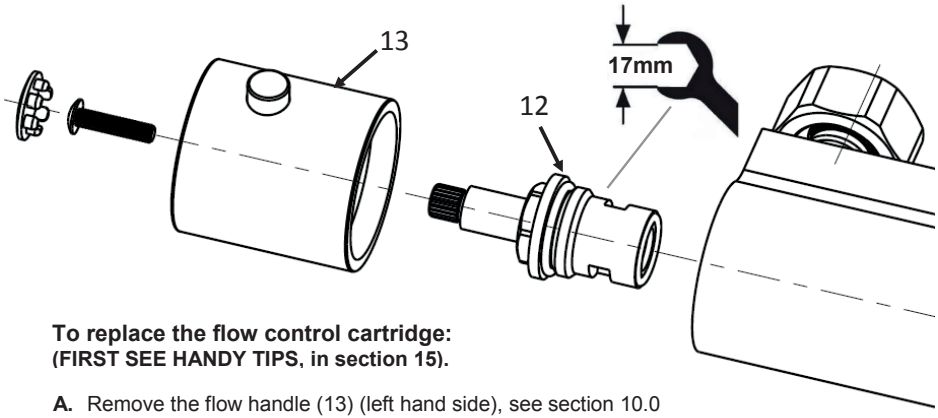

To replace the flow control cartridge:
(FIRST SEE HANDY TIPS, in section 15).

A. Remove the flow handle (13) (left hand side), see section 10.0
B. This will expose the flow cartridge (12).
C. Unscrew cartridge with 17mm A/F spanner and replace if necessary.

18. CHECK VALVES REPLACEMENT

Check valves and strainers (mesh filters) should be regularly serviced particularly in hard water areas. The check valves along with the strainers are located in the retaining nut.

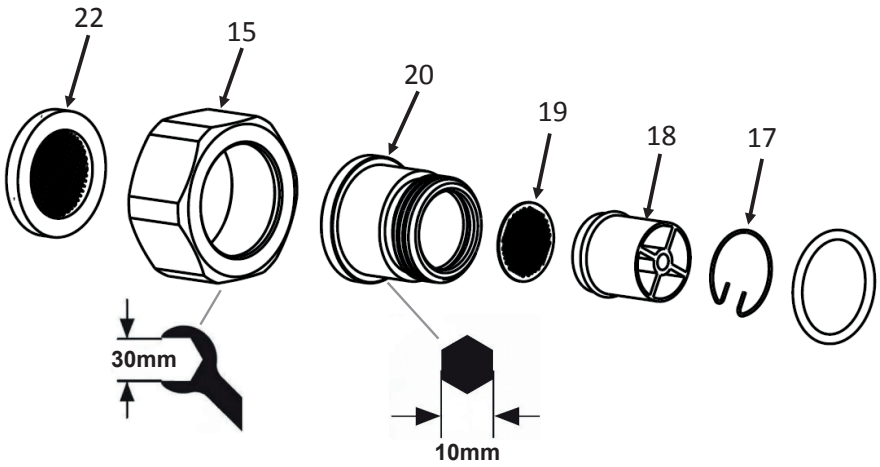

To replace the check valves: (FIRST SEE HANDY TIPS, in section 15).

- **A.** Separate the shower valve from the wall mounts by undoing the captive nuts (15). Use 30mm A/F spanner (take care not to damage chromed surfaces).
- **B.** Remove shower valve from wall. Clean & keep the sealing washers (22) safe.
- **C.** The check valves are housed inside the retaining inserts (20) within the inlet bores.
- **D.** Use 10mm hexagonal key undo the retaining inserts (20). Note: THREAD IS LEFT HAND.
- **E.** Use a pair of "long nose pliers" to squeeze the tangs of the retaining ring (17) & lift out.
- **F.** Gently pull out the check valves (18): check & clean or replace if necessary. Observe the flow direction of the check valve.
- **G.** Remove & clean the secondary finer strainer (19) (mesh filter).
- **H.** Reassemble the parts in reverse sequence.

19. INLINE SERVICE VALVES

Service valves (not supplied with this product) MUST be fitted to permit future maintenance.
They are also needed to perform the cold water isolation test.

These should be fitted as close as is practicable to the water supply inlets of the thermostatic shower valve & be in an easily accessible location.

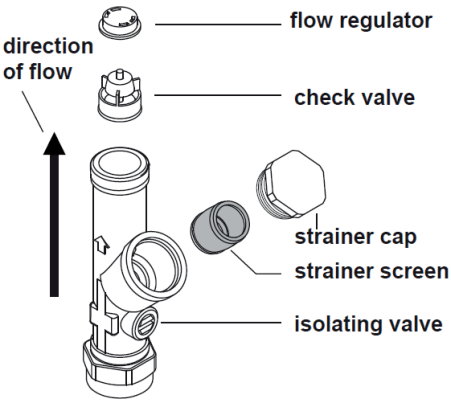

An in-line combined service valve (shown here) can be purchased by contacting Customer Care.

Spares code E960613NU contains a pair of these valves, suitable for 15mm supply pipes.

This valve also contains a flow regulator and check valve (which can be removed if not required).

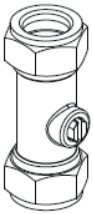

Alternatively, basic in-line service valves with "isolating only" feature (shown here) are available under spares code S9005AA.

fast part

For more information on spare parts why not visit our spare website
www.fastpart-spares.co.uk

20. SPARE PARTS

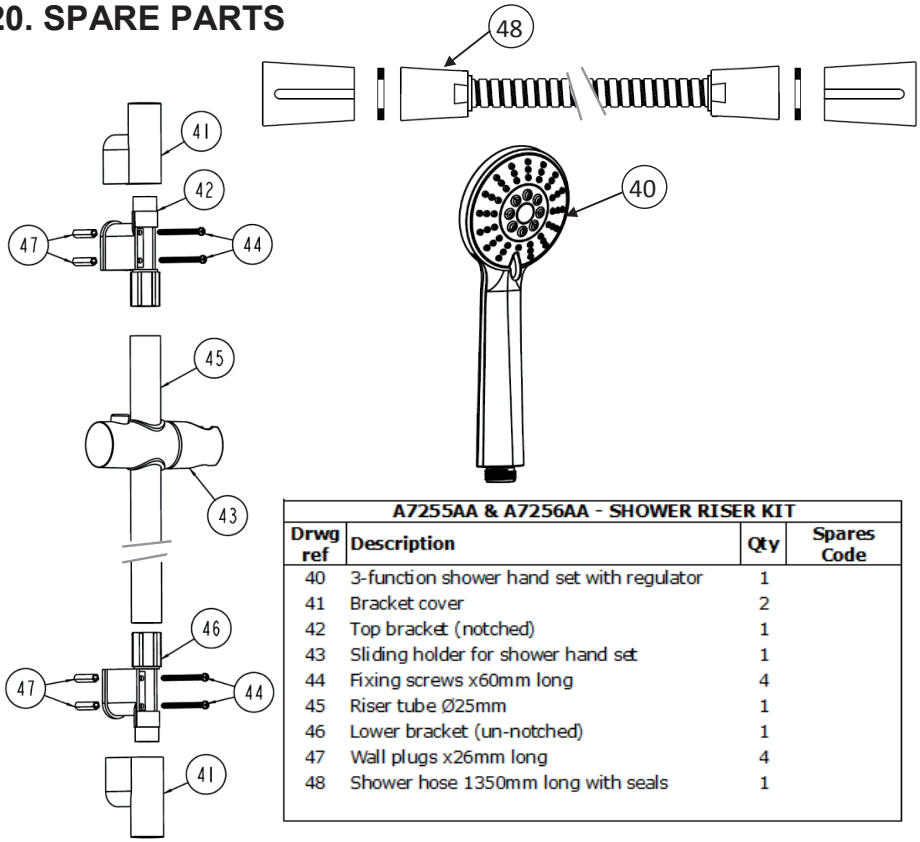

A7255AA & A7256AA - SHOWER RISER KIT			
Drwg ref	Description	Qty	Spares Code
40	3-function shower hand set with regulator	1	
41	Bracket cover	2	
42	Top bracket (notched)	1	
43	Sliding holder for shower hand set	1	
44	Fixing screws x60mm long	4	
45	Riser tube Ø25mm	1	
46	Lower bracket (un-notched)	1	
47	Wall plugs x26mm long	4	
48	Shower hose 1350mm long with seals	1	

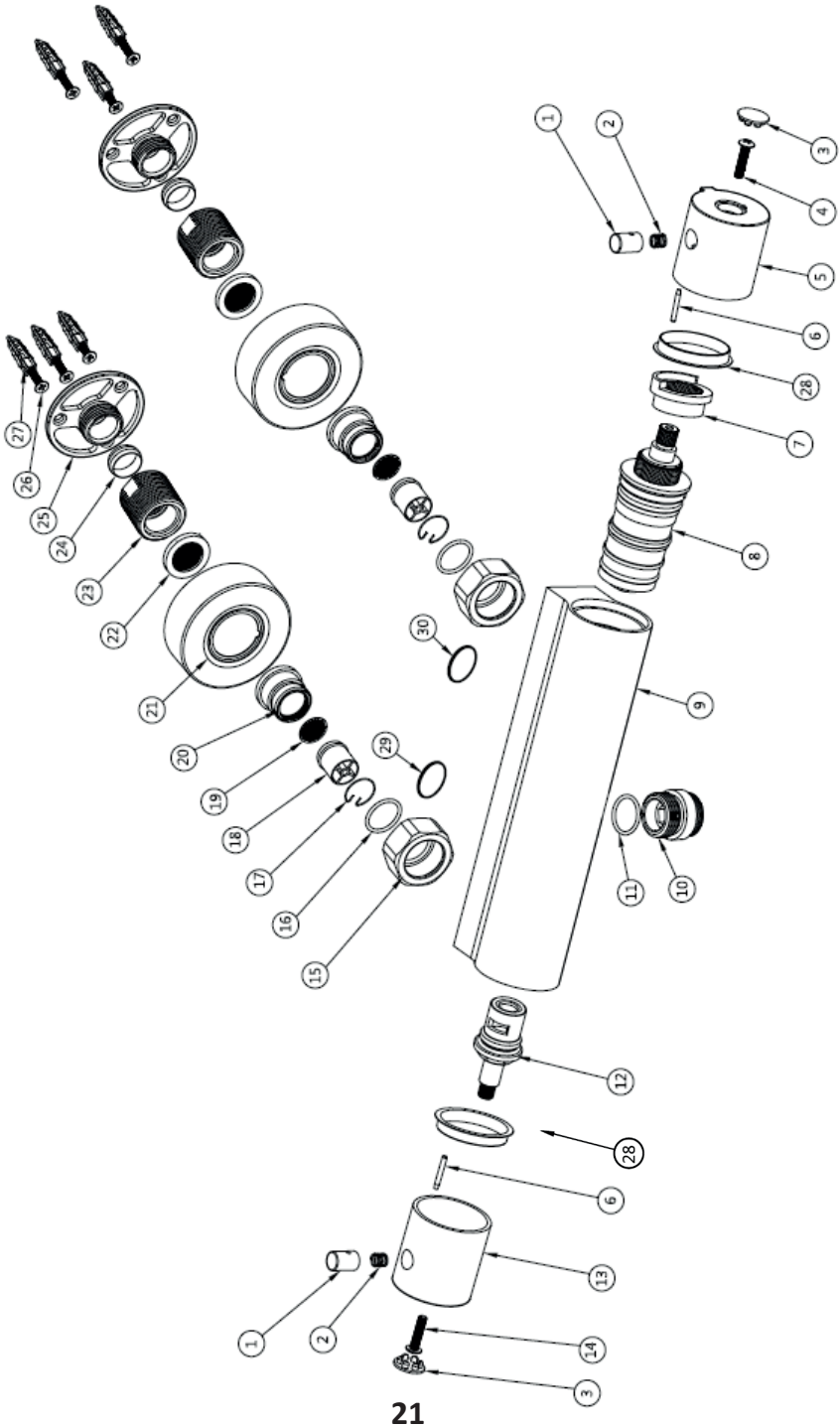
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SPARE PARTS LIST

A7255AA & A7256AA - BAR SHOWER MIXER			
Drwg ref	**Description**	**Qty**	**Spares Code**
1	Handle button	2	
2	Spring for button	2	
3	Handle end cover cap	2	
4	M4x16 Screw - therm handle	1	
5	Thermostatic handle	1	
6	Pin for handle button	2	
7	Therm handle temperature stop ring	1	
8	Thermostatic cartridge	1	
9	Bar shower valve body	1	
10	1/2" shower outlet connector	1	
11	O-ring Ø18x2	1	
12	On-off flow cartridge 1/4 turn ceramic disc	1	
13	Flow handle	1	
14	M4x12 Screw - flow handle	1	
15	Inlet coupling nut	2	
16	O-ring Ø15x1.8	2	
17	Snap ring Ø16x1	2	
18	Check valve DW15/DN10-GF (PAIR)	2	A962594NU
19	Filter screen flat - fine mesh	2	
20	Check valve housing	2	
21	Cylindrical wall shroud	2	
22	Combined convex filter screen & seal	2	
23	Fast wall fixing connector G3/4"	2	
24	Copper olive Ø15mm	2	
25	Fast wall fixing bracket	2	
26	Wall screw	6	
27	Wall plug	6	
28	Handle bush	2	
29	Hot water sticker	1	
30	Cold water sticker	1	

fast part
For more information on spare parts why not visit our spare website
www.fastpart-spares.co.uk

21. CLEANING CHROME SURFACES

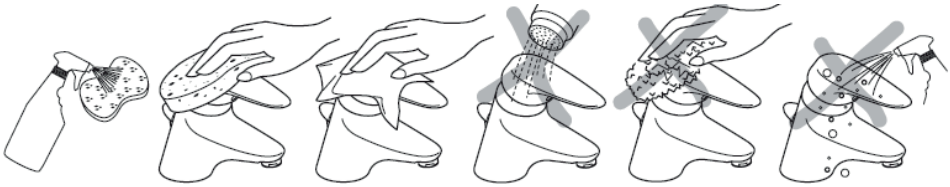

Whilst this product has a high quality durable chrome finish, it should nevertheless be treated with care.
When cleaning chromed products use only a mild detergent, rinse & wipe dry with a soft cloth. Ideally clean after each use to maintain appearance.

Never use abrasive, scouring powders or scrapers. Never use cleaning agents containing alcohol, ammonia, hydrochloric acid, sulphuric acid, nitric acid, phosphoric acid or organic solvents.
Use of incorrect cleaning products / methods may result in chrome damage which is not covered by the manufacturer's guarantee.

22. GUARANTEE

This mixer body & chrome finish are offered with a 5-year guarantee against defects in manufacture. The thermostatic cartridge, flow cartridge, shower handset, hose, & riser rail parts are covered with a 2-year guarantee.
This mixer must be fitted by a competent installer. If in doubt seek advice from a qualified professional.

The guarantee requires the product be used in the manner for which it was intended and that it is installed & maintained in accordance with the fitting instructions and local water bylaws. The guarantee covers products for domestic use.

Ensure this product is fully tested before concealing joints into the wall. On installation ensure that the valve and valve inlet threads can be removed or serviced in accordance with water regulations.

The guarantee is invalidated should the valve be damaged by water borne debris. Make sure that supply pipes are clear of any debris prior to installation, this is particularly important on new plumbing installations. In the unlikely event that this product should fail during the guarantee period we will either replace the faulty part or the complete unit as appropriate.

This guarantee excludes normal wear and tear. This guarantee covers failure of the thermostatic cartridge within the first 2 years of purchase. Replacement cartridges are available to purchase by contacting the Customer Care Help Line. Failure to follow the terms outlined above will invalidate this guarantee. Proof of purchase will be required to validate any guarantee claims.

CUSTOMER CARE HELP LINE

0870 129 6085

CUSTOMER CARE FAX

01482 499611

E-MAIL

UKcustcare@idealstandard.com

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Ideal Standard, The Bathroom Works, National Avenue Kingston-Upon-Hull, HU 4HS, England.

01/19 - A868516

SPECIFICATION SHEET

COLLECTION: CELSIUS
PRODUCT CODE: CEL-148D/2/SQ-C/P

DESCRIPTION:
DX Celsius
concealed 2 outlet, 2 handle thermostatic
shower valve with integrated diverter
wall mounted
with rectangular backplate
thermostatic cartridge V-704-34S
diverter cartridge C-803-33X/3X
2 x 3/4" female inlets
2 x 3/4" female outlets
includes 3/4" - 1/2" adaptors
inc. bleed valve for system flush on installation
min-max wall mount 70-95mm
optimum installation depth 82mm
minimum operating pressure 0.2 bar LP (shower)
minimum operating pressure 1.0 bar MP (bath)

FINISH:
Chrome

FLOW REGULATOR:
N

MINIMUM OPERATING PRESSURE:
0.2 bar LP (shower) 1.0 bar MP (bath)

FLOW RATE AT 3.0 BAR FLOW PRESSURE:
30 l/min

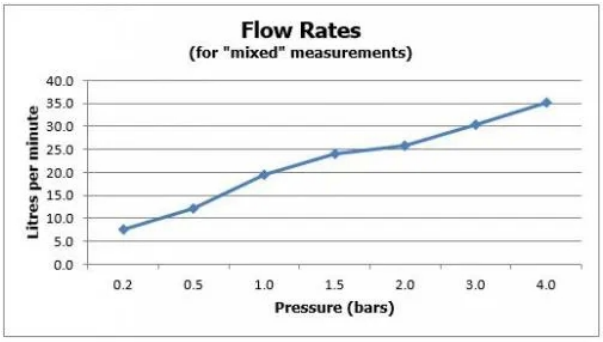

15 year guarantee

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email: sales@vado.com
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VADO

TECHNICAL DRAWING

COLLECTION: CELSIUS
PRODUCT CODE: CEL-148D/2/SQ-C/P

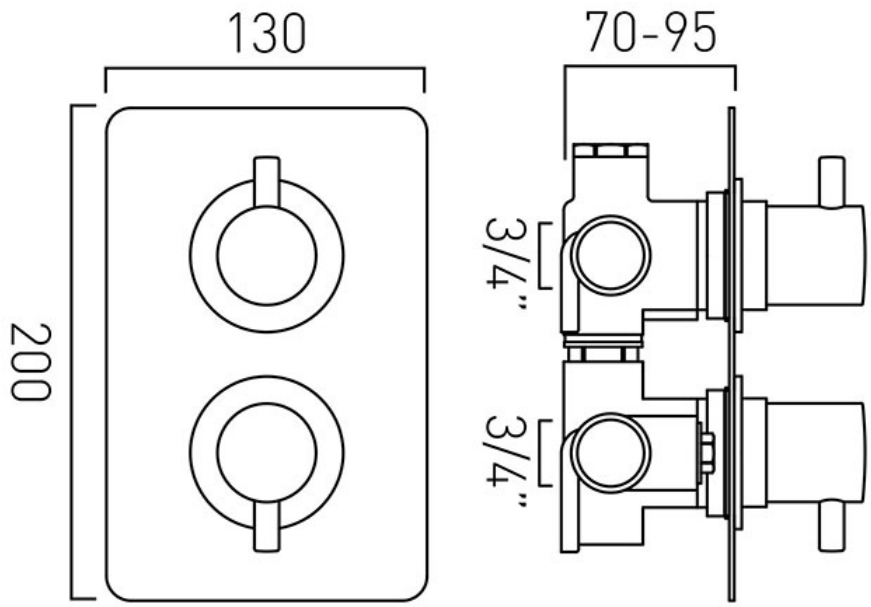

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SPECIFICATION SHEET

COLLECTION: LIFE
PRODUCT CODE: LIF-200/SB-CP

DESCRIPTION:
slimline mono basin mixer
single lever
deck mounted
smooth bodied
without universal basin waste
with directional water flow aerator
ceramic cartridge C010-N25
2 x 1/2" x 400mm flexipipe connections
deck mount drill hole diameter 35mm
minimum operating pressure 1.0 bar MP

FINISH:
Chrome

FLOW REGULATOR:
FR-100/5-PLA

MINIMUM OPERATING PRESSURE:
1.0 bar MP

FLOW RATE AT 3.0 BAR FLOW PRESSURE:
4.6 l/m

15 year guarantee

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VADO

TECHNICAL DRAWING

COLLECTION: LIFE
PRODUCT CODE: LIF-200/SB-CP

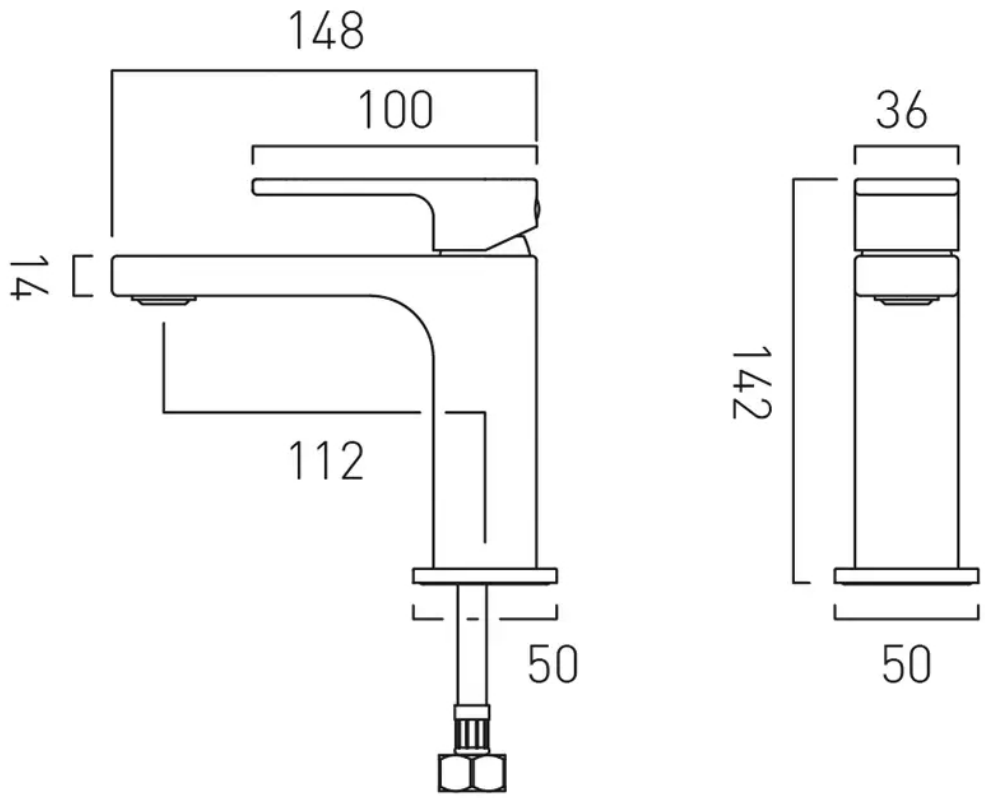

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VADO

SPECIFICATION SHEET

COLLECTION: ION
PRODUCT CODE: CUC-1006-C/P

DESCRIPTION:
Ion
mono kitchen mixer
single lever
deck mounted
with swivel spout
ceramic cartridge C-005-N25
minimum operating pressure 1.0 bar MP

FINISH:
Chrome

FLOW REGULATOR:
FR-100/5-PLA

MINIMUM OPERATING PRESSURE:
1.0 bar MP

FLOW RATE AT 3.0 BAR FLOW PRESSURE:
10 l/min

15 year guarantee

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VADO

TECHNICAL DRAWING

COLLECTION: ION
PRODUCT CODE: CUC-1006-C/P

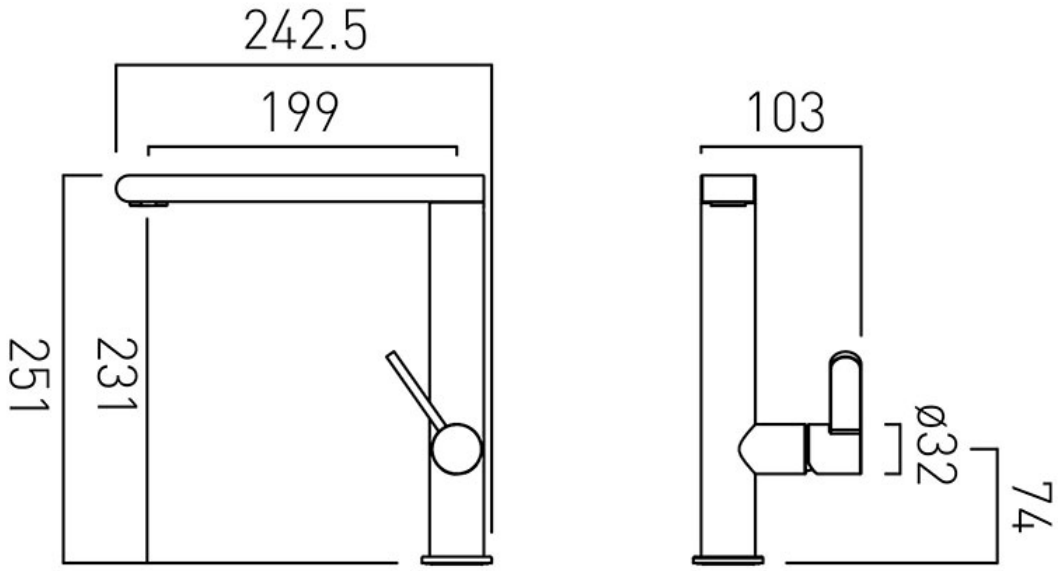

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VADO

User Manual

GETTING STARTED? EASY.

ZDLN1521

EN User Manual
Dishwasher

ZANUSSI

VISIT OUR WEBSITE TO:

Get usage advice, brochures, trouble shooter, service and repair information:
www.zanussi.com/support

⚠ SAFETY INFORMATION

Before the installation and use of the appliance, carefully read the supplied instructions. The manufacturer is not responsible for any injuries or damage that are the result of incorrect installation or usage. Always keep the instructions in a safe and accessible location for future reference.

CHILDREN AND VULNERABLE PEOPLE SAFETY

- This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning the use of the appliance in a safe way and understand the hazards involved.
- Children between 3 and 8 years of age and persons with very extensive and complex disabilities shall be kept away from the appliance unless continuously supervised.
- Children of less than 3 years of age should be kept away from the appliance unless continuously supervised.
- Children should be supervised to ensure that they do not play with the appliance.
- Keep detergents away from children.
- Keep children and pets away from the appliance when the door is open.
- Children shall not carry out cleaning and user maintenance of the appliance without supervision.

GENERAL SAFETY

- This appliance is for cleaning household-type dishes and tableware only.
- This appliance is designed for single household domestic use in an indoor environment.

- This appliance may be used in, offices, hotel guest rooms, bed & breakfast guest rooms, farm guest houses and other similar accommodation where such use does not exceed (average) domestic usage levels.
- Do not change the specification of this appliance.
- The operating water pressure (minimum and maximum) must be between 0.5 (0.05) / 10 (1.0) bar (MPa)
- Follow the maximum number of 13 place settings.
- If the supply cord is damaged, it must be replaced by the manufacturer, its Authorised Service Centre or similarly qualified persons in order to avoid a hazard.
- WARNING: Knives and other utensils with sharp points must be loaded in the basket with their points down or placed in a horizontal position.
- Do not leave the appliance with the open door unattended to avoid stepping accidentally onto it.
- Before any maintenance operation, deactivate the appliance and disconnect the mains plug from the socket.
- Do not use high pressure water sprays and/or steam to clean the appliance.
- If the appliance has ventilation openings in the base, they must not be covered e.g. by a carpet.
- The appliance is to be connected to the water mains using the new supplied hose-sets. Old hose sets must not be reused.

SAFETY INSTRUCTIONS

INSTALLATION

WARNING! Only a qualified person must install this appliance.

- Remove all the packaging.
- Do not install or use a damaged appliance.
- Follow the installation instructions supplied with the appliance.
- Always take care when moving the appliance as it is heavy. Always use safety gloves and enclosed footwear.
- Do not install or use the appliance where the temperature is less than 0 °C.
- Install the appliance in a safe and suitable place that meets installation requirements.
- Do not use the appliance before installing it in the built-in structure due to safety manner.

ELECTRICAL CONNECTION

WARNING! Risk of fire and electric shock.

- Warning: this appliance is designed to be installed / connected to a grounding connection in the building.
- Make sure that the parameters on the rating plate are compatible with the electrical ratings of the mains power supply.
- Always use a correctly installed shockproof socket.

- Do not use multi-plug adapters and extension cables.
- Make sure not to cause damage to the mains plug and to the mains cable. Should the mains cable need to be replaced, this must be carried out by our Authorised Service Centre.
- Connect the mains plug to the mains socket only at the end of the installation. Make sure that there is access to the mains plug after the installation.
- Do not pull the mains cable to disconnect the appliance. Always pull the mains plug.
- This appliance is fitted with a 13 A mains plug. If it is necessary to change the mains plug fuse, use only a 13 A ASTA (BS 1362) fuse (UK and Ireland only).

WATER CONNECTION

- Do not cause damage to the water hoses.
- Before connection to new pipes, pipes not used for a long time, where repair work has been carried out or new devices fitted (water meters, etc.), let the water flow until it is clean and clear.
- Ensure that there are no visible water leaks during and after the first use of the appliance.
- If the water inlet hose is damaged, immediately close the water tap and disconnect the mains plug from the mains socket. Contact the Authorised Service Centre to replace the water inlet hose.

USE

- Do not put flammable products or items that are wet with flammable products in, near or on the appliance.
- Dishwasher detergents are dangerous. Follow the safety instructions on the detergent packaging.
- Do not drink and play with the water in the appliance.
- Do not remove the dishes from the appliance until the programme is complete. Some detergent may remain on the dishes.
- Do not store items or apply pressure on the open door of the appliance.
- The appliance can release hot steam if you open the door while a programme operates.

SERVICE

- To repair the appliance contact the Authorised Service Centre. Use original spare parts only.
- Please note that self-repair or non-professional repair can have safety consequences and might void the guarantee.
- The following spare parts will be available for 7 years after the model has been discontinued: motor, circulation and drain pump, heaters and heating elements, including heat pumps, piping and related equipment including hoses, valves, filters and aquastops, structural and interior parts related to door assemblies, printed circuit boards, electronic displays, pressure switches, thermostats and sensors, software and firmware including reset software. Please note that some of these spare parts are only available to professional repairers, and that not all spare parts are relevant for all models.
- The following spare parts will be available for 10 years after the model has been discontinued: door hinge and seals, other seals, spray arms, drain filters, interior racks and plastic peripherals such as baskets and lids.
- Concerning the lamp(s) inside this product and spare part lamps sold separately: These lamps are intended to withstand extreme physical conditions in household appliances, such as temperature, vibration, humidity, or are intended to signal information about the operational status of the appliance. They are not intended to be used in other applications and are not suitable for household room illumination.

DISPOSAL

WARNING! Risk of injury or suffocation.

- Disconnect the appliance from the mains supply.
- Cut off the mains cable and discard it.
- Remove the door catch to prevent children and pets to get closed in the appliance.

INSTALLATION

WARNING! Refer to Safety chapters.

BUILDING IN

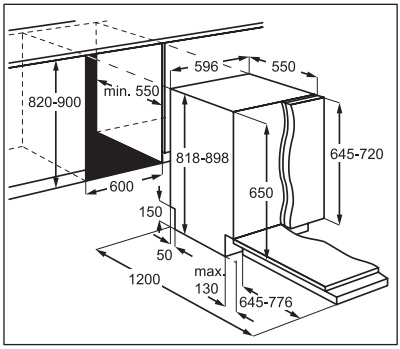

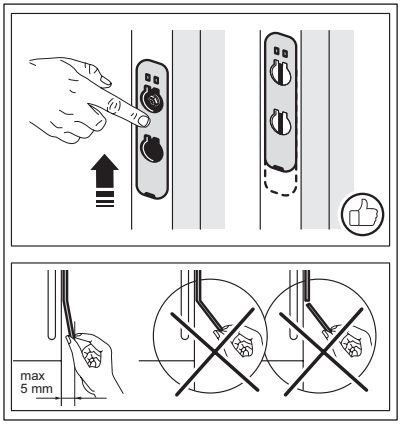

SAFETY CAPS

If the furniture panel is not installed, open the appliance door carefully to avoid the risk of injury.

After installation, make sure the plastic covers are locked in position. Damage or removal of the plastic covers on the sides of the door may impact the functionality of the appliance and may cause an injury. If the plastic cover is damaged, contact the Authorized Service Centre to replace it with the new one.

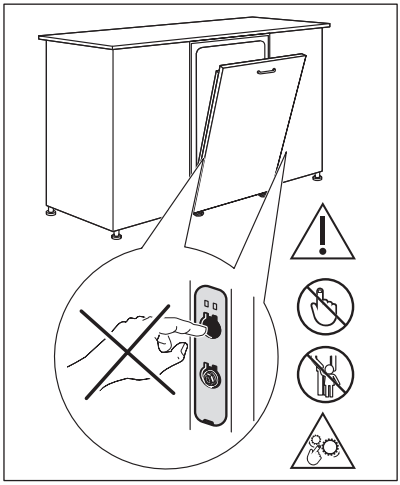

PRODUCT DESCRIPTION

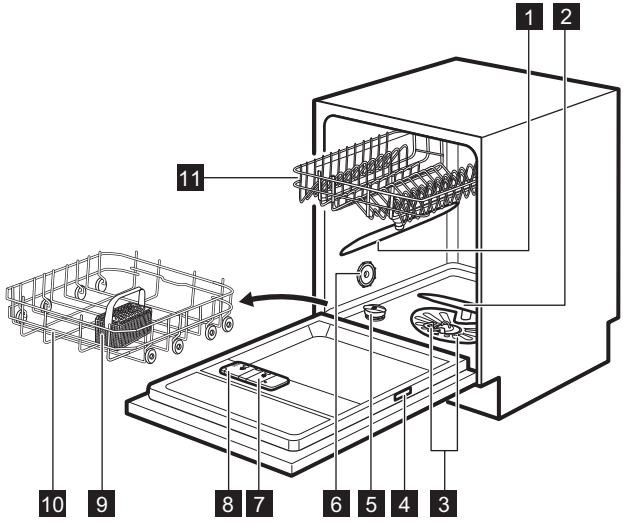

1 Upper spray arm
2 Lower spray arm
3 Filters
4 Rating plate
5 Salt container
6 Air vent
7 Rinse aid dispenser
8 Detergent dispenser
9 Cutlery basket
10 Lower basket
11 Upper basket

The graphic is a general overview. For more details, refer to other chapters or documents provided with the appliance.

CONTROL PANEL

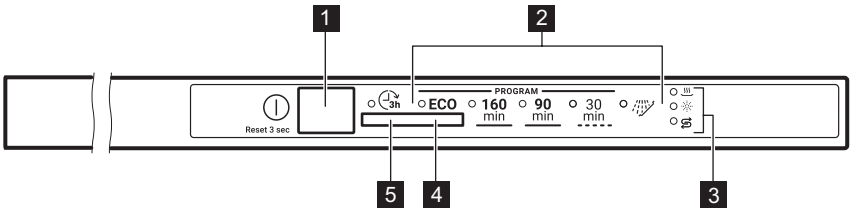

1 On/off button / Reset button
2 Programme indicators

3 Indicators
4 Programme button
5 Delay button

INDICATORS

Indicator	Description
	Drying phase indicator. It is on when you select a programme with the drying phase. It flashes when the drying phase operates.
	Salt indicator. It is on when the salt container needs refilling. It is always off while the programme operates.
	Rinse aid indicator. It is on when the rinse aid dispenser needs refilling. It is always off while the programme operates.

PROGRAMMES

The order of the programmes in the table may not reflect their sequence on the control panel.

Programme	Dishwasher load	Degree of soil	Programme phases
ECO 1)	Crockery, cutlery, pots, pans	Normal, lightly dried-on	▪ Prewash ▪ Dishwashing 50 °C ▪ Intermediate rinse ▪ Final rinse 60 °C ▪ Drying ▪ AirDry 2)
160 min	Crockery, cutlery, pots, pans	Normal to heavy, dried-on	▪ Prewash ▪ Dishwashing 60 °C ▪ Intermediate rinse ▪ Final rinse 60 °C ▪ Drying ▪ AirDry 2)
90 min	Crockery, cutlery, pots, pans	Normal, lightly dried-on	▪ Dishwashing 60 °C ▪ Intermediate rinse ▪ Final rinse 55 °C ▪ Drying ▪ AirDry 2)
30 min	Crockery, cutlery	Fresh	▪ Dishwashing 50 °C ▪ Intermediate rinse ▪ Final rinse 50 °C ▪ AirDry 2)

Programme	Dishwasher load	Degree of soil	Programme phases
3)	All	All	▪ Prewash

1) This programme offers the most efficient use of water and energy consumption for crockery and cutlery with normal soil. This is the standard programme for test institutes. This programme is used to assess compliance with the UK Ecodesign for Energy-Related Products and Energy Information Regulations.
2) Automatic door opening during the drying phase. Refer to "Settings".
3) With this programme, you can quickly rinse off food remains from dishes and prevent odours forming in the appliance. Do not use detergent with this programme.

CONSUMPTION VALUES

Programme 1)2)	Water (l)	Energy (kWh)	Duration (min)
ECO	9.9	0.936	227
160 min	12.4	1.168	160
90 min	10.6	0.985	90
30 min	10.2	0.618	30
	4.2	0.015	15

1) The pressure and the temperature of the water, the variations of the mains supply, the options, the quantity of dishes and the degree of soil can change the values.
2) The values for programmes other than ECO are indicative only.

Information for test institutes

To receive the necessary information for conducting performance tests (e.g. according to: BS EN60436), send an email to:

info.test@dishwasher-production.com

In your request, include the product number code (PNC) from the rating plate.

For any other questions regarding your dishwasher, refer to the service book provided with your appliance.

SETTINGS

PROGRAMME SELECTION MODE AND USER MODE

When the appliance is in programme selection mode it is possible to set a programme and to enter user mode.

Settings available in the user mode:

- The level of water softener according to the water hardness.
- Activation or deactivation of the rinse aid empty notification.
- Activation or deactivation of the acoustic signal for the end of a programme.
- Activation or deactivation of the AirDry.

As the appliance stores the saved settings, there is no need to configure it before every cycle.

How to set the programme selection mode

The appliance is in programme selection mode when the programme indicator ECO flashes. After activation, the appliance is in programme selection mode by default. If not, set the programme selection mode the following way:

Press and hold the on/off button until the appliance is in programme selection mode.

How to enter user mode

Make sure the appliance is in programme selection mode.

To enter the user mode, press and hold the programme button until the indicator **ECO** flashes and the indicators **160** min, **90** min and 30 min are on.

THE WATER SOFTENER

The water softener removes minerals from the water supply, which would have a negative effect on the washing results and on the appliance.

The higher the content of these minerals, the harder your water is. Water hardness is measured in equivalent scales.

The water softener should be adjusted according to the hardness of the water in your area. Your local water authority can advise you on the hardness of the water in your area. Set the right level of the water softener to assure good washing results.

Water hardness

German degrees (°dH)	French degrees (°fH)	mmol/l	mg/l (ppm)	Clarke degrees	Water softener level
47 - 50	84 - 90	8.4 - 9.0	835 - 904	58 - 63	10
43 - 46	76 - 83	7.6 - 8.3	755 - 834	53 - 57	9
37 - 42	65 - 75	6.5 - 7.5	645 - 754	46 - 52	8
29 - 36	51 - 64	5.1 - 6.4	505 - 644	36 - 45	7
23 - 28	40 - 50	4.0 - 5.0	395 - 504	28 - 35	6
19 - 22	33 - 39	3.3 - 3.9	325 - 394	23 - 27	5 **1)**
15 - 18	26 - 32	2.6 - 3.2	255 - 324	18 - 22	4
11 - 14	19 - 25	1.9 - 2.5	185 - 254	13 - 17	3
4 - 10	7 - 18	0.7 - 1.8	70 - 184	5 - 12	2
<4	<7	<0.7	<70	< 5	1 **2)**

1) Factory setting.
2) Do not use salt at this level.

Regardless of the type of detergent used, set the proper water hardness level to keep the salt refill indicator active.

Multi-tabs containing salt are not effective enough to soften hard water.

Regeneration process

For the correct water softener operation, the resin of the softener device needs to be regenerated regularly. This process is automatic and is the part of the normal dishwasher operation.

When the prescribed quantity of water (see values in the table) has been used since the previous regeneration process, a new regeneration process will be initiated between the final rinse and the programme end.

Water softener level	Amount of water (l)
1	250
2	100

Water softener level	Amount of water (l)
3	62
4	47
5	25
6	17
7	10
8	5
9	3
10	3

In case of the high water softener setting, it may occur also in the middle of the programme, before the rinse (twice during a programme). Regeneration initiation has no impact on the cycle duration, unless it occurs in the middle of a programme or at the end of a programme with a short drying phase. In such cases, the regeneration prolongs the total duration of a programme by additional 5 minutes.

Subsequently, the rinsing of the water softener that lasts 5 minutes may begin in the same cycle or at the beginning of the next programme. This activity increases the total water consumption of a programme by additional 4 litres and the total energy consumption of a programme by additional 2 Wh. The rinsing of the softener ends with a complete drain.

Each performed softener rinse (possible more than one in the same cycle) may prolong the programme duration by another 5 minutes when it occurs at any point at the beginning or in the middle of a programme.

All the consumption values mentioned in this section are determined in line with the currently applicable standard in laboratory conditions with water hardness 2.5mmol/L (water softener: level 3) according to the regulation: UK Ecodesign 2021/745.
The pressure and the temperature of water as well as the variations of the mains supply can change the values.

How to set the water softener level

Make sure the appliance is in user mode.

1. Wait until the indicator $\overset{\text{SSS}}{\underline{\quad}}$ starts to flash, the indicator **ECO** continues to flash and the remaining indicators are off.

The intermittent flashing of the indicator $\overset{\text{SSS}}{\underline{\quad}}$ shows the current setting: e.g. 5 flashes + pause + 5 flashes = level 5.

2. Press the programme button repeatedly to change the setting. Each pressing of the programme button increases the level number. After reaching the level 10, the count starts again from the level 1.
3. Press the on/off button to confirm the setting.

THE RINSE AID EMPTY NOTIFICATION

The rinse aid helps to dry the dishes without streaks and stains. It is automatically released during the final rinse.

When the rinse aid chamber is empty, the rinse aid indicator turns on. If the drying results are satisfactory while using multi-tablets only, you can deactivate the notification for refilling the rinse aid. However, for best drying performance, always use rinse aid.

If standard detergent or multi-tablets without rinse aid are used, activate the notification to keep the rinse aid refill indicator active.

How to deactivate the rinse aid empty notification

Make sure the appliance is in user mode.

1. Press the programme button immediately.

The indicator $\overset{160}{\text{min}}$ starts to flash.

2. Wait until the indicator $\overset{160}{\text{min}}$ continues to flash and the remaining programme indicators are off.

The indicator $\overset{\text{SSS}}{\underline{\quad}}$ shows the current setting:

- $\overset{\text{SSS}}{\underline{\quad}}$ is on = Rinse aid empty notification is on.
- $\overset{\text{SSS}}{\underline{\quad}}$ is off = Rinse aid empty notification is off.

3. Press the programme button to change the setting.
4. Press the on/off button to confirm the setting.

ACOUSTIC SIGNALS

Acoustic signals sound when a malfunction of the appliance occurs. It is not possible to deactivate these acoustic signals.

There is also an acoustic signal that sounds when the programme is completed. By default this acoustic signal is deactivated but it is possible to activate it.

How to activate the acoustic signal for the end of the programme

Make sure the appliance is in user mode.

1. Press the programme button twice.

The indicator 90 min starts to flash.

2. Wait until the indicator 90 min continues to flash and the remaining programme indicators are off.

The indicator $\underset{\sim\sim\sim}{\sim\sim\sim}$ shows the current setting:

- $\underset{\sim\sim\sim}{\sim\sim\sim}$ is off = The acoustic signal is off.
- $\underset{\sim\sim\sim}{\sim\sim\sim}$ is on = The acoustic signal is on.

3. Press the programme button to change the setting.
4. Press the on/off button to confirm the setting.

AIRDRY

AirDry improves the drying results with less energy consumption. During the drying phase, the door opens automatically and remains ajar.

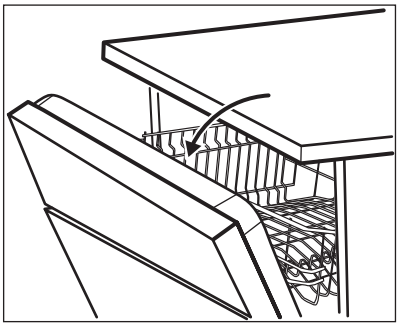

CAUTION! Do not try to close the appliance door within 2 minutes after automatic opening. This can cause damage to the appliance.

AirDry is automatically activated with all programmes excluding (if applicable). The duration of the drying phase and the door opening time vary depending on the selected programme and options.

CAUTION! If children have access to the appliance, it is advised to deactivate AirDry as opening the door may pose a danger.

How to deactivate the AirDry

Make sure the appliance is in user mode.

1. Press the programme button three times.

The indicator 30 min starts to flash.

2. Wait until the indicator 30 min continues to flash and the remaining programme indicators are off.

The indicator $\underset{\sim\sim\sim}{\sim\sim\sim}$ shows the current setting:

- $\underset{\sim\sim\sim}{\sim\sim\sim}$ is off = AirDry is off.
- $\underset{\sim\sim\sim}{\sim\sim\sim}$ is on = AirDry is on.

3. Press the programme button to change the setting.
4. Press the on/off button to confirm the setting.

BEFORE FIRST USE

1. **Make sure that the current level of the water softener agrees with the hardness of the water supply. If not, adjust the level of the water softener.**
2. Fill the salt container.
3. Fill the rinse aid dispenser.
4. Open the water tap.
5. Start a programme to remove any processing residuals that can still be inside the appliance. Do not use detergent and do not put dishes in the baskets.

After starting the programme, the appliance recharges the resin in the water softener for up to 5 minutes. The washing phase starts only after this procedure is complete. The procedure is repeated periodically.

THE SALT CONTAINER

CAUTION! Use rough salt designed for dishwashers only. Fine salt increases the risk of corrosion.

The salt is used to recharge the resin in the water softener and to assure good washing results in daily use.

HOW TO FILL THE SALT CONTAINER

1. Turn the cap of the salt container counterclockwise and remove it.
2. Put 1 litre of water in the salt container (only for the first time).
3. Fill the salt container with 1 kg of salt (until it is full).

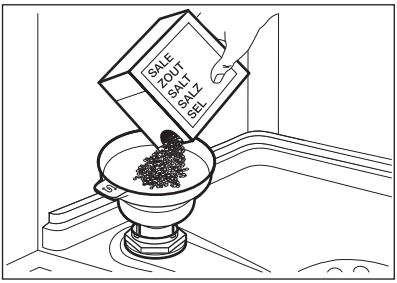

4. Carefully shake the funnel by its handle to get the last granules inside.
5. Remove the salt around the opening of the salt container.

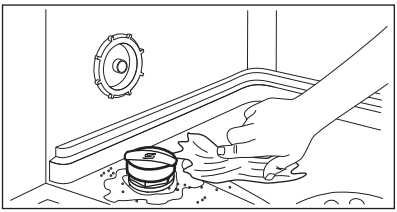

6. Turn the cap of the salt container clockwise to close the salt container.

CAUTION! Water and salt can come out of the salt container when you fill it. After you fill the salt container, immediately start a programme to prevent corrosion.

HOW TO FILL THE RINSE AID DISPENSER

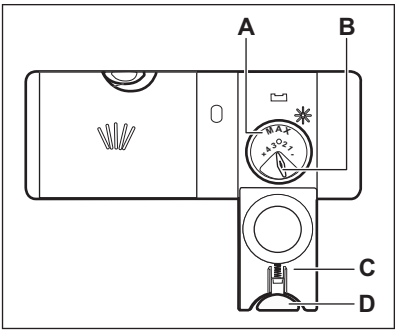

CAUTION! The compartment (**A**) is for rinse aid only. Do not fill it with detergent.

CAUTION! Only use rinse aid designed specifically for dishwashers.

1. Press the release button (**D**) to open the lid (**C**).
2. Fill the dispenser (**A**) until the rinse aid reaches the marking "MAX".
3. Remove the spilled rinse aid with an absorbent cloth to prevent excessive foam formation.
4. Close the lid. Make sure that the release button locks into position.

You can turn the selector of the released quantity (**B**) between position 1 (lowest quantity) and position 4 or 6 (highest quantity).

DAILY USE

1. Open the water tap.
2. Press the on/off button to activate the appliance.

Make sure that the appliance is in programme selection mode.

- If the salt indicator is on, fill the salt container.

- If the rinse aid indicator is on, fill the rinse aid dispenser.

3. Load the baskets.
4. Add the detergent.
5. Set and start the correct programme for the type of load and the degree of soil.

USING THE DETERGENT

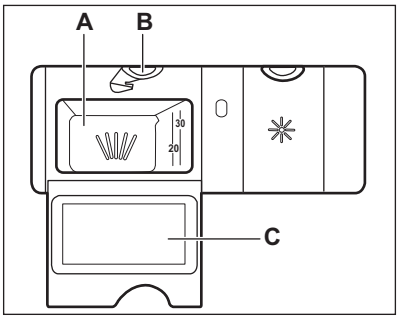

CAUTION! Only use detergent specifically designed for dishwashers.

1. Press the release button (**B**) to open the lid (**C**).
2. Put the detergent, in powder or tablets, in the compartment (**A**).
3. If the programme has a prewash phase, put a small quantity of detergent on the inner part of the appliance door.
4. Close the lid. Make sure that the release button locks into position.

For information about the detergent dosage, refer to the manufacturer's instructions on the packaging of the product. Usually, 20 - 25 ml of gel detergent is adequate for washing a load with normal soil.

Do not fill the compartment (**A**) with more than 30 ml of gel detergent.

SETTING AND STARTING A PROGRAMME

Starting a programme

1. Keep the appliance door ajar.
2. Press the on/off button to activate the appliance. Make sure that the appliance is in programme selection mode.
3. Press the programme button repeatedly until the indicator of the programme you want to select starts flashing.
4. Close the appliance door to start the programme.

Starting a programme with delay start

1. Set a programme.
2. Press the delay button to delay the start of the programme by 3 hours.

The indicator 3h is on.

3. Close the appliance door to start the countdown.

During the countdown, it is not possible to change the programme.

When the countdown is complete, the programme starts.

Opening the door while the appliance operates

Opening the door while a programme is running stops the appliance. It may affect the energy consumption and the programme duration. After closing the door, the appliance continues from the point of interruption.

If the door is opened for more than 30 seconds during the drying phase, the running programme ends. It does not happen if the door is opened by AirDry function.

Do not try to close the appliance door within 2 minutes after AirDry automatically opens it as this may cause damage to the appliance. If, afterwards, the door is closed for at least 3 minutes, the running programme ends.

Cancelling the delay start

Press the on/off button for 3 seconds until the appliance is in programme selection mode.

When you cancel the delay start, you have to set the programme again.

Cancelling the programme

Press the on/off button for 3 seconds until the appliance is in programme selection mode.

Make sure that there is detergent in the detergent dispenser before you start a new programme.

The Auto Off function

This function decreases energy consumption by deactivating automatically the appliance when it is not operating.

The function comes into operation:

- When the programme is complete.
- After 5 minutes if a programme was not started.

End of the programme

When the programme is complete, the Auto Off function switches the appliance off.

Close the water tap.

HINTS AND TIPS

GENERAL

Follow the hints below to ensure optimal cleaning and drying results in daily use and to protect the environment.

- Washing dishes in the dishwasher as instructed in the user manual usually consumes less water and energy than washing dishes by hand.
- Load the dishwasher to its full capacity to save water and energy. For best cleaning results, arrange items in the baskets as instructed in the user manual and do not overload the baskets.
- Do not pre-rinse dishes by hand. It increases the water and energy consumption. When needed, select a programme with a prewash phase.
- Remove larger residues of food from the dishes and empty cups and glasses before putting them inside the appliance.
- Soak or slightly scour cookware with firmly cooked-on or baked-on food before washing it in the appliance.
- Make sure that items in the baskets do not touch or cover each other. Only then can the water completely reach and wash the dishes.
- You can use dishwasher detergent, rinse aid and salt separately or you can use the multi-tablets (e.g. "All in 1"). Follow the instructions on the packaging.
- Select a programme according to the type of load and the degree of soil. **ECO** offers the most efficient use of water and energy consumption.
- To prevent limescale buildup inside the appliance:
  - Refill the salt container whenever necessary.
  - Use the recommended dosage of the detergent and rinse aid.
  - Make sure that the current level of the water softener agrees with the hardness of the water supply.
  - Follow the instructions in the chapter "**Care and cleaning**".

USING SALT, RINSE AID AND DETERGENT

- Only use salt, rinse aid and detergent designed for dishwasher. Other products can cause damage to the appliance.
- In areas with hard and very hard water, we recommend to use basic dishwasher detergent (powder, gel, tablets containing no additional agents), rinse aid and salt separately for optimal cleaning and drying results.
- Detergent tablets do not fully dissolve with short programmes. To prevent detergent residues on the tableware, we recommend that you use tablets with long programmes.
- Always use the correct quantity of detergent. Insufficient dosage of detergent can result in poor cleaning results and hard-water filming or spotting on the items. Using too much detergent with soft or softened water results in detergent residues on the dishes. Adjust the amount of detergent based on the water hardness. Refer to the instructions on the detergent packaging.
- Always use the correct quantity of rinse aid. Insufficient dosage of rinse aid decreases the drying results. Using too much rinse aid results in bluish layers on the items.
- Make sure that the water softener level is correct. If the level is too high, the increased quantity of salt in the water might result in rust on cutlery.

WHAT TO DO IF YOU WANT TO STOP USING MULTI-TABLETS

Before you start to use separately detergent, salt and rinse aid, complete the following steps:

1. Set the highest level of the water softener.
2. Make sure that the salt and rinse aid containers are full.
3. Start the shortest programme with a rinsing phase. Do not add detergent and do put dishes in the baskets.
4. When the programme is complete, adjust the water softener according to the water hardness in your area.
5. Adjust the released quantity of rinse aid.
6. Activate the rinse aid empty notification.

LOADING THE BASKETS

- Always use the whole space of the baskets.
- Use the appliance to wash dishwasher-safe items only.
- Do not wash the following materials in the dishwasher: wood, horn, pewter, copper, aluminium, delicate ornamented porcelain and

unprotected carbon steel. This can cause them to crack, warp, discolour, pit or rust.
- Do not wash in the appliance items that can absorb water (sponges, household cloths).
- Put hollow items (cups, glasses and pans) with the opening facing downwards.
- Make sure that glasses do not touch each other.
- Put light or plastic items in the upper basket. Make sure that the items do not move freely.
- Put cutlery and small items in the cutlery basket.
- Make sure that the spray arms can move freely before you start a programme.

BEFORE STARTING A PROGRAMME

Before you start the selected programme, make sure that:
- The filters are clean and correctly installed.
- The cap of the salt container is tight.
- The spray arms are not clogged.
- There is enough salt and rinse aid (unless you use multi-tablets).
- The arrangement of the items in the baskets is correct.
- The programme is suitable to the type of load and the degree of soil.
- The correct quantity of detergent is used.

UNLOADING THE BASKETS

1. Let the tableware cool down before you remove it from the appliance. Hot items can be easily damaged.
2. First remove items from the lower basket, then from the upper basket.

After the programme is completed, water can still remain on the inside surfaces of the appliance.

CARE AND CLEANING

WARNING! Before maintenance, deactivate the appliance and disconnect the mains plug from the main socket.

Dirty filters and clogged spray arms decrease the washing results. Make a check regularly and, if necessary, clean them.

INTERNAL CLEANING

- Clean the appliance interior with a soft damp cloth.
- Do not use abrasive products, abrasive cleaning pads, sharp tools, strong chemicals, scourer or solvents.
- Wipe clean the door, including the rubber gasket, once a week.
- To maintain the performance of your appliance, use a cleaning product designed for dishwashers at least once every two months. Carefully follow the instructions on the packaging of the product.
- Using short-duration programmes regularly can cause grease and limescale buildup inside the appliance. Run long-duration programmes at least twice a month to prevent the buildup.

REMOVAL OF FOREIGN OBJECTS

Check the filters and the sump after each use of the dishwasher. Foreign objects (e.g. pieces of glass, plastic, bones or toothpicks, etc) decrease the cleaning performance and can cause damage to the drain pump.

CAUTION! If unable to remove the foreign objects, contact an Authorised Service Centre.

1. Disassemble the filters system as instructed in this chapter.
2. Remove any foreign objects manually.
3. Reassemble the filters as instructed in this chapter.

EXTERNAL CLEANING

- Clean the appliance with a moist soft cloth.
- Only use neutral detergents.
- Do not use abrasive products, abrasive cleaning pads or solvents.

CLEANING THE FILTERS

The filter system is made of 3 parts.

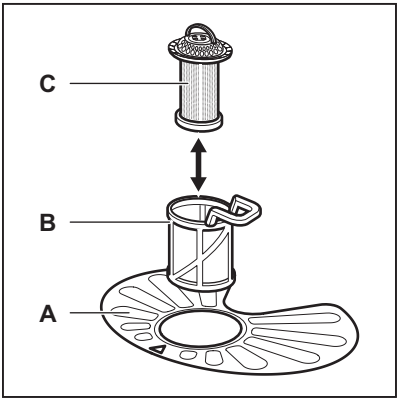

1. Turn the filter (**B**) counterclockwise and remove it.

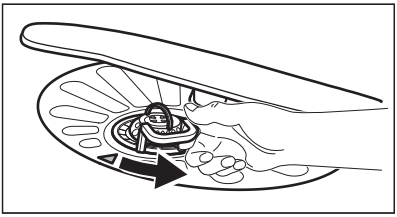

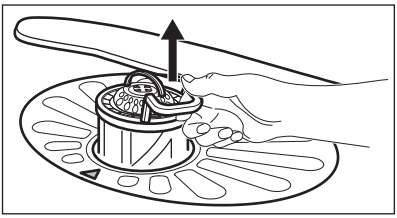

2. Remove the filter (**C**) out of filter (**B**).
3. Remove the flat filter (**A**).

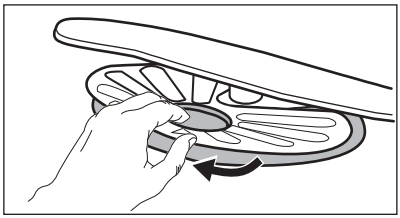

4. Wash the filters.

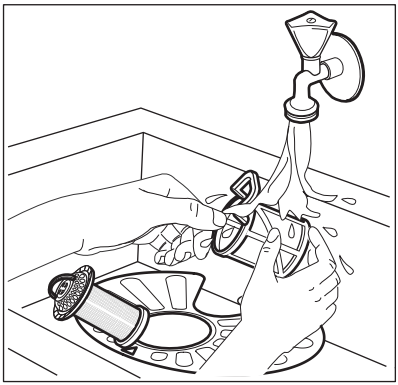

5. Make sure that there are no residues of food or soil in or around the edge of the sump.
6. Put back in place the flat filter (**A**). Make sure that it is correctly positioned under the 2 guides.

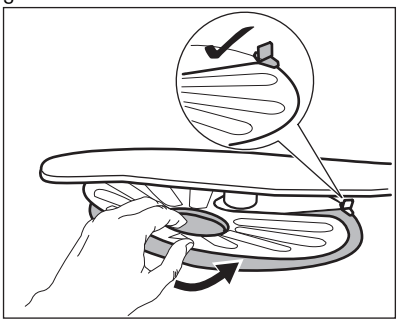

7. Reassemble the filters (**B**) and (**C**).
8. Put back the filter (**B**) in the flat filter (**A**). Turn it clockwise until it locks.

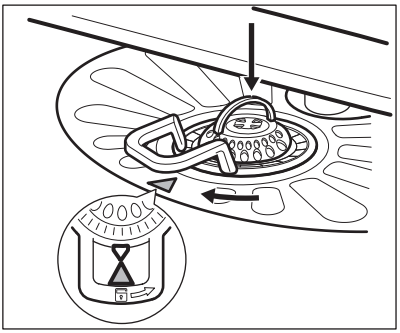

CAUTION! An incorrect position of the filters can cause bad washing results and damage to the appliance.

CLEANING THE LOWER SPRAY ARM

We recommend to clean the lower spray arm regularly to prevent soil from clogging the holes. Clogged holes can cause unsatisfactory washing results.

1. To remove the lower spray arm, pull it upwards.

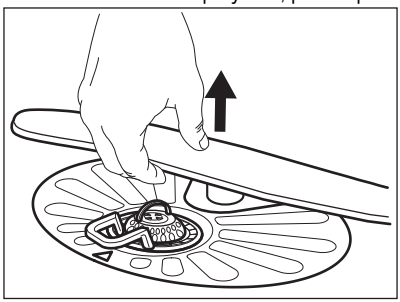

2. Wash the spray arm under running water. Use a thin pointed tool, e.g. a toothpick, to remove particles of soil from the holes.

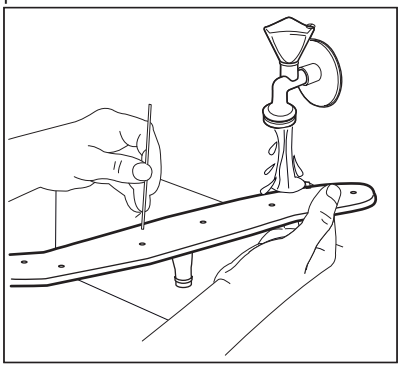

3. To install the spray arm back, press it downwards.

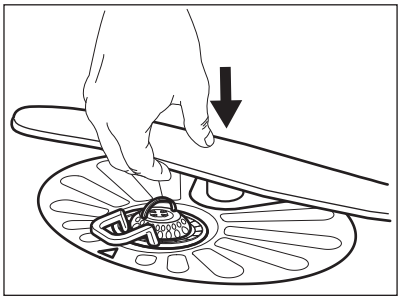

CLEANING THE UPPER SPRAY ARM

Do not remove the upper spray arm. If the openings in the spray arm are clogged, remove the remaining particles of soil with a thin pointed object, e.g. a toothpick.

TROUBLESHOOTING

WARNING! Improper repair of the appliance may pose a danger to the safety of the user. Any repairs must be performed by qualified personnel.

The majority of problems that can occur can be solved without the need to contact an Authorised Service Centre.

Refer to the below table for information on possible problems.

With some problems, the dedicated indicator flashes intermittently to indicate a malfunction and the alarm code.

Problem and alarm code	Possible cause and solution
You cannot activate the appliance.	▪ Make sure that the mains plug is connected to the mains socket. ▪ Make sure that there is no damaged fuse in the fuse box.
The programme does not start.	▪ Make sure that the appliance door is closed. ▪ If the delay start is set, cancel the setting or wait for the end of the countdown. ▪ The appliance recharges the resin inside the water softener. The duration of the procedure is approximately 5 minutes.
The appliance does not fill with water. ▪ The indicator flashes 1 time intermittently. ▪ Acoustic signal sounds 1 time intermittently.	▪ Make sure that the water tap is open. ▪ Make sure that the pressure of the water supply is not too low. For this information, contact your local water authority. ▪ Make sure that the water tap is not clogged. ▪ Make sure that the filter in the inlet hose is not clogged. ▪ Make sure that the inlet hose has no kinks or bends.
The appliance does not drain the water. ▪ The indicator flashes 2 times intermittently. ▪ Acoustic signal sounds 2 times intermittently.	▪ Make sure that the sink spigot is not clogged. ▪ Make sure that the interior filter system is not clogged. ▪ Make sure that the drain hose has no kinks or bends.
The anti-flood device is on. ▪ The indicator flashes 3 times intermittently. ▪ Acoustic signal sounds 3 times intermittently.	▪ Close the water tap. ▪ Make sure that the appliance is correctly installed. ▪ Make sure the baskets are loaded as instructed in the user manual.
Malfunction of the water level detection sensor. ▪ The indicator flashes 4 times intermittently. ▪ Acoustic signal sounds 4 times intermittently.	▪ Make sure that the filters are clean. ▪ Switch the appliance off and on.
Malfunction of the wash pump or the drain pump. ▪ The indicator flashes 5 times intermittently. ▪ Acoustic signal sounds 5 times intermittently.	▪ Switch the appliance off and on.

Problem and alarm code	Possible cause and solution
The temperature of the water inside the appliance is too high or malfunction of the temperature sensor occurred. ▪ The indicator flashes 6 times intermittently. ▪ Acoustic signal sounds 6 times intermittently.	▪ Make sure that the temperature of the inlet water does not exceed 60°C. ▪ Switch the appliance off and on.
Technical malfunction of the appliance. ▪ The indicator flashes 12 times intermittently. ▪ Acoustic signal sounds 12 times intermittently.	▪ Switch the appliance off and on.
The level of water inside the appliance is too high. ▪ The indicator flashes 15 times intermittently. ▪ Acoustic signal sounds 15 times intermittently.	▪ Switch the appliance off and on. ▪ Make sure that the filters are clean. ▪ Make sure that the outlet hose is installed at the right height above the floor. Refer to the installation instructions.
The appliance stops and starts more times during operation.	▪ It is normal. It provides optimal cleaning results and energy savings.
The programme lasts too long.	▪ If the delayed start option is set, cancel the delay setting or wait for the end of the countdown. ▪ Refer to the consumption values table in the chapter "**Programmes**".
Small leak from the appliance door.	▪ The appliance is not levelled. Loosen or tighten the adjustable feet (if applicable). ▪ The appliance door is not centred on the tub. Adjust the rear foot (if applicable).
The appliance door is difficult to close.	▪ The appliance is not levelled. Loosen or tighten the adjustable feet (if applicable). ▪ Parts of the tableware are protruding from the baskets.
The appliance door opens during the wash cycle.	▪ The AirDry function is activated. You can deactivate the function. Refer to "**Settings**".
Rattling/knocking sounds from inside the appliance.	▪ The tableware is not properly arranged in the baskets. Refer to basket loading leaflet. ▪ Make sure that the spray arms can rotate freely.
The appliance trips the circuit-beaker.	▪ The amperage is insufficient to supply simultaneously all the appliances in use. Check the socket amperage and the capacity of the meter or turn off one of the appliances in use. ▪ Internal electrical fault of the appliance. Contact an Authorised Service Centre.

Refer to "**Before first use**", "**Daily use**", or "**Hints and tips**" for other possible causes.

Once you have checked the appliance, deactivate and activate the appliance. If the problem occurs again, contact an Authorised Service Centre.

For alarm codes not described in the table, contact an Authorised Service Centre.

WARNING! We do not recommend using the appliance until the problem has been completely fixed. Unplug the appliance and do not plug it in again until you are certain that it operates correctly.

THE DISHWASHING AND DRYING RESULTS ARE NOT SATISFACTORY

Problem	Possible cause and solution
Poor washing results.	▪ Use more intensive washing programmes. ▪ Clean spray arm jets and the filter. Refer to "**Care and Cleaning**". ▪ Refer to "**Daily use**", "**Hints and tips**" and basket loading leaflet.
Poor drying results.	▪ Tableware has been left for too long inside the closed appliance. ▪ There is no rinse aid or the dosage of rinse aid is not sufficient. Fill the rinse aid dispenser or set the dosage of rinse aid to a higher level. ▪ Plastic items may need to be towel dried. ▪ For the best drying performance activate the function AirDry. ▪ Always use the rinse aid, even with multi-tablets.
There are whitish streaks or bluish layers on glasses and dishes.	▪ The release quantity of rinse aid is too high. Adjust the rinse aid dosage to a lower level. ▪ The quantity of detergent is too high.
There are stains and dry water drops on glasses and dishes.	▪ The released quantity of rinse aid is not sufficient. Adjust the rinse aid dosage to a higher level. ▪ The quality of the rinse aid can be the cause.
The dishes are wet.	▪ For the best drying performance activate the function AirDry. ▪ The programme does not have a drying phase or has a drying phase with low temperature. ▪ The rinse aid dispenser is empty. ▪ The quality of the rinse aid can be the cause. ▪ The quality of the multi-tablets can be the cause. Try a different brand or activate the rinse aid dispenser and use rinse aid and multi-tablets together.
The interior of the appliance is wet.	▪ This is not a defect of the appliance. Humidity condensates on the appliance walls.
Unusual foam during washing.	▪ Use the detergent designed specifically for dishwashers. ▪ Use a detergent from a different manufacturer. ▪ Do not pre-rinse dishes under running water.
Traces of rust on cutlery.	▪ There is too much salt in the water used for washing. Refer to "**The water softener**". ▪ Silver and stainless steel cutlery were placed together. Do not place silver and stainless steel items close together.

Problem	Possible cause and solution
There are residues of detergent in the dispenser at the end of the programme.	▪ The detergent tablet got stuck in the dispenser and was not washed away by water. ▪ Water cannot wash away the detergent from the dispenser. Make sure that the spray arm is not blocked or clogged. ▪ Make sure that items in the baskets do not impede the lid of the detergent dispenser from opening.
Odours inside the appliance.	▪ Refer to "**Internal cleaning**".
Limescale deposits on the tableware, on the tub and on the inside of the door.	▪ The level of salt is low, check the refill indicator. ▪ The cap of the salt container is loose. ▪ Your tap water is hard. Refer to "**The water softener**". ▪ Even using multi-functional tabs use salt and set regeneration of the water softener. Refer to "**The water softener**". ▪ If limescale deposits persist, clean the appliance with the suitable detergents. ▪ Try different detergent. ▪ Contact the detergent manufacturer.
Dull, discoloured or chipped tableware.	▪ Make sure that only dishwasher-safe items are washed in the appliance. ▪ Load and unload the basket carefully. Refer to basket loading leaflet. ▪ Place delicate items in the upper basket.

Refer to "**Before first use**", "**Daily use**" or "**Hints and tips**" for other possible causes.

TECHNICAL INFORMATION

Dimensions	Width / height / depth (mm)	596 / 818 - 898 / 550
Electrical connection **1)**	Voltage (V)	220 - 240
	Frequency (Hz)	50
Water supply pressure	Min. / max. bar (MPa)	0.5 (0.05) / 10 (1.0)
Water supply	Cold water or hot water **2)**	max 60 °C
Capacity	Place settings	13

1) Refer to the rating plate for other values.
2) If the hot water comes from alternative source of energy (e.g. solar panels), use the hot water supply to decrease energy consumption.

LINK TO THE PRODUCT INFORMATION SHEET

The QR code on the energy label supplied with the appliance provides a web link to the product information sheet. Keep the energy label for reference together with the user manual and all other documents provided with this appliance.

For more detailed information about the energy label, visit www.theenergylabel.eu.

ENVIRONMENTAL CONCERNS

Recycle materials with the symbol . Put the packaging in relevant containers to recycle it. Help protect the environment and human health by recycling waste of electrical and electronic appliances. Do not dispose of appliances marked with the symbol with the household waste. Return the product to your local recycling facility or contact your municipal office.

WWW.ZANUSSI.COM/SHOP

UK
CA

156816270-A-302022

User Manual

GETTING STARTED? EASY.

ZWF842C3PW

EN User Manual
Washing Machine

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Get usage advice, brochures, trouble shooter, service and repair information:
www.zanussi.com/support

⚠ SAFETY INFORMATION

Before beginning the installation and use of this appliance, carefully read the supplied instructions.
The manufacturer is not responsible for any injuries or damage that are the result of incorrect installation or usage. Always keep the instructions in a safe and accessible location for future reference.

CHILDREN AND VULNERABLE PEOPLE SAFETY

- This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning the use of the appliance in a safe way and understand the hazards involved.
- Children between 3 and 8 years of age and persons with very extensive and complex disabilities shall be kept away from the appliance unless continuously supervised.
- Children of less than 3 years of age should be kept away from the appliance unless continuously supervised.
- Children should be supervised to ensure that they do not play with the appliance.
- Keep all packaging away from children and dispose of it appropriately.
- Keep detergents away from children.
- Keep children and pets away from the appliance when the door is open.
- If the appliance has a child safety device, it should be activated.
- Children shall not carry out cleaning and user maintenance of the appliance without supervision.

GENERAL SAFETY

- This appliance is for washing domestic-type, machine-washable laundry only.
- This appliance is designed for single household domestic use in an indoor environment.
- This appliance may be used in, offices, hotel guest rooms, bed & breakfast guest rooms, farm guest houses and other similar accommodation where such use does not exceed (average) domestic usage levels.
- Do not change the specification of this appliance.
- The appliance maximum load is 8 kg. Do not exceed the maximum load of each programme (refer to the “Programmes” chapter).
- The operating water pressure at the water entry point from the outlet connection must be between 0.5 bar (0.05 MPa) and 10 bar (1.0 MPa).
- The ventilation opening in the base must not be covered by a carpet, mat, or any floor covering.
- The appliance must be connected to the water mains using the new supplied hose sets, or other new hose sets supplied by the Authorised Service Centre.
- Old hose sets must not be reused.
- If the mains power supply cable is damaged, it must be replaced by the manufacturer, its Authorised Service Centre or similarly qualified persons to avoid an electrical hazard.
- Before any maintenance operation, deactivate the appliance and disconnect the mains plug from the socket.
- Do not use high pressure water sprays and/or steam to clean the appliance.
- Clean the appliance with a moist cloth. Use only neutral detergents. Do not use abrasive products, abrasive cleaning pads, solvents or metal objects.

SAFETY INSTRUCTIONS

INSTALLATION

The installation must comply with relevant national regulations.

- Remove all the packaging and the transit bolts including rubber bush with plastic spacer.
- Keep the transit bolts in a safe place. If the appliance is to be moved in the future they must be reattached to lock the drum to prevent an internal damage.
- Always take care when moving the appliance as it is heavy. Always use safety gloves and enclosed footwear.
- Follow the installation instructions supplied with the appliance.
- Do not install or use a damaged appliance.
- Do not install or use the appliance where the temperature can be less than 0°C or where it is exposed to the weather.
- The floor area on which the appliance is to be installed must be flat, stable, heat resistant and clean.
- Make sure that there is air circulation between the appliance and the floor.
- When the appliance is in its permanent position, check if it is levelled correctly with the aid of a spirit level. If it is not, adjust the feet accordingly.
- Do not install the appliance directly above a floor drain.
- Do not spray water on the appliance and do not expose it to excessive humidity.
- Do not install the appliance where the appliance door cannot be fully opened.
- Do not put a closed container to collect possible water leakage under the appliance. Contact the Authorised Service Centre to ensure which accessories can be used.

ELECTRICAL CONNECTION

WARNING! Risk of fire and electric shock.

- WARNING: This appliance is designed to be installed / connected to a grounding connection in the building.
- Always use a correctly installed shockproof socket.
- Make sure that the parameters on the rating plate are compatible with the electrical ratings of the mains power supply.
- Do not use multi-plug adapters and extension cables.
- Make sure not to cause damage to the mains plug and to the mains cable. Should the mains cable need to be replaced, this must be carried out by our Authorised Service Centre.
- Connect the mains plug to the mains socket only at the end of the installation. Make sure that there is access to the mains plug after the installation.
- Do not touch the mains cable or the mains plug with wet hands.
- Do not pull the mains cable to disconnect the appliance. Always pull the mains plug.
- This appliance is fitted with a 13 A mains plug. If it is necessary to change the mains plug fuse, use only a 13 A ASTA (BS 1362) fuse (UK and Ireland only).

WATER CONNECTION

- The inlet water shall not exceed 25 °C.
- Do not cause damage to the water hoses.
- Before connection to new pipes, pipes not used for a long time, where repair work has been carried out or new devices fitted (water meters, etc.), let the water flow until it is clean and clear.
- Ensure that there are no visible water leaks during and after the first use of the appliance.
- Do not use an extension hose if the inlet hose is too short. Contact the Authorised Service Centre for the replacement of the inlet hose.
- When unpacking the appliance, It is possible to see water flowing from the drain hose. This is due to the testing of the appliance with the use of water in the factory.
- You can extend the drain hose to maximum 400 cm. Contact the Authorised Service Centre for the other drain hose and the extension.
- Make sure that there is access to the tap after the installation.

USE

WARNING! Risk of injury, electric shock, fire, burns or damage to the appliance.

- Follow the safety instructions on the detergent packaging.
- Do not put flammable products or items that are wet with flammable products in, near or on the appliance.
- Do not wash fabrics which are heavily soiled with oil, grease or other greasy substances. It can damage rubber parts of the washing machine. Prewash such fabrics by hand before loading them into the washing machine.

- Do not touch the glass door while a programme operates. The glass can get hot.
- Make sure that all metal objects are removed from the laundry.

SERVICE

- To repair the appliance contact the Authorised Service Centre. Use original spare parts only.
- Please note that self-repair or non-professional repair can have safety consequences and might void the guarantee.
- The following spare parts will be available for 10 years after the model has been discontinued: motor and motor brushes, transmission between motor and drum, pumps, shock absorbers and springs, washing drum, drum spider and related ball bearings, heaters and heating elements, including heat pumps, piping and related equipment including hoses, valves, filters and aquastops, printed circuit boards, electronic displays, pressure switches, thermostats and sensors, software and firmware including reset software, door, door hinge and seals, other seals, door locking assembly, plastic peripherals such as detergent dispensers. Please note that some of these spare parts are only available to professional repairers, and that not all spare parts are relevant for all models.
- Concerning the lamp(s) inside this product and spare part lamps sold separately: These lamps are intended to withstand extreme physical conditions in household appliances, such as temperature, vibration, humidity, or are intended to signal information about the operational status of the appliance. They are not intended to be used in other applications and are not suitable for household room illumination.

DISPOSAL

WARNING! Risk of injury or suffocation.

- Disconnect the appliance from the mains electrical and water supplies.
- Cut off the mains electrical cable close to the appliance and dispose of it.
- Remove the door catch to prevent children or pets from becoming trapped in the drum.
- Dispose of the appliance in accordance with local requirements for the disposal of Waste Electrical and Electronic Equipment (WEEE).

PRODUCT DESCRIPTION

APPLIANCE OVERVIEW

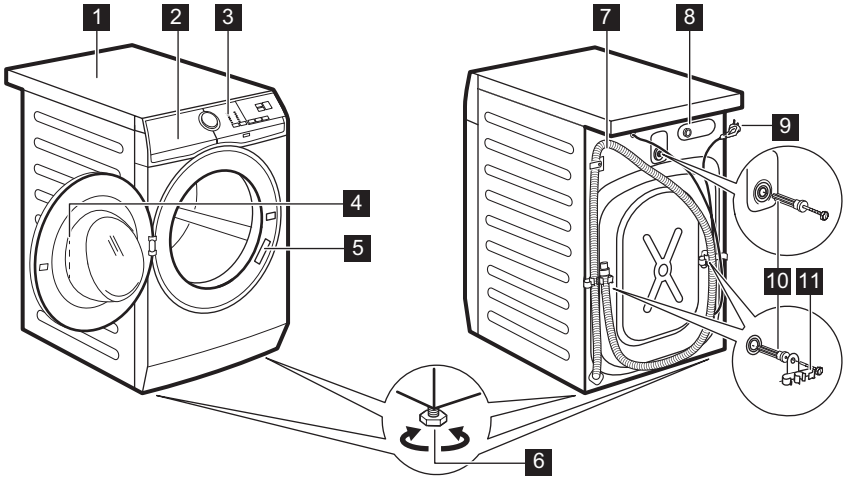

1 Worktop

2 Detergent dispenser

3 Control panel
4 Door handle
5 Rating plate
6 Feet for levelling the appliance
7 Drain hose
8 Inlet hose connection
9 Mains cable
10 Transit bolts
11 Hose support

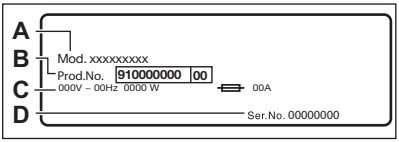

The rating plate reports the model name (**A**) , product number (**B**), electrical ratings (**C**) and serial number (**D**).

TECHNICAL DATA

Dimension	Width/ Height/ Total depth	59,6 cm /84,7 cm /57,6 cm
Electrical connection	Voltage Overall power Fuse Frequency	230-240 V 2000 W 13 A 50 Hz
Level of protection against ingress of solid particles and moisture ensured by the protective cover, except where the low voltage equipment has no protection against moisture		IPX4
Water supply pressure **1)**	Minimum Maximum	0.5 bar (0.05 MPa) 10 bar (1.0 MPa)
Water supply **2)**		Cold water
Maximum Load	Cotton	8 kg
Spin Speed	Maximum spin speed	1351 rpm

1) The appliance works correctly if the water pressure is not lower than 0.05 MPa (0.5 bar). If you cannot connect the water inlet hose to the cold water tap of the primary hydraulic system, connect it to your domestic cold water storage system. Make sure not to exceed a distance of 5.02 m (16.5 ft) between the appliance inlet hose and the bottom of the water storage tank.
2) Connect the water inlet hose to a water tap with a 3/4" thread.

INSTALLATION

WARNING! Refer to Safety chapters.

UNPACKING

1. Open the door. Remove all the items from the drum.

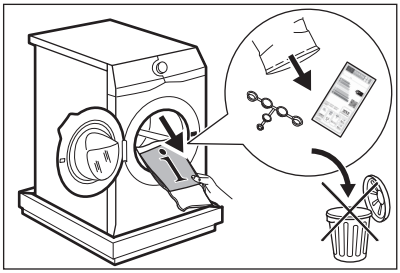

Accessories delivered with the appliance may vary depending on the model.

2. Put the packaging element on the floor behind the appliance and carefully put it down onto its rear side. Remove the polystyrene protection from the bottom.

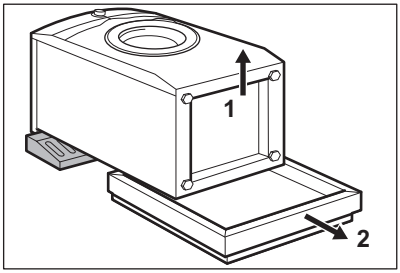

CAUTION! Do not lay washing machine on its front.

3. Put the appliance back into an upright position. Remove the power supply cable and the drain hose from the hose holders.

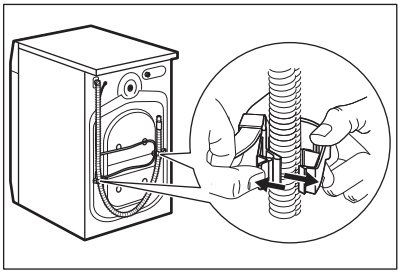

WARNING! It is possible to see water flowing from the drain hose. This is because the washing machine has been tested at the factory.

4. Remove the three transit bolts and pull out the plastic spacers.

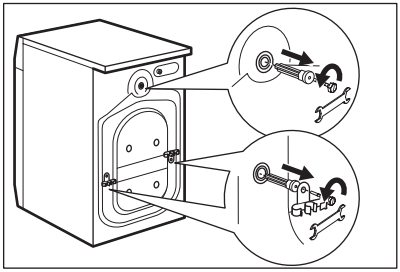

We recommend that you keep the packaging and the transit bolts for any transport of the appliance.

5. Put the plastic caps, that you find in the user manual bag, in the holes.

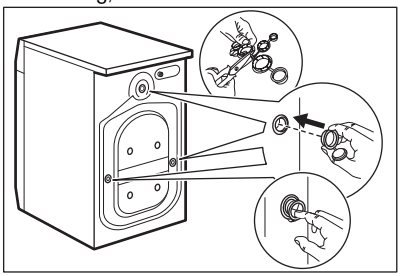

INFORMATION FOR INSTALLATION

Positioning and levelling

Adjust the appliance correctly to prevent vibration, noise and movement of the appliance when it operates.

1. Install the appliance on a flat hard floor. The appliance must be levelled and stable. Make sure that the appliance does not touch the wall or other units and there is air circulation below the appliance.

2. Loosen or tighten the feet to adjust the level. All feet must rest firmly on the floor.

WARNING! Do not put cardboard, wood or equivalent materials below the appliance feet to adjust the level.

The inlet hose

CAUTION! Make sure there is no damage to hoses and there are no leaks from the couplings. Do not use an extension hose if the inlet hose is too short. Contact the service centre for a replacement inlet hose.

1. Connect the water inlet hose to the back of the appliance.

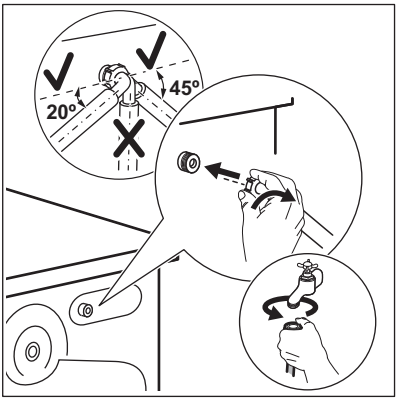

2. Position it toward left or right depending on the positon of the water tap. Make sure that the inlet hose is not in vertical position.

3. If necessary, loosen the ring nut to set it in the correct position.

4. Connect the water inlet hose to the cold water tap with 3/4" thread.

WARNING! The inlet water shall not exceed 25 °C.

Water drainage

The drain hose should stay at a height of no less than 60 cm and not more than 100 cm.

You can extend the drain hose to maximum 400 cm. Contact the authorised service centre for the other drain hose and the extension.

It is possible to connect the drain hose in different ways:

1. Make a U shape with the drain hose and put it around the plastic hose guide.

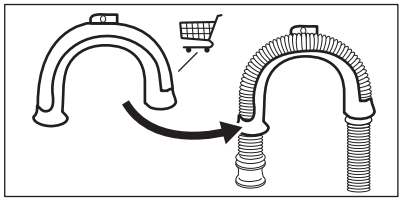

2. On the edge of a sink - Fasten the guide to the water tap or to the wall.

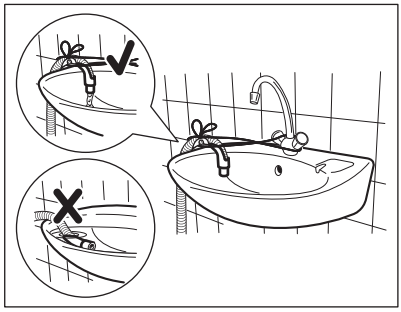

Make sure that the plastic guide cannot move when the appliance drains and the drain hose end is not immersed in the water. There may be a return of dirty water into the appliance.

3. If the end of the drain hose looks like this (see the picture), you can push it directly into the stand pipe.

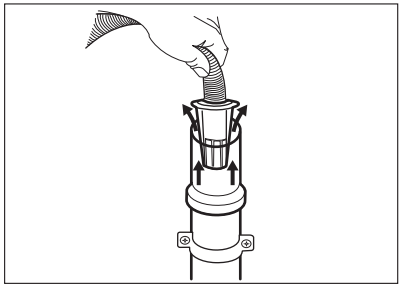

4. To a stand pipe with vent hole - Insert the drain hose directly into a drain pipe. Refer to the illustration.

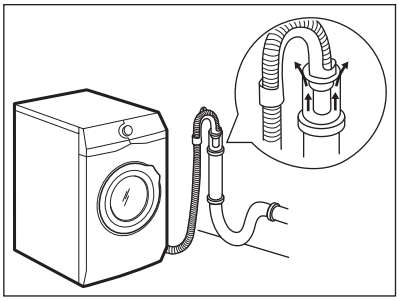

The end of the drain hose must always be ventilated , i.e. the inner diameter of the drain pipe (min. 38 mm - min. 1.5") must be larger than the external diameter of the drain hose.

5. Without the plastic hose guide, to a sink spigot- Put the drain hose in the spigot and tighten it with a clamp. Refer to the illustration.

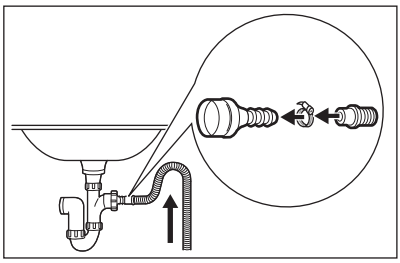

Make sure that the drain hose makes a loop to prevent particles going into the appliance from the sink.

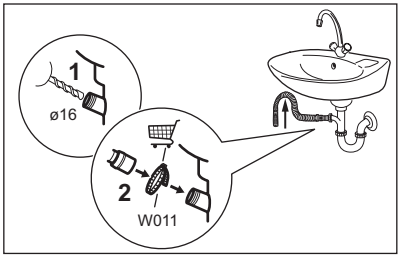

Connect the drain hose to the spigot and tighten it with a clamp. Make sure that the drain hose makes a loop to prevent particles going into the appliance from the sink.

6. Position the hose directly to a built-in drain pipe in the room wall and tighten it with a clamp.

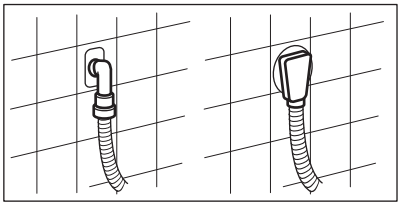

INSTALLATION ON SUSPENDED FLOORING

Suspended wooden floors are particularly susceptible to vibration.

To limit vibration we recommend placing a waterproof wooden panel, at least 15 mm thick, under the appliance. It should be screwed to at least 2 floor beams and should extend beyond the front feet.

If possible, install the appliance where the floor is more stable.

ELECTRICAL CONNECTION

At the end of installation you can connect the mains plug to the mains socket.

The rating plate on the inner edge of the appliance door and the 'Technical Data' chapter indicate the necessary electrical ratings. Make sure that they are compatible with the mains power supply.

Check that your domestic electrical installation can take the maximum load required, also taking into account any other appliances in use.

Connect the appliance to an earthed socket.

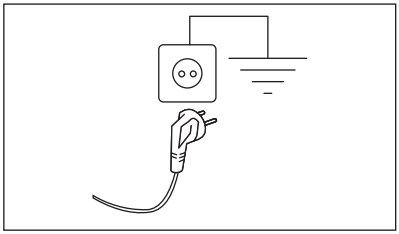

The power supply cable must be easily accessible after installing the appliance.

For any electrical work required to install this appliance, contact our Authorised Service Centre.

The manufacturer does not accept any responsibility for damage or injury through failure to comply with the above safety precaution.

ACCESSORIES

AVAILABLE IN WWW.ZANUSSI.COM/SHOP OR FROM AUTHORISED DEALER

Read carefully the instructions supplied with the accessory.

Only appropriate accessories approved by ZANUSSI ensure the safety standards of the appliance. If unapproved parts are used, any claims will be invalidated.

FIXING PLATE KIT

If you install the appliance on a plinth that is not an accessory supplied by ZANUSSI, secure the appliance in the fixing plates.

Read carefully the instructions supplied with the accessory.

STACKING KIT

The tumble dryer can be stacked on the top of the washing machine **only by using the correct stacking kit**.

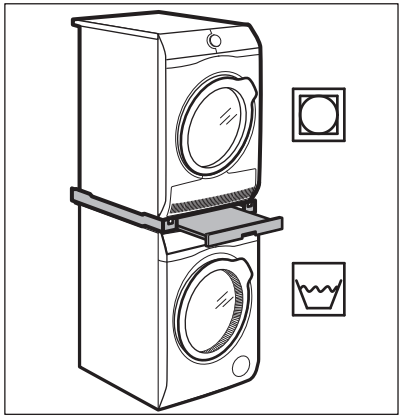

WARNING! Do not put the tumble dryer under the washing machine. Verify the compatible stacking kit by checking the depth of your appliances.

CONTROL PANEL

SPECIAL FEATURES

Your new washing machine meets all modern requirements for an effective treatment of laundry with low water, energy and detergent consumption and will care for fabrics.

- The **AutoAdjust System** automatically adjusts the programme duration to the laundry in the drum to achieve perfect washing results in the minimum possible time. Read the paragraph "The AutoAdjust load detection " for more details.
- This appliance is designed with a **self cleaning draining system**, allowing light fluff fibers that fall off the clothes to be drained out with the water, in such a way that there is no need by the customer to access this area for regular maintenance and cleaning. Read the chapter "Care and Cleaning" for best maintenance and care.

CONTROL PANEL DESCRIPTION

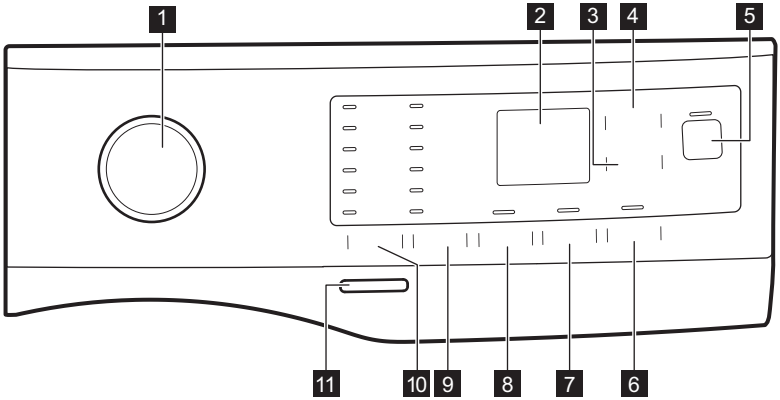

1 Programme dial
2 Display
3 Delay Start touch button
4 FlexiTime touch button
5 Start/Pause touch button
6 Easy Iron touch button
7 Extra Rinse touch button
8 Prewash touch button
9 Spin reduction options touch button
- No Spin option
- Rinse Hold option
- Night option

10 Temp. touch button
11 ON/OFF push button

DISPLAY

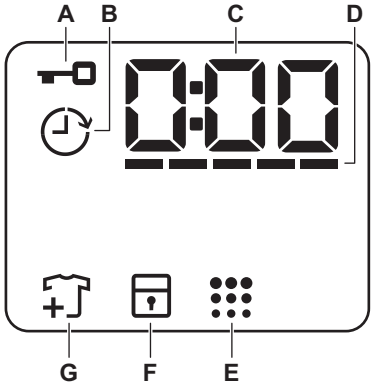

A		Door locked indicator.
B		Delay start indicator.
C		The digital indicator can show: ▪ Programme duration (e. g.). ▪ Delay time (e. g.). ▪ Cycle end (). ▪ Warning code (e.g.).
D		FlexiTime bars level indicator.
E		Drum clean indicator.
F		Child safety lock indicator.
G		Add garments indicator. Illuminates at the beginning of the Wash phase, while the user can still pause the appliance and add more laundry.

DIAL AND BUTTONS

INTRODUCTION

The options/functions are not available with all washing programmes. Check the compatibility between options/functions and washing programmes in the "Programme Chart". An option/function can exclude another one, in this case the appliance doesn't allow you to set incompatible options/functions.

ON/OFF

Press this button for a few seconds to activate or deactivate the appliance. Two different tunes sound while switching the appliance on or off.

As the Stand-by function automatically deactivates the appliance after several minutes to reduce the energy consumption, you may need to activate the appliance again.

For more details, refer to Stand-by paragraph in Daily Use chapter.

TEMP.

When you select a washing programme, the appliance automatically proposes a default temperature.

The indicator Cold ✳ = cold water.

The indicator of the set temperature comes on.

SPIN

When you set a programme, the appliance automatically sets the maximum spin speed allowed except programme Denim.

Additional spin options:

- **No Spin** . The related indicator comes on. Set this option to deactivate all spin phases. The appliance performs only the draining phase of the selected washing programme. Set this option for very delicate fabrics. The rinse phase uses more water for some washing programmes
- **Rinse Hold** . The related indicator comes on.
  The final spin is not performed. The water of the last rinse is not drained out to prevent the fabrics from creasing. The washing programme ends with water in the drum.
  The door stays locked and the drum turns regularly to reduce creasing. You must drain the water to unlock the door.
  If you touch the Start/Pause ▷‖ button, the appliance performs the spinning phase and drains the water.
- **Night** . The related indicator comes on. The intermediate and the final spinning phases are suppressed and the programme ends with water in the drum. This helps to reduce creasing. The door stays locked. The drum turns

regularly to reduce creasing. You must drain the water to unlock the door.
As the programme is very quiet, it is suitable for use at night time when cheaper electricity tariffs are available. In some programmes the rinses are performed with more water.

If you touch the Start/Pause ▷‖ button, the appliance performs only the draining phase.

The appliance empties the water out automatically after approximately 18 hours.

PREWASH

With this option you can add a prewash phase to a washing programme.

The relevant indicator illuminates.

- Use this option to add a pre-wash phase at 30 °C before the washing phase.
  This option is recommended for heavily soiled laundry, especially if containing sand, dust, mud and other solid particles.

These options can increase the programme duration.

PERMANENT EXTRA RINSE

With this option you can add a few rinses according to the selected washing programme.

Use this option for people with allergies to detergent residues and with sensitive skin.

This option increases the programme duration.

The corresponding indicator above the touch button illuminates and also stays permanently on during next cycles until this option is deactivated.

EASY IRON

The appliance carefully washes and spins the laundry to prevent the creases.

The appliance decreases the spin speed, uses more water and adapts the programme duration to the type of laundry.

The related indicator comes on.

DELAY START

With this option you can delay the start of a programme to a more convenient time.

Touch the button repeatedly to set the required delay. The time increases in steps of 1 hour up to 20 hours.

The display shows the indicator ◷ and the selected delay time. After touching the Start/Pause ▷‖ button, the appliance begins the countdown and the door is locked.

FLEXITIME

With this option you can reduce the programme duration depending on the load size and the degree of soiling. This adjustment should be made after the setting of Temp. and Spin .

When you set a washing programme, the display shows the default duration and ‾‾‾‾‾ dashes.

Touch FlexiTime button to reduce the programme duration according to your needs. The display shows the new programme duration and a number of dashes will decrease accordingly:

‾‾‾‾‾ suitable for a full load of normally soiled garments.

‾‾‾ a quick cycle for a smaller lightly soiled garments (max. half load recommended).

‾ the shortest cycle to freshen up a small amount of laundry.

The FlexiTime is available only with the programmes in the table.

indicator	Eco 40-60	Cottons	Synthetics	Dark Colours
‾‾‾‾‾ 1)	■	■	■	■
‾‾‾	■	■	■	■
‾	■	■	■	■

1) Defaullt duration for all programmes.

START/PAUSE ▷‖

Touch the Start/Pause ▷‖ button to start, pause the appliance or interrupt a running programme.

PROGRAMMES

PROGRAMME CHART

Programme Default temperature Temperature range	Reference spin speed Spin speed range	Maximum load	Programme description (Type of load and level of soiling)
Eco 40-60 40 °C [1)]	1400 rpm (1400- 800 rpm)	8 kg	**White cotton and fast-coloured cotton**. Normally soiled items. The energy consumption decreases and the time of the washing programme is extended, ensuring good washing results.
Cottons 40°C 90°C - Cold	1400 rpm (1400- 800 rpm)	8 kg	**White cotton and coloured cotton**. Normally, heavily and lightly soiled items.
Synthetics 40°C 60°C - Cold	1200 rpm (1200- 800 rpm)	3 kg	**Synthetic items or mixed fabric items**. Normally soiled items.
Delicates 30°C 40°C - Cold	1200 rpm (1200- 800 rpm)	2 kg	**Delicate fabrics such as acrylics, viscose and mixed fabrics requiring gentler washing**. Normally and lightly soiled items.
Wool 40 °C 40°C - Cold	1200 rpm (1200- 800 rpm)	1,5 kg	**Machine washable wool, hand washable wool and other fabrics** with «hand washing» care symbol[2)].
Denim 30 °C 40 °C - Cold	800 rpm (1200 - 800 rpm)	3 kg	**Special programme for Denim clothing with delicate washing phase to minimize colour fading and marks**. For better care a reduced load size is recommended.
Sportswear 30 °C 40°C - Cold	1200 rpm (1200- 800 rpm)	3 kg	**Synthetic and delicate items**. Lightly soiled items or items to refresh.
Spin/Drain 3)	1400 rpm (1400 -800 rpm)	8 kg	**All fabrics, except woollens and delicate fabrics**. To spin the laundry and to drain the water in the drum.
Rinse	1400 rpm (1400- 800 rpm)	8 kg	To rinse and spin the laundry. **All fabrics**, except woollens and very delicate fabrics. Reduce the spin speed accordingly to the type of laundry.
Dark Colours 40°C 60°C - Cold	1200 rpm (1200- 800 rpm)	8 kg	**Cotton items or mixed fabric items in dark colours.** Normally soiled items.

Programme Default temperature Temperature range	Reference spin speed Spin speed range	Maximum load	Programme description (Type of load and level of soiling)
CleanBoost 60 °C	1400 rpm (1400- 800 rpm)	8 kg	White cotton items. This program removes micro-organisms thanks to a washing phase with the temperature maintained above 60°C for several minutes. This helps remove germs, bacteria, micro-organism and particles. An additional rinsing phase ensures a proper removal of detergent residues and pollens/allergenic items. In this way the wash is more effective.
14min Refresh 30 °C	800 rpm (800- 800 rpm)	1,5 kg	**Synthetic and mixed fabric items.** Very light soiling and items to freshen up.
30min Rapid 40°C 40°C - 30°C	1200 rpm (1200- 800 rpm)	3 kg	**Synthetic and mixed fabric items.** Lightly soiled items.
60min EasyWash 30°C 60°C - 30°C	1400 rpm (1400- 800 rpm)	5 kg	Cotton and fast-coloured synthetic items. Complete washing program that, in only 60 minutes, washes the daily soiled laundry intensively and ensures a good washing performance in a short time.

1) According to UK Ecodesign for Energy-Related Products and Energy Information Regulations and to the EU Ecodesign Regulation 2019/2023 and the EU Energy Label Regulation 2019/2014, this programme at 40 °C is able to clean normally soiled cotton laundry declared to be washable at 40 °C or 60 °C, together in the same cycle.

For the reached temperature in the laundry, the programme duration and other data, please refer to 'Consumption Values' chapter.
The most efficient programmes in terms of energy consumption are generally those that perform at lower temperatures and longer duration.

2) During this cycle the drum rotates slowly to ensure a gentle wash. It can seem that the drum doesn't rotate or doesn't rotate properly, but this is normal for this programme.
3) Set the spin speed. Make sure it is suitable for the type of fabric being washed. If you set the No Spin option then only the drain phase is available.

Programme options compatibility

Programme	OPTIONS	Spin				Prewash	Extra Rinse	Easy Iron	FlexiTime	Delay Start
Eco 40-60		■	■	■		■	■		■	■

Programme	OPTIONS	Spin				Prewash	Extra Rinse	Easy Iron	FlexiTime	Delay Start
Cottons		■	■	■	■	■	■	■	■	■
Synthetics		■	■	■	■	■	■	■	■	■
Delicates		■	■	■	■		■			■
Wool		■	■	■						■
Denim		■	■	■	■		■	■		■
Sportswear		■	■	■		■	■	■		■
Spin/Drain		■	■							■
Rinse		■	■	■			■			■
Dark Colours		■	■	■		■	■		■	■
CleanBoost		■	■	■		■	■			■
14min Refresh			■	■						■
30min Rapid		■	■							■
60min EasyWash		■	■	■			■			■

Suitable detergents for washing programmes

Programme	Universal powder[1)]	Liquid Universal	Liquid for coloureds	Delicates woollens	Special
Eco 40-60	▲	▲	▲	--	--
Cottons	▲	▲	▲	--	--
Synthetics	▲	▲	▲	--	--
Delicates	--	--	--	▲	▲
Wool	--	--	--	▲	▲
Denim	--	--	▲	▲	▲
Sportswear	--	▲	▲	--	▲
Dark Colours	--	--	▲	▲	▲
CleanBoost	▲	▲	▲	--	--

Programme	Universal powder[1)]	Liquid Universal	Liquid for coloureds	Delicates woollens	Special
14min Refresh	--	▲	▲	--	--
30min Rapid	--	▲	▲	--	--
60min EasyWash	▲	▲	▲	--	--

1) At temperature higher than 60 °C the use of powder detergent is recommended.

▲ = Recommended

-- = Not recommended

SETTINGS

ACOUSTIC SIGNALS

This appliance has different acoustic signals, that operate when:

- You activate the appliance (special short tune).
- You deactivate the appliance (special short tune).
- You touch the buttons (click sound).
- You make an invalid selection (3 short sounds).
- The programme is completed (sequence of sounds for about 1 minute).
- The appliance has a malfunction (sequence of short sounds for about 5 minutes).

To **deactivate/activate** the acoustic signals set a one of the programme, touch the Temp. and the Spin buttons simultaneously for about 2 seconds. The display shows On/Off

If you deactivate the acoustic signals, they continue to operate when the appliance has a malfunction.

CHILD LOCK

With this option you can prevent children from playing with the control panel.

To **activate/deactivate** this option, hold down the Easy Iron button until **comes on/goes off** on the display.

The appliance will default to this option after you switch it off.

The Child Lock function may not be available for a few seconds after switching the appliance on.

BEFORE FIRST USE

1. Make sure that the electrical power is available and the water tap is open.
2. Pour a small quantity of detergent into the compartment marked by .
3. Set and start a programme for cotton at the highest temperature without any laundry in the drum.

This removes all possible dirt from the drum and the tub.

DAILY USE

WARNING! Refer to Safety chapters.

ACTIVATING THE APPLIANCE

1. Connect the mains plug to the mains socket.
2. Open the water tap.
3. Press the ON/OFF button for a few seconds to activate the appliance.

A short tune sounds.

LOADING THE LAUNDRY

1. Open the appliance door.
2. Empty the pockets and unfold the items before you put them in the appliance.

3. Put the laundry in the drum, one item at a time.
Do not put too much laundry in the drum.
4. Close the door firmly.

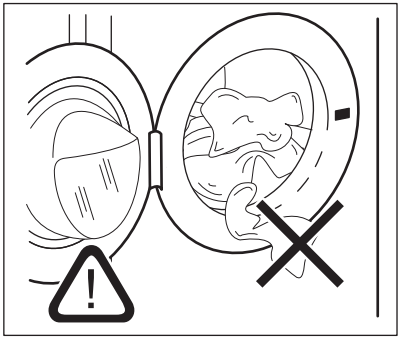

CAUTION! Make sure that no laundry gets caught between the seal and the door to avoid risk of water leakage and damage to the laundry.

Washing heavily oiled, greasy stains could cause damage to rubber parts of the washing machine.

DETERGENT COMPARTMENTS. USING AND ADDITIVES

1. Measure out specified detergents and the fabric conditioner.
2. Put the detergent and the fabric conditioner into the proper compartments.
3. Carefully close the detergent drawer.

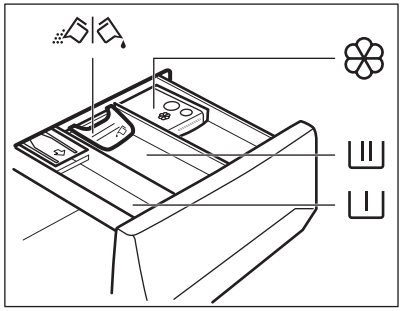

I	Compartment for prewash phase, soak programme or stain remover.
II	Compartment for washing phase.
❀	Compartment for liquid additives (fabric conditioner, starch).
MAX	Maximum level for quantity of liquid additives.
	Flap for powder or liquid detergent.

Always follow the instructions that you find on the packaging of the detergent products, but we recommend that you do not exceed the maximum indicated level. This quantity will however guarantee the best washing results.

After a washing cycle, if necessary, remove any detergent residue from the detergent dispenser.

POSITION OF THE DETERGENT FLAP

1. Pull out the detergent dispenser until it stops.
2. Remove the drawer. Press the place with the (PUSH) to remove the drawer easily.

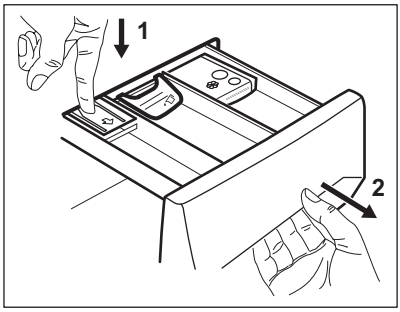

3. To use liquid detergent, adjust the flap in right position, turn the flap down.

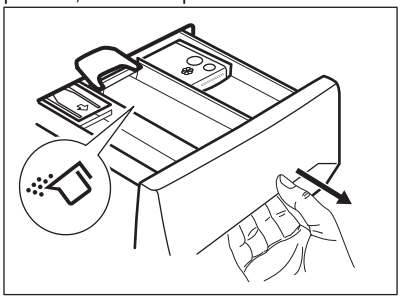

With the flap in the position **DOWN**:

- Do not use gelatinous or thick liquid detergents.
- Do not exceed to liquid detergent dose indicated on the flap.
- Do not set the prewash phase.
- Do not set the delay start function.

4. Measure out the detergent and the fabric conditioner.
5. Put back the drawer in the recess.
6. To use powder detergent again turn flap in the position **UP**

Make sure that the flap does not cause a blockage when you close the drawer.

SETTING A PROGRAMME

1. Turn the programme dial to select the desired washing programme.

The indicator of the Start/Pause ▷‖ button flashes. The display shows an indicative programme duration.

2. To change the temperature and/or the spin speed, touch the related buttons.
3. If desired, set one or more options by touching the related buttons. The related indicators illuminate on the display and the given information changes accordingly.

If a selection is **not possible** an acoustic signal sounds.

STARTING A PROGRAMME

Touch the Start/Pause ▷‖ button to start the programme. It is not possible to start the programme when the indicator of the button is off and doesn't flash (e.g. programme dial on a wrong position).

The related indicator stops flashing and stays on. The programme starts, the door is locked. The display shows the indicator 🔒.

The drain pump can operate shortly before the appliance fills water.

STARTING A PROGRAMME WITH THE DELAY START

1. Touch the Delay Start ▷‖ button repeatedly until the display shows the desired delay time. On the display the indicator shows 🕒

2. Touch the Start/Pause ▷‖ button. The appliance door locks and starts the countdown of the delay start. The display shows the indicator 🔒.

When the countdown is completed, the programme starts automatically.

Cancelling the delay start after the countdown has started

To cancel the delay start:

1. Touch the Delay Start 🕒 button repeatedly until the display shows the desired delay time. On the display the indicator shows 🕒

Touch the Start/Pause ▷‖ button. The appliance lock the door and starts the countdown of the delay start. The display shows the indicator 🔒.

When the countdown is completed, the programme starts automatically.

2. Touch the Start/Pause ▷‖ button to pause the appliance. The related indicator flashes.
3. Touch the Delay Start 🕒 button repeatedly until the display shows 🔓 and the indicator 🕒 goes off.
4. Touch the Start/Pause ▷‖ button again to start the programme immediately.

Changing the delay start after the countdown has started

To change the delay start:

1. Touch the Start/Pause ▷|| button to pause the appliance. The related indicator flashes.
2. Touch the Delay Start button repeatedly until the display shows the desired delay time.
3. Touch the Start/Pause ▷|| button again to start the new countdown.

THE AUTOADJUST SYSTEM LOAD DETECTION

After touching the Start/Pause ▷|| button:

1. The AutoAdjust System starts estimating the weight of the load to calculate the real programme duration. During this phase the FlexiTime bars ‾‾‾‾ placed below the time digits play a simple animation.
2. After about 15-20 minutes the FlexiTime bars disappear and new cycle duration is displayed. The appliance automatically adjusts the programme duration to the load to achieve perfect washing results in the minimum possible time.

The AutoAdjust System is not available with all programmes such as :Wool, Rinse, Spin and programmes with short cycles.

INTERRUPTING A PROGRAMME AND CHANGING THE OPTIONS

When the programme is running, you can change **only some** options:

1. Touch the Start/Pause ▷|| button.

The related indicator flashes.

2. Change the options. The given information in the display changes accordingly.
3. Touch the button Start/Pause ▷|| again.

The washing programme continues.

CANCELLING A RUNNING PROGRAMME

1. Press the button ON/OFF to cancel the programme and to deactivate the appliance.
2. Press the button ON/OFF again to activate the appliance.

If the AutoAdjust System has completed and the water filling has already started, the new programme starts **without repeating the AutoAdjust System**. The water and the detergent are not drained out in order to avoid waste.

There is also an alternative way of cancelling:

1. Rotate the selector knob to the "Reset" position • .

2. Wait for 1 second. The display shows ‾‾‾ . Now, you can set a new washing programme.

OPENING THE DOOR - ADDING GARMENTS

If the temperature and level of the water in the drum are too high and/or the drum is still rotating you should not open the door.

While a programme or the delay start operates, the appliance door is locked. The display shows the indicator 🔒.

1. Touch the Start/Pause ▷|| button.

In the display the related door lock indicator goes off.

2. Open the appliance door. If necessary, add or remove the items. Close the door and touch the Start/Pause ▷|| button.

The programme or the delay start continues.

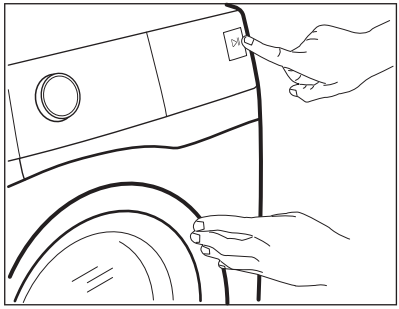

END OF THE PROGRAMME

When the programme has finished, the appliance stops automatically. The acoustic signals operate (if they are active). The display shows 0:00

The indicator of the Start/Pause ▷|| button goes off.

The door unlocks and the indicator 🔒 goes off.

1. Press button ON/OFF to deactivate the appliance.

After five minutes from the end of the programme, the energy saving function automatically deactivates the appliance.

When you activate the appliance again, the display shows the end of the previous programme. Turn the programme dial to set a new cycle.

2. Remove the laundry from the appliance.
3. Make sure that the drum is empty.
4. Keep the door and the detergent dispenser slightly ajar to prevent mildew and odours.

DRAINING WATER OUT AFTER END OF CYCLE

If you have chosen a programme or an option that does not empty out the water of the last rinse, the programme is completed, but:

- The time area shows 0:00 and the display shows the door locked.
- The drum still turns at regular intervals to prevent creases in the laundry.
- The door stays locked.
- You must drain the water to open the door:

1. If necessary, touch the Spin button to decrease the spin speed proposed by the appliance.
2. Press theStart/Pause button:
   - If you have set Rinse Hold the appliance drains the water and spins.
   - If you have set Night the appliance only drains the water

The option indicator Rinse Hold disappears.

3. When the programme is completed and the door locked indicator goes off, you can open the door.
4. Press the ON/OFF button for a few seconds to deactivate the appliance.

STAND-BY FUNCTION

The Stand-by function automatically deactivates the appliance to reduce the energy consumption when:

- You do not use the appliance for 5 minutes when no programme is running.
  Press the button ON/OFF to activate the appliance again.
- 5 minutes after the end of the washing programme.
  Press the ON/OFF button to activate the appliance again.
  The display shows the end of the last programme.
  Turn the programme dial to set a new cycle.

If the dial is rotated to the "Reset" position •, the appliance automatically turns off in 30 seconds.

If you set a programme or an option that ends with water in the drum, the Stand-by function **doesn't deactivate** the appliance to remind you to drain the water.

HINTS AND TIPS

WARNING! Refer to Safety chapters.

THE LAUNDRY LOAD

- Divide the laundry into: white, coloured, synthetics, delicates and wool.
- Follow the washing instructions on the laundry care labels.
- Do not wash white and coloured items together.
- Some coloured items can discolour with the first wash. We recommend that you wash them separately for the first couple of times.
- Turn multilayered fabrics, wool and items with printed illustrations inside out.
- Pre-treat stubborn stains.
- Wash stubborn stains with a special detergent.
- Be careful with curtains. Remove the hooks and put the curtains in a washing bag or pillowcase.
- A very small load can cause balance problems with the spin phase leading to excessive vibration. If this occurs:
  a. interrupt the programme and open the door (refer to "Daily Use" chapter);
  b. manually redistribute the load so that the items are spaced evenly around the tub;
  c. press the Start/Pause button. The spin phase continues.
- Avoid washing garments full of long animal hair or poor quality garments releasing lots of fluff that could block the drain circuit and therefore requiring the Service assistance.
- Button up pillowcases, close zippers, hooks and poppers. Tie up belts, cords, shoelaces, ribbons and any other loose elements.
- Do not wash laundry without hems or with cuts. Use a washing bag to wash small and/or delicate items (e.g. underwired bras, belts, tights, shoelaces, ribbons, etc.).

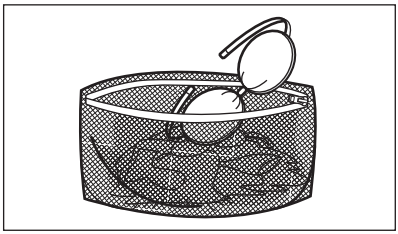

- Empty pockets and unfold the items.

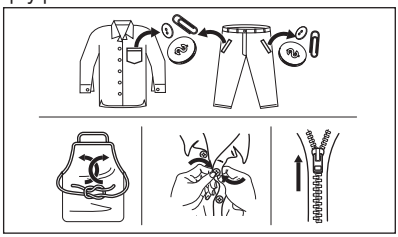

STUBBORN STAINS

For some stains, water and detergent is not sufficient.

We recommend that you pre-treat these stains before you put the items in the appliance.

Special stain removers are available. Use the special stain remover that is applicable to the type of stain and fabric.

DETERGENT TYPE AND QUANTITY

The choice of detergent and use of correct quantities not only affects your wash performance, but also helps to avoid waste and protect the environment:

- Use only detergents and other treatments specially made for washing machines. First, follow these generic rules:
  - powder detergents for all types of fabric, excluding delicate. Prefer powder detergents containing bleach for whites and laundry sanitization,
  - liquid detergents, preferably for low temperature wash programmes (60 °C max) for all types of fabric, or special ones for woollens only.
- The choice and quantity of detergent will depend on: type of fabric (delicates, woollens, cottons, etc), the colour of clothes, size of the load, degree of soiling, wash temperature and hardness of the water used.
- Follow the instructions that you find on packaging of the detergents or other treatments without exceeding the indicated maximum level (**MAX**).
- Do not mix different types of detergents.
- Use less detergent if:
  - you are washing a small load,
  - the laundry is lightly soiled,
  - there is large amounts of foam during washing.
- When using detergent tabs or pods, always put them inside the drum, not in the detergent dispenser.

Insufficient detergent may cause:

- unsatisfactory washing results,
- the wash load to turn grey,
- greasy clothes,
- mould in the appliance.

Excessive detergent may cause:

- sudsing,
- reduced washing effect,
- inadequate rinsing,
- a greater impact for the environment.

ECOLOGICAL HINTS

To save water, energy and to help protect the environment, we recommend that you follow these tips:

- **Normally soiled laundry** may be washed **without prewash** in order to save detergent, water and time (the environment is protected too!).
- Loading the appliance to the **maximum capacity indicated for each programmes helps to reduce energy and water consumption**.
- With adequate pre-treatment, stains and limited soiling can be removed; the laundry can then be washed at a lower temperature.
- To use the correct quantity of detergent, refer to the quantity suggested by the detergent producer and check the water hardness of you domestic system. Refer to 'Water hardness'.
- Set the **maximum possible spin speed** for the selected washing programme **before drying your laundry in a tumble dryer**. This will save energy during drying!

WATER HARDNESS

If the water hardness in your area is high or moderate, we recommend that you use a water softener for washing machines. In areas where the water hardness is soft it is not necessary to use a water softener.

To find out the water hardness in your area, contact your local water authority.

Use the correct quantity of water softener. Follow the instructions that you find on the packaging of the product.

ALARM CODES AND POSSIBLE FAILURES

The appliance does not start or it stops during operation. First try to find a solution to the problem (refer to the tables).

WARNING! Deactivate the appliance before carrying out any check.

With some problems, the display shows an alarm code and the Start/ Pause ▷‖ **button may flash continuously:**

Problem	Possible solution
E 10 The appliance does not fill with water properly.	▪ Make sure that the water tap is open. ▪ Make sure that the pressure of the water supply is not too low. For this information, contact your local water authority. ▪ Make sure that the water tap is not clogged. ▪ Make sure that the inlet hose has no kinks, damages or bends. ▪ Make sure that the connection of the water inlet hose is correct. ▪ This problem may be also caused by the clogged drain circuit. Please contact the Authorised Service Centre. ▪ Make sure that the filter of the inlet hose and the filter of the valve are not clogged. Refer to 'Care and cleaning'.
E20 The appliance does not drain the water.	▪ Make sure that the sink spigot is not clogged. ▪ Make sure that the drain hose has no kinks or bends. ▪ This problem may be caused by the clogged drain circuit. Please contact the Authorised Service Centre. ▪ Make sure that the connection of the drain hose is correct. ▪ Set the drain programme if you set a programme without drain phase. ▪ Set the drain programme if you set an option which ends with water in the tub.
E40 The appliance door is open or not closed correctly.	▪ Make sure that the door is properly closed.
E91 Internal fail. No communication between electronic elements of the appliance.	▪ The programme was not finished properly or the appliance stopped too early. Switch the appliance off and on again. ▪ If the alarm code appears again, contact the Authorised Service Centre.
EH0 The mains supply is unstable.	▪ Wait until mains supply is stable.

If the display shows other alarm codes, deactivate and activate the appliance. If the problem continues, contact the Authorised Service Centre.
In case of different problem with the washing machine check the table below for possible solutions.

Problem	Possible solution
The programme does not start.	▪ Make sure that the mains plug is connected to the mains socket. ▪ Make sure that the appliance door is closed. ▪ Make sure that there is no damaged fuse in the fuse box. ▪ Make sure that the Start/Pause ▷‖ has been touched. ▪ If the delay start is set, cancel the setting or wait for the end of countdown. ▪ Deactivate the Child Lock function if it is on. ▪ Check the position of the knob on the selected programme.
The appliance fills with water and drains immediately.	▪ Make sure that the drain hose is in the correct position. The hose may be positioned too low. Refer to "Installation instruction".
The spin phase does not operate or the washing cycle lasts longer than usual.	▪ Set the spin programme. ▪ This problem may be caused by the clogged drain circuit. Please contact the Authorised Service Centre. ▪ Adjust manually the items in the tub and start the spin phase again. This problem may be caused by balance problems.
There is water on the floor.	▪ Make sure that the couplings of the water hoses are tight and there is not water leakages. ▪ Make sure that the water inlet hose and the drain hose have no damages. ▪ Make sure you use the correct detergent and the correct quantity of it.
You cannot open the appliance door.	▪ Make sure that a washing programme that ends with water in tub, has not been selected. ▪ Make sure that the washing programme is finished. ▪ Set the drain or the spin programme if there is water in the drum. ▪ Make sure that the appliance receives electrical power. ▪ This problem may be caused by a failure of the appliance. Contact the Authorised Service Centre.
The appliance makes an unusual noise and vibrates.	▪ Make sure the levelling of the appliance is correct. Refer to "Installation instruction". ▪ Make sure that the packaging and/or the transit bolts are removed. Refer to "Installation instruction". ▪ Add more laundry in the drum. The load may be too small.
The programme duration increases or decreases during programme execution.	▪ The AutoAdjust System is able to adjust the programme duration according to the type and the laundry load size. Refer to "The AutoAdjust System load detection" in "Daily Use" chapter.
The washing results are not satisfactory.	▪ Increase the detergent quantity or use a different detergent. ▪ Use special products to remove the stubborn stains before you wash the laundry. ▪ Make sure that you set the correct temperature. ▪ Decrease the laundry load.
Too much foam in the drum during the washing cycle.	▪ Reduce the quantity of detergent.

Problem	Possible solution
After the washing cycle, there are some detergent residues in the dispenser drawer.	▪ Make sure that the flap is in the correct position (UP for powder detergent - DOWN for liquid detergent). ▪ Make sure you have used the detergent dispenser according the indications given in this user manual.

After the check, activate the appliance. The programme continues from the point of interruption.
If the problem occurs again, contact the Authorised Service Centre.
The necessary data for the service centre are on the rating plate.

CARE AND CLEANING

WARNING! Refer to Safety chapters.

PERIODIC CLEANING SCHEDULE

Periodic cleaning helps to extend the life of your appliance.

After each cycle, keep the door and the detergent dispenser slightly ajar to get air circulation and dry the humidity inside the appliance: this will prevent mildew and odours.

If the appliance is not used for a long time: close the water tap and unplug the appliance.

Indicative periodic cleaning schedule:

Descaling	Twice a year
Maintenance wash	Once a month
Clean door seal	Every two months
Clean drum	Every two months
Clean detergent dispenser	Every two months
Clean the inlet hose and the valve filter	Twice a year

The following paragraphs explain how you should clean each part.

REMOVING FOREIGN OBJECTS

Make sure that pockets are empty and all loose elements are tied up before running your cycle. Refer to "The laundry load" in "Hints and tips".

Remove any foreign objects (such as metal clip, buttons, coins, etc) that you may find in the door seal, the inlet hose filter and the drum. Refer to "Door seal with double lip trap", "Cleaning the drum" and "Cleaning the inlet hose and the valve filter" paragraphs. If necessary, please contact the Authorised Service Centre.

EXTERNAL CLEANING

Clean the appliance with mild soap and warm water only. Fully dry all the surfaces. Do not use a scouring pads or any scratching material.

CAUTION! Do not use alcohol, solvents or chemical products.

CAUTION! Do not clean the metal surfaces with chlorine-based detergent.

DESCALING

If the water hardness in your area is high or moderate, we recommend that you use a water descaling product for washing machines.

Regularly examine the drum to check for limescale.

Regular detergents already contain water softening agents, but we recommend to run a cycle with an empty drum and a descaling product occasionally.

Always follow the instructions that you find on the packaging of the product.

MAINTENANCE WASH

The repeated and prolonged use of low temperature programmes can cause detergent deposits, fluff residues, bacterial growth inside the drum and the tub. This could generate bad odours and mildew. To eliminate these deposits and clean

the inner part of the appliance, run a maintenance wash regularly (at least once a month).

Refer to "Cleaning the drum" paragraph.

CLEANING THE DRUM

Regularly examine the drum to prevent unwanted deposits.

Rust deposits in the drum may occur due to rusting foreign body in the washing or tap water containing iron

Clean the drum with special products for stainless steel.

Always follow the instructions that you find on the packaging of the product. Do not clean the drum with acidic descaling products, scouring products containing chlorine or iron or steel wool.

For a thorough clean:

1. Remove all laundry from the drum.
2. Run a Cottons programme with the highest temperature.
3. Add a small quantity of powder detergent into the empty drum, in order to rinse out any left residues.

Door seal with double lip trap

This appliance is designed with a **self cleaning draining system**, allowing light fluff fibers that fall off the clothes to be drained out with the water. Regularly examine the seal. Coins, buttons, other small items can be recovered at the end of the cycle.

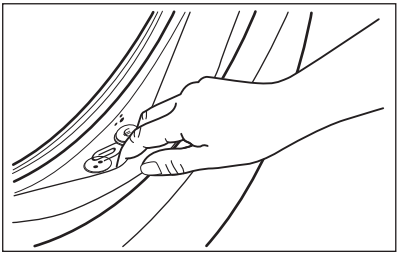

Clean it when needed, using ammonia cream cleanser agent without scratching the seal surface.

Always obey the instructions that you find on the packaging of the product.

CLEANING THE DETERGENT DISPENSER

1.

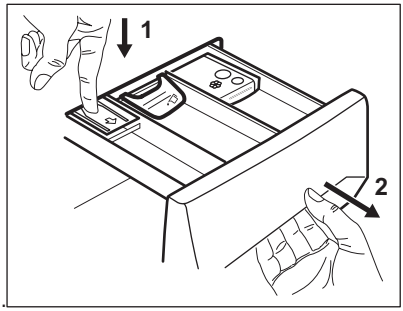

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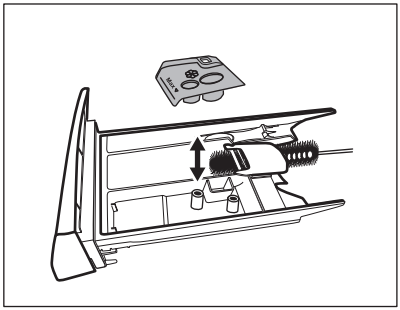

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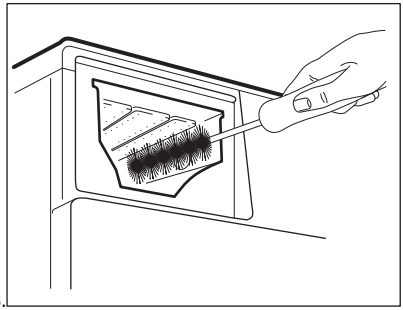

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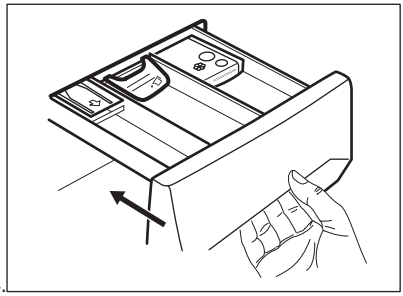

CLEANING THE INLET HOSE AND THE VALVE FILTER

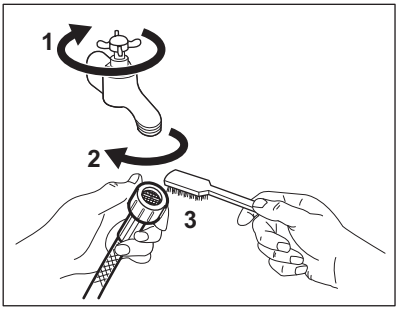

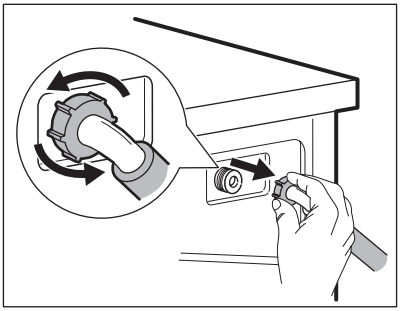

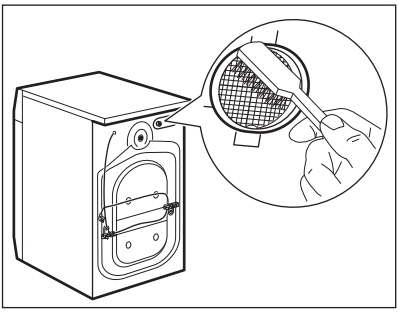

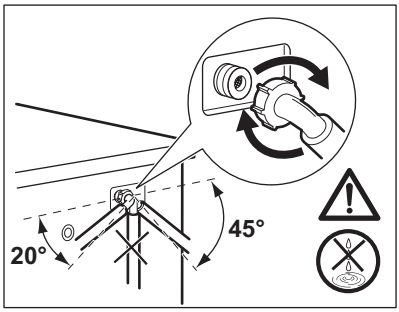

EMERGENCY DRAIN

If the appliance cannot drain the water, carry out the same procedure, described in 'Cleaning the drain pump' paragraph. If necessary, clean the pump.

FROST PRECAUTIONS

If the appliance is installed in an area where the temperature can reach values around 0° C or drop below, remove the remaining water from the inlet hose and the drain pump.

1. Disconnect the mains plug from the mains socket.
2. Close the water tap.
3. Put the two ends of the inlet hose in a container and let the water flow out of the hose.
4. Empty the drain pump. Refer to the emergency drain procedure.
5. When the drain pump is empty, install the inlet hose again.

WARNING! Make sure that the temperature is higher than 0 °C before you use the appliance again. The manufacturer is not responsible for damages caused by low temperatures.

TROUBLESHOOTING

WARNING! Refer to Safety chapters.

CONSUMPTION VALUES

INTRODUCTION

See the web link **www.theenergylabel.eu** for detailed information about Energy Label.

The QR codes on the EU and UK energy labels supplied with the appliance provide a web link to the information related to the performance of the appliance. For the energy label with the EU flag, it is also possible to find the information in the EU EPREL database using the link https://eprel.ec.europa.eu and the model name and product number that you find on the rating plate of the appliance. Refer to 'Product description' chapter for the position of the rating plate. Keep the energy labels for reference together with the user manual and all other documents provided with this appliance.

LEGEND

kg	Laundry load.	**hh:mm**	Programme duration.
kWh	Energy consumption.	**°C**	Temperature in the laundry.
Litres	Water consumption.	**rpm**	Spin speed.
%	Remaining moisture at the end of spinning phase. The higher is the spin speed, the higher is the noise and the lower is the remaining moisture.		

Values and programme duration may differ depending on different conditions (e.g. room temperature, water temperature and pressure, load size and type of laundry, supply voltage) and also if you change the default setting of a programme.

ACCORDING TO UK ECODESIGN FOR ENERGY-RELATED PRODUCTS AND ENERGY INFORMATION REGULATIONS AND TO EU ECODESIGN REGULATION 2019/2023 AND THE EU ENERGY LABEL REGULATION 2019/2014

Eco 40-60 programme	kg	kWh	Litres	hh:mm	%	°C	rpm[1)]
Full load	8	0.980	52.0	3:25	53.00	41.0	1351
Half load	4	0.612	42.0	2:40	53.00	34.0	1351
Quarter load	2	0.250	33.0	2:35	54.00	22.0	1351

1) Maximum spin speed.

Power consumption in different modes

Off (W)	Stand-by (W)	Delay start (W)
0.50	0.50	4.00

Time to Off/Standby mode is 15 minutes maximum.

COMMON PROGRAMMES

These values are indicative only.

Programme	kg	kWh	Litres	hh:mm	%	°C	rpm[1)]
Cottons [2)] 90°C	8	2.500	95.0	3:10	52.00	85.0	1400
Cottons 60°C	8	1.650	85.0	2:55	52.00	55.0	1400
Cottons [3)] 20°C	8	0.400	85.0	2:55	52.00	20.0	1400
Synthetics 40°C	3	0.650	55.0	2:00	35.00	40.0	1200
Delicates [4)] 30°C	2	0.300	45.0	1:20	35.00	30.0	1200
Wool 30°C	1,5	0.300	65.0	1:05	30.00	30.0	1200

1) Reference indicator of the spin speed.
2) Suitable for washing heavily soiled textiles.
3) Suitable for washing lightly soiled cottons, synthetic and mixed fabrics.
4) It also performs as quick washing cycle for lightly soiled laundry.

ENVIRONMENTAL CONCERNS

Recycle materials with the symbol . Put the packaging in relevant containers to recycle it. Help protect the environment and human health by recycling waste of electrical and electronic appliances. Do not dispose of appliances marked with the symbol with the household waste. Return the product to your local recycling facility or contact your municipal office.

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